Currency Invoicing of Japanese Exporters: Trade Aspects of the Yen Internationalization in East Asia

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Abstract

This paper examines the currency invoicing of Japan's exports to East Asia by applying the theory of pricing-to-market (PTM). The notable features of this paper are, first, to use a number of sample commodities obtained from the data on monthly series of H.S. code nine-digit exports, and second, to examine currency invoicing of Japanese exporters by making a distinction between the long-run and the short-run PTM under the framework of the error-correction model. Contrary to the results of the previous literature, we show that Japanese exporters of the electric machinery industry tend to stabilize the export price in terms of the U.S. dollars even in their exports to East Asia, which implies that Japan's electric machinery exports to East Asia tend to be invoiced in U.S. dollars. Given the large presence of the electronics industry for trade and investment between Japan and East Asia, it is hard to expect the further use of the yen in trade transactions in the near future.

Key words: Invoice currency, Pricing-to-market (PTM), Internationalization of the yen, East Asia.

JEL classification: F12, F14, F33, F36.

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1. Introduction

The purpose of this paper is to examine currency invoicing practices of Japanese machinery exporters by applying the theory of pricing-to-market (PTM) and to discuss its implications for the trade aspects of the yen internationalization in East Asia.[1]

The question of the internationalization of the yen has been debated in both academic and business circles, stimulated by the recent changes in the global economy, such as the outbreak of the Asian currency crisis and the onset of the euro in Europe. There have been so far a considerable number of studies that examine the role of the yen in trade transactions,[2] and now it is generally recognized that the U.S. dollar is largely used in Japan's external trade. It must be noted, however, that Japan increased yen-invoiced exports to East Asia from the late 1980s and also that the yen-invoiced ratio was higher in exports to East Asia than in exports to other regions through the 1990s (Table 1).[3]

The difference of currency invoicing ratios across export destinations can be explained by the PTM behavior of Japanese exporters. Indeed, many studies have pointed out that currency invoicing of Japanese exporters has to do with the PTM behavior.[4] However, only few attempts have been made at a rigorous empirical study on the currency invoicing behavior. One exception is the seminal work of Fukuda and Ji (1994) that have examined currency invoicing of Japanese exporters by comparing the exchange rate pass-through of exports to the Untied States with that

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[1] East Asia is defined as the following eight economies: Korea, Taiwan, Hong Kong, Singapore, Indonesia, Malaysia, Philippines and Thailand. In this paper, China is not included in East Asia owing to the data problem. The details will be described in Section 4.

[2] See, for example, Tavlas and Ozeki (1992), Ito (1993), Iwami (1995, Chapter 5) and Kawai (1996).

[3] For the detailed data on currency invoicing ratios of Japan's exports and imports, see Sato (1999). The original source is MITI, *Yushutsu Kessai Tsukadate Doko Chosa [Export Settlement Currency Invoicing]*.

[4] See, for example, Hamada and Horiuchi (1987), Tavlas and Ozeki (1992) and Ito (1993).

of exports to East Asia.[5] The result of their empirical examination is that while Japanese machinery exporters tend to stabilize their selling prices in terms of the U.S. dollar in the U.S. markets, they tend to pass-through changes in the exchange rate to East Asian importers. Fukuda and Ji attribute the different pattern of currency invoicing between two markets to the difference in the firm's pricing strategies.

Noting the upward tendency of yen-invoiced exports to East Asia from the late 1980s as well as the above finding of the previous literature, some studies conclude that the role of the yen will increase in East Asia over time as the economic interdependence through trade and investment between Japan and East Asia deepens significantly.[6] Indeed, Japan expanded investment and trade with East Asian countries from the mid-1980s, particularly in the 1990s, which appears to have tightened the economic linkages between the regions substantially. We must note, however, that Tables 1 and 2 show a different pattern of yen-invoiced exports from the conclusion of the previous studies.

Specifically, the yen-invoiced ratio of exports to Southeast Asia shows a cyclical trend that corresponds to the yen-U.S. dollar exchange rate movements: the upward trend of the yen-invoiced ratio from 1987 coincides with the yen depreciation period after the Plaza and Louvre Accord, and the downward trend from 1993 to 1995 corresponds to the yen appreciation period.[7] Furthermore, Table 2 indicates a different pattern of yen-invoiced exports to Southeast Asia across major machinery industries in recent years: on one hand, the yen-invoiced ratio is high in

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[5] Fukuda and Ji apply the theoretical model of Giovannini (1998) that shows that the choice of the invoice currency is based on the similar conditions that governs PTM or exchange rate pass-through. See also Friberg (1998). Goldberg and Knetter (1997) present a concise survey of this issue.

[6] See, for example, Kawai (1996, p.351, p.355).

[7] Ito (1993) has pointed out that the decline of the yen-invoiced ratio from 1985 to 1987 in exports to the world (Table 1), which corresponded to the rapid yen appreciation period, might reflect the PTM behavior of Japanese exporters. The point we would like to emphasize is that such co-movements between the yen-invoiced ratio and the yen-U.S. dollar exchange rate can be observed even in exports to Southeast Asia (Table 1).

the transport equipment industry; and on the other hand, the ratio is relatively low in the electric machinery industry. This observation implies that, contrary to the results of the previous literature, Japanese exporters may stabilize the export price in terms of the U.S. dollar even in exports to East Asia, and also that currency invoicing practices differ substantially across machinery industries or commodities. Noting the above currency invoicing patterns, this paper examines the pricing or currency invoicing behavior of Japanese exporters on the basis of the theoretical model that relates PTM to currency invoicing, and discusses its implications for the use of the yen in trade transactions.[8] [9]

The notable feature of this paper is as follows. First, this paper uses thirteen types of commodities that are obtained form the data on monthly series of H.S. code nine-digit exports for empirical analysis. Whereas the previous literature has examined only a few types of commodities,[10] much more sample commodities must be investigated since it is very hard to generalize the estimated results obtained from a few sample commodities. Second, we

[8] We may say that if the forward/futures market is perfect, the choice of the invoice currency would have little to do with the firm's exchange rate risk problem, and hence, PTM. However, Japanese firms do not necessarily fully avoid exchange rate risk by hedging through forward/futures markets. MITI (1996, Figure 1-5-4), for example, reports the result of the questionnaire survey (based on multiple answers) on hedging behavior of Japanese firms against exchange rate risks, which indicates that "the shift toward yen-invoiced transactions" (26.8 percent) and "the pass-through of export prices to importers" (16.3 percent) account for a large share next to "the hedging through forward markets" (30.2 percent). It seems reasonable to suppose that the currency invoicing strategy does matter to exporting firms for avoiding exchange rate risks.

[9] There are a variety of approaches to the internationalization of the yen, and it is other roles of a currency, such as a vehicle currency, a reserve currency and a peg currency, that are typically considered to be a determinant factor in the internationalization of the currency. Indeed, most of the East Asian economies had in effect pegged their currencies to the U.S. dollar, and the U.S. dollar plays a dominant role of a vehicle currency in the foreign exchange market of the East Asian economies (see, for example, Sato, 1999, Table 14). In this respect, there seems to be little possibility for the yen to be used much more extensively in East Asia. In trade transactions, however, other factors such as a bargaining power on dividing a currency risk between exporters and importers also play an important role in determining the choice of the currency. Even if the U.S. dollar is widely used in other transactions, there seems to be room for the further use of the yen in trade transactions.

[10] For example, Fukuda and Ji (1994) have examined four commodities (TVs, VCRs and two types of automobiles) and Sato (1999) has investigated three commodities (piston engines, hybrid integrated circuits and automobiles).

distinguish between the short-run and the long-run PTM behavior of Japanese exporters by using the cointegration technique and the error-correction model. This distinction is particularly important in considering the currency invoicing practices of exporters, since it is not the long-run PTM but the short-run PTM that captures the effect of currency invoicing on the destination-specific adjustment of markups. Gagnon and Knetter (1995) have attempted to make such a distinction using the error-correction model.[11] Following their approach, we also discriminate between the short-run and the long-run PTM to examine the currency invoicing of Japanese machinery exporters.

The remainder of this paper is organized as follows. Section 2 makes a concise survey of the literature on PTM and currency invoicing, and presents the basic model for empirical analysis. Section 3 explains the methodology for empirical analysis. In section 4, the data for empirical analysis is described. Section 5 reports the result of unit root tests, cointegration tests and the error-correction regression. Implications for the yen internationalization in East Asia are also discussed. The final section concludes the paper.

2. Theoretical Framework

When the firm adjusts the markups of export products in response to exchange rate changes, such destination-specific adjustment of markups is called the PTM behavior. The PTM behavior can be explained in the following basic model. Suppose that a firm produces in the domestic country and sells in both domestic and foreign markets. Assuming that the firm sells

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[11] Gagnon and Knetter have used annual data for their empirical estimation. However, testing with annual data does not necessary provide us with correct information about the effects of currency invoicing on export prices, since currency contracts typically last several months only and the coefficient of the short-run PTM would be biased toward that of the long-run PTM when we use annual data. In contrast, this paper uses monthly data for empirical analysis the result of which is expected to give us more reliable information about currency invoicing practices.

the export good in the foreign currency, the profit of the firm is:

$$\pi_t = p_t h(p_t, y) + S_t p_t^* f(p_t^*, y_t^*) - C\{[h(\cdot) + f(\cdot)], w_t, p_t^m\}, \qquad (1)$$

where p_t and p_t^* denote the firm's domestic selling price and the export price (in terms of the foreign currency) at period *t*, respectively; y_t and y_t^* denote the real income of the domestic and foreign countries at period *t*, respectively; and w_t and p_t^m denote wage and raw materials price in the domestic currency at period *t*, respectively. The demand function is assumed to be $h = h(p_t, y_t)$ in the domestic market and $f = f(p_t^*, y_t^*)$ in the foreign market. $C\{\cdot)$ is the cost function and S_t is the exchange rate at period *t* expressed as the domestic currency price of the foreign currency.

The first-order conditions for the maximization problem of Eq.(1) are:

$$p_t = C_1\{\cdot\}m(p_t, y_t), \qquad (2)$$

$$S_t p_t^* = C_1\{\cdot\}m^*(p_t^*, y_t^*), \qquad (3)$$

where C_1 is marginal cost, $m(\cdot)$ is the markup of the domestic price over marginal cost, and $m^*(\cdot)$ is the markup of the foreign price (expressed in the domestic currency).

The PTM effect concerns the relative price of the good destined for the two markets: foreign and domestic markets in this case. Accordingly, the literature on PTM examines the response of the relative export price ($S_t p_t^* / p_t$) against the exchange rate changes, so called the "PTM elasticity":

$$d\ln(S_t p_t^* / p_t)/d\ln S_t = d(\ln C_1\{\cdot\} + \ln m^*)/d\ln S_t - d(\ln C_1\{\cdot\} + \ln m)/d\ln S_t$$

$$= d\ln m^* / d\ln S_t - d\ln m / d\ln S_t . \tag{4}$$

The PTM elasticity will be positive when there is a difference in the effect of exchange rate changes on the markup between the domestic and foreign markets. Since the exchange rate changes are unlikely to affect the domestic markup, the second term in the right-hand side of the last equation would be zero ($d\ln m / d\ln S = 0$). On the other hand, assuming that the foreign demand curve is less convex than the constant elasticity curve, a depreciation (appreciation) of the exchange rate increases (decreases) the markup of the foreign market (i.e., $d\ln m^* / d\ln S > 0$), and hence the left-hand side of Eq.(4) will be positive.

In light of the above discussion, and considering that income in domestic and foreign markets can be expected to affect the ratio of the export price to the domestic selling price, the following equation can be adopted:[12]

$$\ln(Sp^* / p)_t = \beta_0 + \beta_1 \ln S_t + \beta_2 \ln y_t^* + \beta_3 \ln y_t . \tag{5}$$

The literature on PTM focuses on the sign of β_1: if the firm pursues the PTM behavior, β_1 will be positive and statistically significant. However, most studies have not explicitly recognized that the choice of the invoice currency does affect the exchange rate pass-through.

Giovannini (1988) and Fukuda and Ji (1994) have explicitly considered the effect of the currency invoicing in the framework of the PTM model, and shown that the choice of the invoice currency is based on the similar conditions that govern PTM. Specifically, they solve the firm's

[12] Note that cost factors (wages and raw material prices) are not included in the Eq. (5), while the cost factors can influence pricing equations (2) and (3) through their effects on marginal costs. However, to the extent that we implicitly assume the common marginal costs, changes in marginal costs are unlikely to have significant influence on the ratio of the export price to the domestic selling price.

maximization problem of the expected profit assuming that the exchange rate is a stochastic variable. Giovannini has shown theoretically that the choice of the invoice currency depends on the shape of the firm's profit function in each foreign market: firms set their export prices in the foreign (domestic) currency if the profit function is concave (convex) in the exchange rate. Fukuda and Ji have extended the theoretical model of Giovannini and shown that 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.[13] [14] Accordingly, Fukuda and Ji have tested the following hypothesis:

Hypothesis 1: When invoicing in the foreign currency, the PTM elasticity is high and significantly positive. When invoicing in the domestic currency, the PTM elasticity is less statistically significant.

Fukuda and Ji have made an empirical examination by using the first-difference of Eq.(5).[15] However, a more suitable approach is to adopt the error-correction formulation of the

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[13] This condition will hold to the extent that the demand function in the foreign market is concave. Fukuda and Ji have considered a monopolistically competitive firm and shown that which currency invoicing behavior leads to the highest expected profits depends on the curvature of profit functions that are in turn conditional on the shape of demand functions. In their model, to the extent that the demand function in the foreign market is concave in the selling price in terms of the foreign currency, the foreign currency invoicing of exporting firms leads to a positive correlation between the exchange rate in terms of the domestic currency and the export price in terms of the domestic currency.

[14] It is interesting to consider what causes a difference in the shape of profit functions. Fukuda and Ji relate this issue to the so-called "McKinnon's hypothesis." McKinnon (1979) suggests that trade in specialized manufactured products (so-called "tradables I") tends to be invoiced in the exporter's currency and trade in primary products (so-called "tradables II") tends to be invoiced in a major international currency. Producers of tradables I appear to have some market power over their products due to the distinctive character of the products, which enables them to invoice their exports in their national currency. In contrast, since tradables II such as primary products are relatively homogeneous and can be precisely graded and compared, they tend to be registered at a centralized commodity exchange in a particular country whose currency is used internationally. We may say that the profit functions of tradables I are interpreted to be concave and those of tradeables II to be convex (Fukuda and Ji, 1994, p.514).

[15] Exactly speaking, the Fukuda and Ji's model is much simpler and do not allow for the effect of real income.

PTM model. The underlying idea is that exporters can stabilize their export prices in terms of the importers' currency in the following two ways: first, by adjusting profit margins intentionally even when invoicing in their own currency, and second, by invoicing in the importers' currency with the result that export prices are stabilized automatically at least in the short-run.[16] In order to recognize the short-run response of the export price against exchange rate fluctuations due to the choice of the invoice currency, we attempt to distinguish between the long-run and the short-run PTM behavior under the error-correction framework. Gagnon and Knetter (1995) have theoretically examined the effects of different currency invoicing on the short-run dynamics of export prices using the error-correction formulation based on an adjustment cost model. They have shown that in the framework of the error-correction model, the coefficient of the first-differenced exchange rate is positive, higher and statistically significant when invoicing in the importer's currency, while the corresponding coefficient tends to be lower and less statistically significant when invoicing in the exporter's currency. Motivated by the Gagnon and Knetter's work, we make an empirical estimation of the following error-correction formulation:

$$\Delta \ln(Sp^* / p)_t = \gamma_0 + \gamma_1 \Delta \ln S_t + \gamma_2 \Delta \ln y_t^* + \gamma_3 \Delta \ln y_t - \alpha \hat{\varepsilon}_{t-1} + u_t, \qquad (6)$$

where $\hat{\varepsilon}_t \ (= \ln(Sp^* / p)_t - \hat{\beta}_0 - \hat{\beta}_1 \ln S_t - \hat{\beta}_2 \ln y_t^* - \hat{\beta}_3 \ln y_t)$ are the residuals obtained from the OLS estimation; the estimate of α provides information on the speed of adjustment and u_t is the white noise residual.[17] Hence, the hypothesis we will examine below is as follows:

[16] See Marston (1990) and Sasaki (1996) as well for a rigorous discussion about this distinction.

[17] Eq.(6) assumes no lagged difference of each variable for simplicity of explanation. In the empirical analysis below, however, we employ the Hendry's "general-to-specific" approach and allow for lagged differences of variables if they are statistically significant.

Hypothesis 2: When invoicing in the foreign currency, the coefficient of the contemporaneous first-differenced exchange rate (γ_1), so-called the short-run PTM elasticity, is positive and statistically significant. When invoicing in the domestic currency, the short-run PTM elasticity is less statistically significant.

In the following section, we first perform unit root tests to check whether the variables are stationary or not, and then, run the cointegration tests to find any possible cointegrating relationship between the variables. If they are cointegrated, we will run the error-correction regression to distinguish between the short-run and the long-run PTM.

3. Methodology for Empirical Analysis

We employ time series methodology that allows for possible non-stationarity of the series, long-run equilibrium relationship, and short-run dynamics of export prices in response to exchange rate changes. We use two types of cointegration technique: the Johansen cointegration test and the Hendry's dynamic single equation method for cointegration tests.[18] If we find a cointegrating relationship, we reformulate it into an (vector) error-correction form to allow for short-run dynamics as well as gradual adjustment to a long-term equilibrium.

The Johansen cointegration technique is based on the maximum likelihood estimation of the vector error-correction model. Let X_t be a ($n \times 1$) vector of I(1) variables. Then, it is possible to specify the following unrestricted vector autoregression (VAR) involving up to *k*-lags of X_t:

[18] For the Johansen test, see Johansen (1988) and Johansen and Juselius (1990). For the Hendry method, see Hendry and Doornik (1999).

$$X_t = \mu + A_1 X_{t-1} + ... + A_k X_{t-k} + \varepsilon_t, \qquad (7)$$

where A_i is an $(n \times n)$ matrix of parameters and ε_t are a Gaussian error term. Equation (7) can be reformulated into a vector error-correction form:

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + ... + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \varepsilon_t, \qquad (8)$$

where $\Gamma_1 = -(I - A_1 - ... - A_i)$, ($i$ = 1, … , $k-1$), and $\Pi = -(I - A_1 - ... - A_k)$. Our major interest is in the matrix $\Pi = \alpha\beta'$, where α represents the speed of adjustment to disequilibrium, while β is a matrix of long-run coefficients such that the term $\beta' X_{t-k}$ represents up to $(n-1)$ cointegration relationship in the multivariate model. Thus, the test for cointegration is to determine how many $r \le (n-1)$ cointegration vectors exist in β, which amounts to testing whether $\Pi = \alpha\beta'$ has reduced rank.

We use the trace statistic and the maximum eigenvalue statistic. The null hypothesis that there are at most r cointegrating vectors ($0 \le r \le n$) can be tested by the trace statistic:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i),$$

where $\hat{\lambda}_i$'s are the $(n-r)$ smallest squared canonical correlations of X_{t-1} with respect to ΔX_t corrected for lagged differences and T is the sample size used for estimation. Another test of the significance of the largest λ_r is to use the maximum eigenvalue statistic:

$$\lambda_{\max} = -T \ln(1 - \hat{\lambda}_{r+1}).$$

This is to test that there are r cointegration vectors against the alternative that r + 1 exist.

In implementing the Johansen test, we follow the Hendry's approach of general-to-specific modeling.[19] We initially estimate VAR with twelve lags, then reduce the longest lag if none is very significant for the *F*-test of the overall significance in the system of each regressor. After determining the common lag length, we perform the test for reduced rank.

We must note that the results of the Johansen test are very sensitive to misspecification of the lag length and also to the assumption that the errors are independent normal.[20] Taking into account such problems, we perform the Hendry's dynamic single equation method for cointegration tests as well.[21] Whereas the Engle and Granger (1987) cointegration technique is more popular as a residual-based ADF cointegration test, it is less powerful and inefficient than the Hendry's dynamic regression method.

Suppose that the true data generating process involves dynamic terms. In this case, the Engle-Granger's estimation of the static model at the first stage of their cointegration procedure will push more complicated dynamic terms into the residual, with the result that the latter may exhibit severe autocorrelation. Despite the "superconsistency" property of the OLS estimator when the series are cointegrated, the estimates of the long-run relationship will be biased in finite sample cases.[22] Hendry has advocated the method that involves adding lagged terms of both dependent and independent variables in the static OLS estimation at the first stage of the Engle-Granger's procedure. Thus, the following model is estimated: $a(L)y_t = b(L)x_t + u_t$, where $a(L) = 1 - a_1L - a_2L^2 - ... - a_pL^p$ and $b(L) = b_0 + b_1L + b_2L^2 + ... + b_qL^q$. Evaluating *a(L)* at $L = 1$, that is, $a(1) = 1 - \sum_{i=1}^{n} a_i$ and given that $a(1) \neq 0$, the long-run equation is: $y = (b(1)/a(1))x = Kx$. We initially run the dynamic regression with twelve lags, and then the

[19] See Doornik and Hendry (2000). We use *PcFiml* version 9 for the Johansen cointegration test.

[20] See Maddala and Kim (1998), Chapter 5.

[21] For the detail of the Hendry's dynamic single equation method for cointegration tests, see Hendry and Doornik (1999).

[22] See Banerjee et al. (1993) and Maddala and Kim (1998), Chapters 5 and 6.

non-significant lagged terms are removed sequentially and such sequential reduction is supported by an *F*-test. In implementing the empirical estimation, we use *PcGive* version 9 that reports the estimates of the long-run solution and the results of cointegration test, i.e., the unit root test for the residuals of the long-run solution.

4. Data Description

One notable feature of this paper is to employ a large number of sample commodities obtained from the Japanese customs data (Japan Tariff Association, various issues), which contrasts markedly with the previous literature that uses only three or four commodities with shorter sample periods.

We use the monthly series of unit values for the 1988-99 period that are calculated form the data on quantities and values of H.S. code nine-digit exports. In the existing literature on the PTM behavior of Japanese exporters, commodity breakdown data on Japanese export price index published by the Bank of Japan (BOJ) is generally used, whereas the regional breakdown data is not available in the BOJ statistics. To the extent that we are interested in the difference in the PTM behavior across export destinations, it is unit values that are the only measure of price we can obtain on a destination-specific basis.[23] We test the thirteen commodities that are listed in the Appendix. These products are chosen from the three major Japanese machinery industries: general machinery, electric machinery and transport equipment.[24]

[23] See Goldberg and Knetter (1997), p.1254. Whereas we can avoid the aggregation problem by using highly disaggregated data, it may be hard to generalize the conclusions obtained from such studies due to a limited coverage of commodities or industries (Ohno, 1989, p.552). Noting this limitation, this paper first chose from the three machinery industries the sub-categories that is relatively large in terms of the export volume, and then picked up thirteen types of commodity from the sub-categories.

[24] The volume of the three major machinery exports accounts for, say, 68.9 percent of Japan's overall exports in 1998 (computed from The Japan Tariff Association, 1998).

The data source for the export commodities is Japan Tariff Association (various issues) that reports the quantities and values of Japan's exports by both commodity and country. Each export value is based on the FOB (free on board) value in terms of the yen. The unit value (i.e., average export price) is calculated by dividing each export value by its export quantity.[25] Since we use the highly disaggregate commodity data, the obtained unit values can be regarded as an approximation of the actual export price of each commodity to each country.[26] Then, the ratio of the export price to the domestic selling price is computed by dividing the unit value of the specific commodity by the corresponding domestic wholesale price index. The data source for the domestic wholesale price index is the Bank of Japan (various issues). All the data are monthly and seasonality is adjusted for empirical tests.[27]

It must be noted that there are two problems when we use the data from Japan Tariff Association (various issues). First, since the commodity classification was changed drastically in January 1988, it is very difficult to use a consistent series of data ranging from the pre-1988 period to the present.[28] Accordingly, we use the monthly data from January 1988 to December 1999 for empirical analysis. We must also note that much longer sample period is preferable for the cointegration analysis and that our analysis has a limitation in that the sample time span is somewhat short.

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[25] For unit values of exports to East Asia, we divide the total amounts of exports to eight East Asian economies by the corresponding total quantity.

[26] Graphic analysis of unit values for each commodity indicates a large fluctuation of the series and the presence of outliers, even though obvious data input errors were dropped when we calculated the unit values for exports to East Asia. The large fluctuation may be due to the data problem intrinsic to the unit value series: while the export price index data (for example, BOJ, various issues) allows for the change in quality of the commodity over time, the quality change cannot be captured in the case of unit values obtained from Japan Tariff Association (various issues). A further consideration of this problem should be necessary in future work.

[27] We use the Census X-11 (multiplicative) command in the Eviews 3.1 for seasonal adjustment.

[28] Up until the end of 1987, the commodity classification of Japan Tariff Association (various issues) was based upon the Customs Co-operation Council Nomenclature (CCCN). Since the beginning of 1988, the classification has been based upon Harmonized Commodity Description and Coding System (HS).

Second, the commodity classification is also often changed in the data from January 1988 to the present, which causes another difficulty in choosing a consistent series of data. As for the integrated circuit (IC) category, for example, DRAM (dynamic random access memories) nowadays accounts for a large share in Japan's total IC exports, and hence, it would be preferable to use DRAM for empirical tests. Because of the short product cycle in the semiconductor industry, however, the DRAM data is available only from January 1996 in Japan Tariff Association (various issues).[29] Since a longer time span is preferred, we choose hybrid ICs and monolithic ICs.

This paper examines currency invoicing practices of Japanese firms in exports to East Asia as well as the United States, and the data for the nominal yen-dollar exchange rate is used in this analysis.[30] Most East Asian countries had adopted the currency basket system and in effect pegged their currencies to the U.S. dollar at least up to the outbreak of the currency crisis.[31] As long as East Asian currencies are tied strongly to the U.S. dollar, it seems reasonable to assume that exporters and importers in the East Asian countries are exposed to less exchange rate risk when their imports and exports are invoiced in U.S. dollars. After the Asian currency crisis, the above assumption may not be plausible for some of the currencies, such as the Thai Baht, Korean Won, and Indonesia Rupiah. However, our main interest is whether Japan's exports to the East Asian countries are invoiced in U.S. dollars or in other currencies (mainly the yen), because East Asian currencies are not typically used in foreign trade. Accordingly, we use the yen-dollar exchange rate for our analysis.

[29] Another way is to pick up several commodities that account for the largest share for each period and then to connect them to make a consistent series of the data. However, since the gap of the average price is often so large between them, it is very difficult to use such series for analysis.

[30] For the estimation of the long-run PTM, it would be better to use the real exchange rate instead of the nominal exchange rate. However, we use the nominal exchange rate in empirical analysis because our main interest is in the short-run dynamics of markup adjustment in response to the change in nominal exchange rate. Further consideration of this point will be necessary.

[31] See Frankel and Wei (1994), Kwan (1994), and Esaka (1999).

Industrial production index is used as a proxy for real income data since we need monthly series of data.[32] All data is obtained from IMF (various issues) and the country data (see Appendix for details). For the industrial production index of East Asia, we construct the weighted average of industrial production for eight East Asian economies. The weights for each month are based on the corresponding annual averaged share of Japan's exports to each economy.[33] It must be noted that there are two problems in dealing with the industrial production data for East Asia. First, for Hong Kong, Indonesia and Thailand, monthly data is not published and only quarterly data is available. To make a monthly series of weighted average data, we convert the quarterly series of three economies' industrial production data to the monthly series.[34] Second, China's industrial production data is available only from December 1991. If we include China in East Asia, we have to use much shorter sample period for empirical analysis. To avoid such short time span problem, we exclude China from East Asia and define eight East Asian economies as East Asia.

5. Empirical Results

5.1 Testing for Unit Roots

The first task for time series analysis is to examine whether the variables are stationary or not. We use the Phillips-Perron (PP) test and the KPSS test to test the stationarity of the variables. In the PP tests, the null hypothesis is non-stationarity of a variable. On the other

[32] We must note the drawbacks of using industrial production indexes: first, this index does not cover the service sector, and second, the index may represent the supply side rather than the demand side factor.

[33] The data on the share of Japan's exports to each East Asian economy is obtained from International Centre for the Study of East Asian Development (2000).

[34] Singapore started to publish the monthly data from January 1997. Hence, we use quarterly data up to December 1996 for Singapore as well. We used the "CONVERT (INTERPOL)" command in TSP 4.5 that specifies linear interpolation when converting to a higher frequency.

hand, in the KPSS test, the null is that a variable is stationary and the alternative hypothesis is that a variable has a unit root.[35]

The results of the unit root tests are reported in Table 3.[36] First, the results of the PP test are to reject the null hypothesis of a unit root in level for seven cases in both exports to the United States and to East Asia. Turning to the results of the PP test in the first-difference, we strongly reject the null for all cases. Second, the results of the KPSS test in level show that we reject the null hypothesis of the stationarity of a variable for all cases except transistors (the United States) and trucks (East Asia), which indicates that these two variables may be stationary in level. The test results in the first-difference indicate that the null cannot be rejected in all cases except US industrial production. We must note that there is a conflict in test results between two tests.[37] However, only in the case of transistors (the United States) and trucks (East Asia), both unit root tests suggest a level stationarity. Accordingly, we hereafter assume that all the variables are I(1) except for transistors (the United States) and trucks (East Asia), and the last two variables are excluded in the following cointegration analysis.

5.2 Cointegration Tests

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[35] Kwiatkowski et al. (1992) test is now known as the KPSS test. The KPSS test assumes that a time series variable y_t could be decomposed into the sum of a deterministic trend, a random walk and a stationary error as in the following equation: $y_t = \xi t + r_t + \varepsilon_t$. Here r_t is a random walk: $r_t = r_{t-1} + u_t$, where the u_t are iid (0, σ_u^2). The stationarity of y_t is tested by testing whether $\sigma_u^2 = 0$.

[36] We performed unit root tests in level with trend and constant and in the first-difference with constant only for all variables, based on the visual inspection on each variable in a graphic analysis. As for the number of lags for the PP and KPSS tests, we choose the lags suggested by Newey and West (1994). We do not report the results of the augmented Dickey-Fuller (ADF) test, since the ADF test is less powerful. Even if taking into account the result of the ADF test, the conclusion in the text will not change.

[37] Such a conflict in test results may be due to the data problem intrinsic to unit value series: since unit values cannot allow for the changes in quality of the commodity concerned, the series have a number of outliers, which may cause conflicting results between two types of tests. This problem is not fully considered in this paper, and we assume that the variables are I(0) only if both tests suggest that they are stationary in level; otherwise they are I(1).

The results of cointegration tests are reported in Tables 4 and 5. Let us first look at the results in the case of exports to the United States (Table 4). On the basis of the Johansen test statistic, either trace test or maximum eigenvalue test rejects the null hypothesis of zero cointegrating vectors for nine of twelve cases. The null of at most one cointegrating vector is rejected in compressors, VCRs and automobile I. In the case of magnetic disk units, facsimiles and trucks, the test statistic cannot reject the null hypothesis of zero cointegrating vectors. However, taking a careful look at the results of trace statistic, the null is barely accepted at the 5 percent significance level in the case of magnetic disk units and facsimiles. In addition, on the basis of the Hendry's dynamic regression method of cointegration tests, the null hypothesis that there is no cointegrating relationship is rejected at the 5 percent level in magnetic disk units and facsimiles. The same is true in the case of trucks. Whereas in some cases there is a conflict between the results of two cointegration methods,[38] we hereafter assume that there is a cointegrating relationship if the null hypothesis of no cointegration is rejected by either test method.

Turning to exports to East Asia (Table 5), the Johansen test statistic rejects the null hypothesis of zero cointegrating vectors in seven cases, in two of which the null of at most one cointegrating vector is rejected: the case of VCRs and monolithic ICs. Next, on the basis of the Hendry's method, the null hypothesis of no cointegration is rejected in eight cases. Neither the Johansen test nor the Hendry's method can reject the null of no cointegration for three cases: compressors, engines and motorcycles. Otherwise, there seems to be a cointegrating relationship. Accordingly, the three commodities (compressors, engines and motorcycles) are excluded from the following analysis and the remaining nine are examined using an (vector) error-correction model.

[38] Such a conflict of the test results may be due to the short time span of the sample data.

5.3 Error-Correction Analysis

The next step after obtaining the long-run cointegrating relationship is to build an (vector) error-correction model to reveal the short-run PTM behavior. We adopt the following three approaches.

(1) If we find a cointegrating relationship by the Johansen test, we transform the VAR model into a vector error-correction model. We first conduct the test of restrictions on the cointegration vectors jointly with the test for weak exogeneity of the exchange rate variable.[39] Whereas in the vector error-correction model only the lagged differenced terms enter into the right-hand side of the equations, our major interest is not in the coefficient of the lagged exchange rate ($\Delta \ln S_{t-i}$, i = 1, …, T) but in that of the current exchange rate ($\Delta \ln S_t$), since the short-run PTM due to the importer's currency invoicing is likely to be captured by the coefficient of the contemporaneous exchange rate. Second, we obtain a parsimonious VAR (i.e., a parsimonious vector error-correction model) by removing insignificant regressors and testing whether this reduction in the model is supported by an F-test. Then, only if it is weakly exogenous, we condition on the exchange rate so that the current exchange rate ($\Delta \ln S_t$) enters into the right-hand side of the equations.[40]

(2) If we find a cointegrating relationship not by the Johansen test but by the Hendry's dynamic method only, we transform the long-run model into an error-correction model. The error-correction regression is initially run with relevant lag length of first-differenced terms. Then non-significant lagged terms are removed sequentially and such sequential reduction is supported by an F-test.

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[39] Tests for weak exogeneity in the system is to conduct a test of the hypothesis that $H : \alpha_{ij} = 0$, for j =1, …, r, where $\Pi = \alpha\beta'$ in Eq.(8) and α represents the speed of adjustment to disequilibrium, by using a likelihood ratio (LR) test statistic.

[40] We follow the procedure advocated by Doornik and Hendry (2000).

(3) If a cointegrating relationship is found by the Johansen test but the exchange rate variable is not weakly exogenous, we cannot obtain any information on the coefficient of the contemporaneous exchange rate. In this case, we use the Hendry's method instead by assuming that all variables in the right-hand side of the equation are weakly exogenous and also that there is a single unique cointegration vector, whereas the LR test for weak exogeneity in the system suggests that the exchange rate is not weakly exogenous. Hence, we must be careful in interpreting the estimated results in this case. We follow this approach in the following four cases: VCRs, hybrid ICs, automobiles I and II in exports to East Asia.[41]

Long-run PTM

The results are reported in Tables 6 and 7. Let us first look at the long-run PTM relationship. In exports to the Untied States, the estimates of the exchange rate are positive and statistically significant in eight of eleven cases, which implies that markup adjustment associated with the exchange rate changes has a stabilizing effect on the export prices in the U.S. markets. For example, the estimate of 0.87 for compressors indicates that a 10 percent depreciation (appreciation) of the yen-dollar exchange rate will lead to an 8.7 percent increase (reduction) in the markup of export prices in terms of the yen. Interestingly, the estimates of the exchange rate for engines and automobile I are negative and statistically significant, implying that the long-run PTM strategy is not conducted in exporters of these commodities, whereas it is now widely accepted that Japanese exporters tend to stabilize the export price in the U.S. markets. It must also be noted that we cannot build any meaningful long-run relationship for trucks, though the result of cointegration test (Hendry's method) in Table 4 suggests that there is a cointegrating relationship for trucks.

[41] VCRs (the United States) are not weakly exogenous either, but we could not obtain any meaningful result using the Hendry's method. Hence, we exclude the result of VCRs from Table 6.

Turning to the results for exports to East Asia (Table 7), the estimates of the exchange rate for six commodities are positive and statistically significant. In other words, the long-run PTM behavior is likely to be conducted across three machinery industries even in exports to East Asia, which contradicts the general view on the pricing strategy of Japanese exporters. Our finding is particularly interesting, since Japanese machinery exporters are typically considered to have strong competitiveness or market power in the East Asian markets, and hence, the exporters were expected to pass-through exchange rate changes to importers even in the long-run.

Finally, we must note that industrial production indexes indicate unexpected signs in some cases. As for the Japanese industrial production index, we obtain expected negative coefficients in only three cases for exports to East Asia; otherwise the coefficients is positive or not statistically significant. For exports to the United States, all coefficients are positive or not statistically significant. Turning to the foreign industrial production index, we get expected positive coefficients in seven cases for exports to the United States and in five cases for exports to East Asia; otherwise the coefficients are negative or statistically insignificant. This observation suggests that the industrial production index is not necessarily a good proxy for income, whereas we have no choice but to use the industrial production index since we need the monthly data. A further consideration of how to handle this data problem will be necessary.

Short-run PTM

Let us now consider the results of error-correction regression. In Tables 6 and 7, we report the contemporaneous short-run PTM elasticity and the coefficient of the error-correction term only, since other coefficients are secondary matters for our analysis. When we obtain a conditional vector error-correction model, the result of the relative export equation (in which the dependent variable is the first difference of the relative export price) is reported. The short-run PTM elasticity, i.e., the first difference of the exchange rate, indicates the short-run response of export price to changes in the exchange rate that may reflect the choice of the invoice currency. The error-correction term, EC (-1), measures the response of the export prices to a deviation from its long-run equilibrium value in the previous period.

First, looking at the results of the short-run PTM elasticity in exports to the United States (Table 6), all the estimated results except for automobile I are positive and statistically significant at least at the 5 percent level, implying that U.S. dollar-invoiced exports are likely to be conducted. It must be noted, however, that in the general machinery and transport equipment industries, some of the estimated coefficients are equal to or below 0.40, though more than 80 percent of Japan's machinery exports to the United States are invoiced in U.S. dollars.[42] Whereas the estimated coefficients are somewhat smaller than the actual currency invoicing ratio in some cases, we would like to emphasize that the results do exhibit a significant positive correlation between the relative export price and the exchange rate in ten of eleven cases. U.S. dollar invoicing is likely to elicit a certain degree of stabilization of dollar denominated export prices in the short-run in the U.S. markets. Another thing we must note is that even in the case of engines and automobile I, where the coefficient of the exchange rate in the long-run PTM is negative, the estimates of the short-run PTM elasticity are positive and statistically significant, though the significance level for automobile I is only at the 10 percent level. All the error-correction terms are negative and the results of goodness-of-fit are reasonable in most cases. The Lagrange-multiplier (LM) test for serial correlation accepts the null of no autocorrelation in all cases.

Second, turning to the case of exports to East Asia (Table 7), the estimates of the short-run PTM elasticity are positive and statistically significant at least at the 5 percent level for five cases: magnetic disk units, facsimiles, VCRs, transistors and monolithic ICs, though we must be

[42] In March 1998, 82.1 percent of Japan's general machinery exports to the United States are invoiced in U.S. dollars. 86.4 percent of the electric machinery exports and 87.4 percent of the transport equipment exports are invoiced in U.S. dollars as well. See Sato (1999), Table 7.

careful in interpreting the estimated result for VCRs since, as mentioned earlier, the LR test for weak exogeneity in the system suggests that the exchange rate is not weakly exogenous in this case. This result implies that the exporters of these commodities (mainly electric machinery products) tend to invoice their exports in U.S. dollars.[43] In the case of lathes and automobiles I and II that are categorized into the general machinery and the transport equipment industry, respectively, the estimates of the short-run PTM elasticity are significantly negative or not significantly different from zero, while the estimates of the exchange rate in the long-run PTM is significantly positive.[44] This result implies that while the exporters of these commodities tend to adjust their markup to stabilize the export price in terms of the U.S. dollar in the long-run, they are likely to invoice their exports in the yen. Again, all the error-correction terms are significantly negative and the results of the goodness-of-fit are reasonable in most cases. The LM test accepts the null of no autocorrelation in all cases except magnetic disk units and transistors.

5.4 Implications for the Yen Internationalization in East Asia

The estimated results reported in Table 7 show a marked difference in the short-run PTM elasticity (i.e., the estimate of ΔEXR) between the electric machinery products and others: on one hand, the short-run PTM elasticity is positive and statistically significant in the electric machinery exports to East Asia; on the other hand, the elasticity is negative or less statistically

[43] The estimates of the short-run PTM are larger than unity for magnetic disk units, VCRs and transistors. This is true for magnetic disk units and hybrid ICs in exports to the United States as well. The possible reason is that we use unit values for empirical analysis. As mentioned earlier, the unit value series exhibit substantial variations and a number of outliers, since unit values do not account for changes in quality of the commodity concerned unlike the export price index data. Owing to the rapid technological progress in the semiconductor and IC industry and the computer-related industry, the estimated results for these industries may indicate unexpectedly large coefficients.

[44] Again, we must be careful in interpreting the results for automobiles I and II, because we assumed that the exchange rate is weakly exogenous though the LR test for weak exogeneity in the system suggests that the exchange rate is not weakly exogenous.

significant in general machinery and transport equipment exports to East Asia. These results contrast markedly with the conclusion of the previous literature that states that Japanese machinery exporters tend to pass-through exchange rate changes to East Asian importers with the result that the yen-invoiced ratio is high in exports to East Asia. Rather, our estimated results are consistent with the currency invoicing patterns of Japan's machinery exports to Southeast Asia reported in Table 2 that indicates that the ratio of yen-invoiced exports is relatively low and that of U.S. dollar invoiced exports is higher in the electric machinery exports to Southeast Asia.[45]

The strong tendency of U.S. dollar invoicing for exports of the electric machinery products seems to be explained by the characteristic of these products. Semiconductors and ICs are less differentiated products than other machinery products such as general machinery and transport equipment products, and hence, exporters of the former may not be able to have a strong market power even in East Asian markets. In addition, computer-related products like magnetic disk units that are assembled from electric components (including semiconductors and ICs) tend to be invoiced in U.S. dollars since U.S. dollar invoicing is advantageous as long as the electric components are traded generally in U.S. dollars. It is interesting to note that other electronic products such as facsimiles and VCRs are also likely invoiced in U.S. dollars, implying that the U.S. dollar may be largely used in the visual apparatus and telecommunication equipment industry as well, though testing with more sample commodities should be necessary to support our conclusion.[46]

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[45] To check the robustness of our empirical findings, we also made an empirical examination of the first-differenced model: we regressed the first-difference of the relative export price on the first-difference of the exchange rate, like Fukuda and Ji (1994) and Sato (1999). The result showed that the PTM elasticity (i.e., the coefficient of the first-difference of the exchange rate) is positive and statistically significant for all electric machinery exports to East Asia except for magnetic disk units. Interestingly, the PTM elasticity is significantly positive for compressors as well; otherwise, it is not statistically significant for exports to East Asia. In the case of exports to the United States, the PTM elasticity is positive and statistically significant for all commodities. We may say that the additional empirical results support the validity of the findings in the text.

[46] It is also interesting to investigate the parameter constancy of the error-correction estimation, especially for exports to East Asia. We ran the break-point *F*-test over the sample period for four products

Currency invoicing practices of the electric machinery exporters are particularly important in considering the international use of the yen, because recent increase in Japan's trade with East Asia is largely due to the active investment and trade of the electric machinery industry. Given that the electric machinery industry continues to play a major role in facilitating trade and investment between Japan and East Asia, the use of the yen in trade transactions cannot be expected to increase substantially in East Asia.[47]

6. Concluding Remarks

Our main finding is the different currency invoicing pattern in Japan's exports to East Asia across commodities or industries. There is fairly general agreement that Japanese machinery exporters typically tend to conduct yen-invoiced exports with East Asian economies. However, the result of our empirical analysis have shown that Japan's electric machinery exporters have a tendency to invoice in U.S. dollars even in exports to East Asia, which is contrary to the conclusion of the previous literature. To the extent that the electric machinery industry plays a major role in facilitating trade-investment linkage between Japan and East Asia, it seems hard to expect the further use of the yen in East Asia as the invoice currency in the near future.

The analysis of this paper, however, has some limitations due mainly to the data problem. First, the sample time span is somewhat short since we use the Japanese customs data, which may affect our estimated results. Second, the unit value series that we used in empirical analysis tend

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(magnetic disk units, facsimiles, transistors and monolithic ICs) in exports to East Asia, and the result is that the null hypothesis of constant parameters could not be rejected in all cases. Therefore, we may say that Japanese exporters tend to invoice in U.S. dollars in exports of these products to East Asia over the sample period.

[47] This point is discussed in Sato (1999) in detail.

to fluctuate very substantially and also have a number of outliers since the unit value series do not allow for change in quality of the commodity over time. Such a problem intrinsic to the unit value series may also have some influence on our analysis. Third, it is hard to get the consistent series of data for East Asian countries. In the case of industrial production index data, for example, we have no choice but to convert the quarterly data into monthly data with some strong assumption. Fourth, we have used the nominal yen-U.S. dollar exchange rate for the analysis of the long-run as well as the short-run PTM behavior. However, the real exchange rate is preferable for the analysis of the long-run PTM, and we must be careful in interpreting the results of the long-run PTM in our analysis. The careful treatment of these points will be necessary.

We can extend the analysis of this paper in the following way. First, it is necessary to use much more sample commodities for the empirical analysis, which may support the conclusion of this paper. Second, while this paper examines the currency invoicing of Japanese exporters by focusing on East Asia, we can advance our analysis further by investigating currency invoicing in exports to sub-regions such as the Asian NIEs and ASEAN and also exports to each East Asian economy. Finally, whereas we use the basic model that is widely used in the literature on PTM and currency invoicing, a further consideration of the model specification will be necessary. These are left for future research.

Appendix: Data for Empirical Tests

In the empirical analysis, the thirteen kinds of commodities are examined. The export price data are based on Japan Tariff Association (various issues), *Japan Exports & Imports (Commodity by Country)*. These export prices are listed as follows.

Commodity:	*Export Price Data Description:*
Compressors	- HS Code: 8414.30-100 (1988:1-1999:12). - Compressors of a kind used for air conditioning machines of motor vehicles.
Engines	- HS Code: 8407.34-900 (1988:1-1999:12). - Spark-ignition reciprocating internal combustion piston engines of a kind used for the propulsion of vehicles (other than railway or tramway rolling-stock, and parts and accessories thereof), of a cylinder capacity exceeding 1,000 cc, other than those for motorcycles.
Lathes	- HS Code: 8458.11-000 (1988:1-1999:12). - Horizontal lathes, for removing metal, numerically controlled.
Magnetic disk units	- HS Code: 8471.70-300 (1988:1-1999:12). - Magnetic Disk Units.
Facsimiles	- HS Code: 8517.82-100 (1988:1-1995:12), 8517.21-000 (1996:1-1999:12). - Facsimile machines.
VCRs	- HS Code: 8521.10-000 (1988:1-1999:12). - Video recording or reproducing apparatus, whether or not incorporating a video tuner, of magnetic tape-type.
Transistors	- HS Code: 8541.21-910 (1988:1-1999:12). - Cased Silicon Transistors with a dissipation rate of less than 1 W, other than photosensitive transistors.

Monolithic ICs	- HS Code: 8542.19-900 (1988:1-1995:12), 8542.30-900 (1996:1-1999:12). - Cased other monolithic integrated circuits.
Hybrid ICs	- HS Code: 8542.20-000 (1988:1-1995:12), 8542.40-000 (1996:1-1999:12). - Hybrid integrated circuits.
Automobile I	- HS Code: 8703.23-910 (1988:1-1999:12). - Motor cars and other motor vehicles principally designed for the transport of persons with spark-ignition internal combustion reciprocating piston engine, of a cylinder capacity exceeding 1,500 cc but not exceeding 2,000 cc, excluding those unassembled or disassembled.
Automobile II	- HS Code: 8703.23-920 (1988:1-1999:12). - Motor cars and other motor vehicles principally designed for the transport of persons with spark-ignition internal combustion reciprocating piston engine, of a cylinder capacity exceeding 2,000 cc but not exceeding 3,000 cc, excluding those unassembled or disassembled.
Trucks	- HS Code: 8704.22-920 (1988:1-1999:12). - Motor vehicles for the transport of goods with compression-ignition internal combustion piston engine, g.v.w. exceeding 5 tonnes but not exceeding 20 tonnes, of a cylinder capacity exceeding 4,500 cc, excluding those unassembled or disassembled.
Motorcycles	- HS Code: 8711.20-900 (1988:1-1999:12). - Motorcycles and cycles fitted with an auxiliary motor, with engines of a cylinder capacity exceeding 50 cc but not exceeding 250 cc, excluding those unassembled or disassembled.

The domestic price indexes are based on the wholesale price index data of Bank of Japan (various issues), *Price Index Annual* and *Price Index Monthly*. The domestic price indexes are listed as follows.

Commodity:	*Domestic Price Index Data Description:*
Compressors	- Air & gas compressors (1988:01-1989:12). - Compressors (1990:01-1999:12).
Engines	- Internal combustion engines for general use (1988:01-1989:12). - Industrial internal combustion engines-gasoline (1990:01-1999:12).
Lathes	- NC lathes (1988:01-1994:12). - Lathes (1995:01-1999:12).
Magnetic disk units	- Electronic machinery (88:01-89:12) - Electronic computers' related accessories (90:01-99:12)
Facsimiles	- Facsimiles (1988:01-1999:12).
VCRs	- Video tape recorders (1988:01-1999:12).
Transistors	- Transistors (1988:01-1999:12).
Monolithic ICs	- Integrated Circuits (1988:01-1999:12).
Hybrid ICs	- Integrated Circuits (1988:01-1999:12).
Automobile I	- Small passenger cars (up to 2,000 cc; 1988:01-1999:12).
Automobile II	- Passenger cars (over 2,000 cc; 1988:01-1999:12).
Trucks	- Trucks (over 2,000 cc; 1988:01-1999:12).
Motorcycles	- Motorcycles (1988:01-1999:12).

The yen-dollar exchange rate is the monthly average (nominal) exchange rate, based on IMF (various issues), *International Financial Statistics, Monthly,* CD-ROM edition.

The industrial production price index for the United States, Japan, Korea, Hong Kong, Singapore, Malaysia, Philippines are obtained from IMF (various issues), *International Financial Statistics, Monthly,* CD-ROM edition. The Taiwan data is from the website of National Statistics of Taiwan, the Republic of China (http://www.stat.gov.tw/main.htm). The Indonesia data is from BPS, *Statistics Indonesia*, various years. The Thailand data is taken from the Bank of Thailand website (http://www.bot.or.th). All the data are indexed on the 1995 base year (1995=100).

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Table 1. Invoice Currency Ratios in Japan's Exports (%)

	Exports to:							
	World		United States		EU (EC)		Southeast Asia	
Year	Yen	Dollar	Yen	Dollar	Yen	Dollar	Yen	Dollar
1970	0.9	90.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1975	17.0	78.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1980	28.9	66.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1981	31.8	62.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1982	33.8	60.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1983	42.0	50.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1984	39.5	53.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1985	39.3	52.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1986	36.5	53.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1987	33.4	55.2	15.0	84.9	44.0	8.2	41.1	56.5
1988	34.3	53.2	16.4	83.5	43.9	7.6	41.2	56.0
1989	34.7	52.4	16.4	83.5	42.2	7.0	43.5	53.6
1990	37.5	48.8	16.2	83.7	42.1	6.4	48.9	48.1
1991	39.4	46.8	16.5	83.4	42.0	6.8	50.8	45.9
S1992	40.1	46.6	16.6	83.2	40.3	11.1	52.3	41.6
M1993	42.8	45.6	18.0	81.6	42.7	7.2	52.4	44.4
S1993	39.9	48.4	16.5	83.3	41.0	7.5	52.5	44.3
M1994	40.7	48.6	19.4	80.5	40.9	8.5	52.0	45.1
S1994	39.7	48.3	19.0	80.8	36.6	9.0	49.0	47.9
M1995	37.6	51.5	17.5	82.3	37.2	11.3	47.2	49.9
S1995	36.0	52.5	17.0	82.9	34.9	12.2	44.3	53.4
M1996	35.9	53.1	15.9	83.9	36.1	12.5	44.1	53.5
S1996	35.2	53.3	14.5	85.4	33.3	12.4	46.3	51.3
M1997	35.8	52.8	16.6	83.2	34.3	13.4	45.5	51.7
S1997	35.8	52.1	15.3	84.5	34.2	12.3	47.0	50.2
M1998	36.0	51.2	15.7	84.1	34.9	13.2	48.4	48.7

Notes:
1) S refers to September and M refers to March.
2) Southeast Asia is defined as the following 22 countries (economies): Asian NIEs (Korea, Taiwan, Hong Kong, and Singapore), ASEAN4 (Indonesia, Malaysia, Philippines, and Thailand), Brunei, Cambodia, Laos, Myanmar, India, Pakistan, Sri Lanka, Maldives, Bangladesh, East Timor, Macao, Afghanistan, Nepal, and Bhutan.

Sources:
BOJ, *Yushutsu Shinyojo Tokei [Export Letter of Credit Statistics].*
MITI, *Yushutsu Kakunin Tokei [Export Confirmation Statistics]*.
MITI, *Yushutsu Hokukosho Tsukadate Doko [Export Currency Invoicing Report]*.
MITI, *Yushutsu Kessai Tsukadate Doko Chosa [Export Settlement Currency Invoicing]*.

Table 2. Invoice Currency Ratios in Japan's Exports to Southeast Asia

A. Invoice currency ratio (%) from 1987 to 1991

Commodity	Yen-invoiced ratio					Dollar-invoiced ratio				
	1987	1988	1989	1990	1991	1987	1988	1989	1990	1991
All commodities	41.1	41.2	43.5	48.9	50.8	56.5	56.0	53.6	48.1	45.9
Machines	54.0	52.6	55.3	60.9	62.6	43.0	43.8	40.9	35.2	33.2
Generators	66.1	64.3	68.1	67.8	67.5	29.0	32.9	31.1	29.2	25.9
TVs	38.8	42.8	53.0	72.4	74.8	55.8	49.0	41.8	21.1	19.9
VCRs	63.6	48.2	44.7	61.8	62.3	31.0	44.0	45.9	28.9	27.7
Automobiles	71.5	68.6	68.2	67.1	69.8	25.9	26.1	24.6	26.1	19.1
Ships	42.6	63.6	85.7	79.4	77.2	57.3	36.3	13.3	20.6	22.8
Heavy electric	40.9	39.9	49.0	46.6	51.7	53.9	58.2	48.9	51.2	45.4

B. Yen-invoiced ratio (%) from March 1994 to March 1998

Commodity	M1994	S1994	M1995	S1995	M1996	S1996	M1997	S1997	M1998
All commodities	52.0	49.0	47.2	44.3	44.1	46.3	45.5	47.0	48.4
General machinery	69.0	65.8	66.8	63.7	59.9	57.9	59.7	61.9	59.7
Electric machinery	41.8	39.7	37.0	35.9	39.7	41.3	37.9	42.0	42.7
ICs (Integrated circuits)	25.9	28.6	24.2	24.7	24.4	32.6	24.4	22.3	26.7
Telecom equipment	n.a.	n.a.	n.a.	n.a.	35.8	34.9	28.3	36.0	34.0
Transport equipment	78.4	74.4	71.5	69.3	58.5	68.5	72.3	75.6	81.3
Passenger motor cars	75.0	73.6	66.1	66.4	72.6	72.3	74.1	81.8	87.7
Parts of motor vehicles	n.a.	n.a.	n.a.	n.a.	60.5	62.3	61.3	72.7	81.1

C. Dollar-invoiced ratio (%) from March 1994 to March 1998

Commodity	M1994	S1994	M1995	S1995	M1996	S1996	M1997	S1997	M1998
All commodities	45.1	47.9	49.9	53.4	53.5	51.3	51.7	50.2	48.7
General machinery	29.3	32.6	31.6	34.9	38.7	40.6	38.5	36.4	37.7
Electric machinery	53.2	54.6	57.6	60.2	56.5	54.5	57.2	53.9	53.4
ICs (Integrated circuits)	67.8	65.5	71.4	73.2	72.5	63.6	71.7	74.6	70.8
Telecom equipment	n.a.	n.a.	n.a.	n.a.	55.1	53.8	62.3	52.0	48.6
Transport equipment	18.9	23.3	26.2	28.8	39.7	29.7	25.1	21.4	15.4
Passenger motor cars	14.4	18.8	22.8	26.8	20.8	22.0	16.5	8.2	2.6
Parts of motor vehicles	n.a.	n.a.	n.a.	n.a.	39.3	37.4	38.4	26.6	17.8

Note: S refers to September and M refers to March.

Sources:
MITI, *Yushutsu Kakunin Tokei [Export Confirmation Statistics]*.
MITI, *Yushutsu Kessai Tsukadate Doko Chosa [Export Settlement Currency Invoicing]*.

Table 3. Results of Unit Root Tests

Variables:	*Level* PP test		*Level* KPSS test		*First-difference* PP test		*First-difference* KPSS test	
A. Exports to the United States:								
Compressors	-2.27		0.39	**	-15.18	**	0.06	
Engines	-3.19		0.31	**	-13.47	**	0.14	
Lathes	-5.41	**	0.24	**	-20.91	**	0.03	
Magnetic Disk Units	-2.67		0.52	**	-18.01	**	0.14	
Facsimiles	-3.98	*	0.57	**	-15.60	**	0.12	
VCR	-5.92	**	0.20	*	-20.05	**	0.14	
Transistors	-5.69	**	0.13		-20.11	**	0.06	
Monolithic ICs	-2.44		0.43	**	-14.09	**	0.10	
Hybrid ICs	-7.45	**	0.19	*	-23.30	**	0.04	
Automobile I	-1.52		0.29	**	-13.99	**	0.21	
Automobile II	-2.73		0.16	*	-12.83	**	0.08	
Truck	-3.91	*	0.20	*	-13.65	**	0.05	
Motorcycles	-8.40	**	0.20	*	-22.36	**	0.03	
Yen-US Dollar EXR	-1.89		0.41	**	-8.09	**	0.08	
US Industrial Production	-1.31		0.65	**	-10.52	**	0.75	**
JP Industrial Production	-2.69		0.18	*	-18.37	**	0.11	
B. Exports to East Asia:								
Compressors	-5.60	**	0.25	**	-15.18	**	0.06	
Engines	-2.68		0.63	**	-13.47	**	0.14	
Lathes	-10.29	**	0.18	*	-20.91	**	0.03	
Magnetic Disk Units	-6.22	**	0.21	*	-18.01	**	0.14	
Facsimiles	-4.14	**	0.35	**	-15.60	**	0.12	
VCR	-4.44	**	0.32	**	-20.05	**	0.14	
Transistors	-3.40		0.20	*	-20.11	**	0.06	
Monolithic ICs	-1.85		0.17	*	-14.09	**	0.10	
Hybrid ICs	-2.85		0.21	*	-23.30	**	0.04	
Automobile I	-2.61		0.28	**	-13.99	**	0.21	
Automobile II	-2.94		0.32	**	-12.83	**	0.08	
Truck	-5.91	**	0.09		-13.65	**	0.05	
Motorcycles	-1.08		0.51	**	-22.36	**	0.03	
EA Industrial Production	-4.55	**	0.25	**	-8.09	**	0.08	

Notes:
1. Commodity price data denotes the export price relative to the corresponding WPI.
2. All the data are monthly and natural log transformed.
3. Sample period is from January 1988 to December 1999 for all data.
4. In the industrial production data, US denotes the United States, JP Japan, and EA East Asia.
5. Double asterisks (**) and a single asterisk (*), respectively, indicate that the statistics are significant at the 1 and 5 % levels. The critical values is based on MacKinnon (1991) for the PP test and on Kwiatkowski et al. (1992) for the KPSS test.
6. We use four lags for both PP and KPSS tests, suggested by Newey-West (1994).
7. The unit root tests for level are conducted with trend and constant, and the tests for first-difference are conducted with constant only.

Table 4. Results of Cointegration Tests: United States

	Hendry's Method	*Johansen cointegration tests*				
			Maximum eigenvalue test		Trace test	
	Test stat.	Ho:rank=p	Test stat.	95%	Test stat.	95%
Compressors:	-6.95 **	p == 0	35.53 **	27.1	72.92 **	47.2
		p <= 1	23.81 *	21.0	37.39 **	29.7
		p <= 2	12.92	14.1	13.58	15.4
		p <= 3	0.65	3.8	0.65	3.8
Engines:	-3.48	p == 0	25.11	27.1	50.50 *	47.2
		p <= 1	16.02	21.0	25.38	29.7
		p <= 2	8.02	14.1	9.36	15.4
		p <= 3	1.35	3.8	1.35	3.8
Lathes:	-2.51	p == 0	25.52	27.1	47.57 *	47.2
		p <= 1	13.64	21.0	22.05	29.7
		p <= 2	8.06	14.1	8.41	15.4
		p <= 3	0.35	3.8	0.35	3.8
Magnetic Disk Units:	-4.06 *	p == 0	24.45	27.1	46.12	47.2
		p <= 1	14.31	21.0	21.66	29.7
		p <= 2	6.58	14.1	7.35	15.4
		p <= 3	0.78	3.8	0.78	3.8
Facsimiles:	-4.04 *	p == 0	21.21	27.1	46.79	47.2
		p <= 1	15.27	21.0	25.59	29.7
		p <= 2	10.27	14.1	10.31	15.4
		p <= 3	0.05	3.8	0.05	3.8
VCR:	-2.10	p == 0	45.01 **	27.1	84.07 **	47.2
		p <= 1	25.93 **	21.0	39.06 **	29.7
		p <= 2	12.88	14.1	13.13	15.4
		p <= 3	0.25	3.8	0.25	3.8
Cased Mono-lithic ICs:	-5.15 **	p == 0	23.63	27.1	51.44 *	47.2
		p <= 1	19.52	21.0	27.81	29.7
		p <= 2	8.25	14.1	8.29	15.4
		p <= 3	0.03	3.8	0.03	3.8
Hybrid ICs:	-4.72 **	p == 0	34.41 **	27.1	53.87 *	47.2
		p <= 1	11.63	21.0	19.45	29.7
		p <= 2	7.31	14.1	7.82	15.4
		p <= 3	0.51	3.8	0.51	3.8
Automobile I:	-0.96	p == 0	32.48 **	27.1	63.17 **	47.2
		p <= 1	18.16	21.0	30.69 *	29.7
		p <= 2	9.81	14.1	12.53	15.4
		p <= 3	2.72	3.8	2.72	3.8
Automobile II:	-1.71	p == 0	26.04	27.1	53.94 **	47.2
		p <= 1	13.83	21.0	27.90	29.7
		p <= 2	9.24	14.1	14.07	15.4
		p <= 3	4.83 *	3.8	4.83 *	3.8
Trucks:	-4.77 **	p == 0	20.70	27.1	39.59	47.2
		p <= 1	10.81	21.0	18.89	29.7
		p <= 2	6.59	14.1	8.08	15.4
		p <= 3	1.49	3.8	1.49	3.8
Motorcycles:	-3.90 **	p == 0	34.50 **	27.1	54.08 **	47.2
		p <= 1	12.60	21.0	19.58	29.7
		p <= 2	6.15	14.1	6.98	15.4
		p <= 3	0.82	3.8	0.82	3.8

Notes:

1. Double asterisks (**) and a single asterisk (*), respectively, indicate that the statistics are significant at the 1 and 5 % levels.
2. Critical values for the Hendry's dynamic single equation method for cointegration test are reported by *PcGive* version 9. Critical values for the Johansen cointegration test are from Osterwald-Lenum (1992).

Table 5. Results of Cointegration Tests: East Asia

	Hendry's Method	*Johansen cointegration tests*				
			Maximum eigenvalue test		Trace test	
	Test stat.	Ho:rank=p	Test stat.	95%	Test stat.	95%
Compressors:	-3.14	p == 0	17.24	27.1	35.89	47.2
		p <= 1	12.82	21.0	18.64	29.7
		p <= 2	3.20	14.1	5.82	15.4
		p <= 3	2.63	3.8	2.63	3.8
Engines:	-1.09	p == 0	23.11	27.1	41.22	47.2
		p <= 1	11.21	21.0	18.11	29.7
		p <= 2	6.90	14.1	6.90	15.4
		p <= 3	0.00	3.8	0.00	3.8
Lathes:	-4.27 *	p == 0	28.11 *	27.1	48.19 *	47.2
		p <= 1	17.45	21.0	20.08	29.7
		p <= 2	2.19	14.1	2.64	15.4
		p <= 3	0.45	3.8	0.45	3.8
Magnetic Disk Units:	-5.29 **	p == 0	28.32 *	27.1	48.85 *	47.2
		p <= 1	15.81	21.0	20.52	29.7
		p <= 2	4.25	14.1	4.72	15.4
		p <= 3	0.46	3.8	0.46	3.8
Facsimiles:	-3.80 *	p == 0	22.15	27.1	41.74	47.2
		p <= 1	16.41	21.0	19.59	29.7
		p <= 2	2.84	14.1	3.19	15.4
		p <= 3	0.35	3.8	0.35	3.8
VCR:	-8.68 **	p == 0	34.31 **	27.1	62.28 **	47.2
		p <= 1	22.29 *	21.0	27.97	29.7
		p <= 2	5.65	14.1	5.68	15.4
		p <= 3	0.04	3.8	0.04	3.8
Transistors:	-3.93 *	p == 0	25.69	27.1	44.06	47.2
		p <= 1	11.50	21.0	18.37	29.7
		p <= 2	6.66	14.1	6.87	15.4
		p <= 3	0.21	3.8	0.21	3.8
Cased Mono-lithic ICs:	-4.04 *	p == 0	36.13 **	27.1	66.84 **	47.2
		p <= 1	25.74 **	21.0	30.71 *	29.7
		p <= 2	4.93	14.1	4.98	15.4
		p <= 3	0.05	3.8	0.05	3.8
Hybrid ICs:	-4.04 *	p == 0	36.86 **	27.1	57.33 **	47.2
		p <= 1	16.43	21.0	20.47	29.7
		p <= 2	3.75	14.1	4.04	15.4
		p <= 3	0.29	3.8	0.29	3.8
Automobile I:	-3.44	p == 0	45.67 **	27.1	68.06 **	47.2
		p <= 1	15.93	21.0	22.39	29.7
		p <= 2	6.32	14.1	6.46	15.4
		p <= 3	0.14	3.8	0.14	3.8
Automobile II:	-4.38 *	p == 0	40.22 **	27.1	65.03 **	47.2
		p <= 1	19.59	21.0	24.82	29.7
		p <= 2	5.22	14.1	5.22	15.4
		p <= 3	0.01	3.8	0.01	3.8
Motorcycles:	-1.68	p == 0	23.10	27.1	38.10	47.2
		p <= 1	8.82	21.0	15.07	29.7
		p <= 2	5.69	14.1	6.26	15.4
		p <= 3	0.57	3.8	0.57	3.8

Notes:

1. Double asterisks (**) and a single asterisk (*), respectively, indicate that the statistics are significant at the 1 and 5 % levels.
2. Critical values for the Hendry's dynamic single equation method for cointegration test are reported by *PcGive* version 9. Critical values for the Johansen cointegration test are from Osterwald-Lenum (1992).

Table 6. Long-run and Short-run PTM: United States

Commodity/	*Long-run PTM*			*Error Correction Model*			
(Test Method)	EXR	IPUS	IPJP	ΔEXR	EC (-1)	R-sq	LM test
Compressors	0.87 **			0.32 **	-0.57 **	0.68	0.12
(J-test)	(0.05)			(0.10)	(0.11)		[0.89]
Engines	-0.22 *	0.73 **		0.37 **	-0.19 **	0.39	2.38
(J-test)	(0.10)	(0.00)		(0.10)	(0.04)		[0.10]
Lathes	0.47 **	0.82 **	1.40 **	0.69 **	-0.19 *	0.44	0.56
(J-test)	(0.16)	(0.15)	(0.50)	(0.25)	(0.08)		[0.57]
Magnetic Disk	1.54 **	-0.94 **	0.64	1.20 **	-0.23 **	0.43	0.09
Units (H-test)	(0.35)	(0.33)	(1.04)	(0.32)	(0.06)		[0.91]
Facsimiles	0.85 **	0.55 **	-0.01	0.95 *	-0.49 *	0.43	0.73
(H-test)	(0.18)	(0.19)	(0.60)	(0.39)	(0.11)		[0.48]
Monolithic ICs	0.87 **	2.81 **	2.76 **	0.69 **	-0.14 **	0.22	2.14
(J-test)	(0.27)	(0.26)	(0.85)	(0.25)	(0.05)		[0.12]
Hybrid ICs	0.84 **	2.21 **		1.47 **	-0.43 **	0.37	1.88
(J-test)	(0.20)	(0.23)		(0.52)	(0.10)		[0.16]
Automobile I	-1.83 **			0.19 #	-0.03 *	0.56	0.73
(J-test)	(0.60)			(0.10)	(0.01)		[0.49]
Automobile II	0.48 **	0.62 **		0.40 **	-0.04 **	0.57	0.59
(J-test)	(0.13)	(0.14)		(0.07)	(0.02)		[0.55]
Trucks	-0.17			0.36 **	-0.22 **	0.29	1.41
(H-test)	(0.12)			(0.13)	(0.05)		[0.25]
Motorcycle	0.50 **	0.28 **		0.90 *	-0.86 **	0.53	1.35
(J-test)	(0.09)	(0.10)		(0.35)	(0.00)		[0.26]

Notes:

1) Double asterisks (**), a single asterisk (*) and a sharp (#), respectively, indicate that the statistics are significant at the 1, 5 and 10 % levels. The numbers in parentheses are standard errors.
2) Test Method: "J-test" denotes the Johansen test, and "H-test" denotes the Hendry's dynamic single equation method for cointegration test.
3) Dependent variable is the relative export price or the first-differenced relative export price.
4) Long-run PTM: (i) Normalized cointegration vectors are reported for J-test and the coefficient of the long-run model is reported for H-test. (ii) EXR denotes the yen-US dollar exchange rate. IPUS and IPJP denote US industrial production and Japan's industrial production, respectively.
5) Error-Correction Model: (i) EC(-1) denotes error correction term. (ii) For R-sq. of J-test, the square of the correlation of actual and fitted values in the relative export price equation is reported. (iii) LM test denotes the Lagrange-multiplier test for serial correlation of the relative export price equation, which is valid for equations and systems with lagged dependent variables. *PcFiml* reports the *F*-statistic and the null hypothesis is no autocorrelation. The numbers in square bracket are *p*-values.

Table 7. Long-run and Short-run PTM: East Asia

Commodity/	*Long-run PTM*			*Error Correction Model*			
(Test Method)	EXR	IPEA	IPJP	ΔEXR	EC (-1)	R-sq	LM test
Lathes	0.37 *	0.46 **	-1.56 **	-0.34	-0.93 **	0.49	1.61
(J-test)	(0.15)	(0.10)	(0.42)	(0.48)	(0.09)		[0.20]
Magnetic Disk	1.38 **	-0.28		1.43 *	-0.77 **	0.56	4.07 *
Units (J-test)	(0.23)	(0.18)		(0.69)	(0.14)		[0.02]
Facsimiles	0.03	-1.27 **	1.26 *	0.40 *	-0.26 **	0.28	1.53
(H-test)	(0.17)	(0.12)	(0.52)	(0.16)	(0.07)		[0.22]
VCR	1.05 **	1.63 **	3.72 **	2.21 **	-0.73 **	0.40	1.63
(H-test)	(0.21)	(0.15)	(0.61)	(0.52)	(0.08)		[0.20]
Transistors	0.07	-0.61 **	1.66 **	1.13 **	-0.23 **	0.32	7.46 **
(H-test)	(0.20)	(0.15)	(0.55)	(0.20)	(0.07)		[0.00]
Monolithic ICs	0.58 **	2.00 **	1.65 **	0.43 *	-0.08 *	0.43	2.11
(J-test)	(0.15)	(0.12)	(0.47)	(0.18)	(0.04)		[0.13]
Hybrid ICs	0.35	1.23 **	2.80 **	0.48 #	-0.14 **	0.36	2.65 #
(H-test)	(0.36)	(0.23)	(1.05)	(0.25)	(0.04)		[0.08]
Automobile I	1.39 **		-3.70 **	-0.63 *	-0.17 **	0.33	0.85
(H-test)	(0.51)		(1.38)	(0.26)	(0.04)		[0.43]
Automobile II	0.47 **	0.23 **	-0.80 *	-0.26 #	-0.34 **	0.36	0.82
(H-test)	(0.14)	(0.09)	(0.37)	(0.14)	(0.06)		[0.44]

Notes:

1) Double asterisks (**), a single asterisk (*) and a sharp (#), respectively, indicate that the statistics are significant at the 1, 5 and 10 % levels. The numbers in parentheses are standard errors.
2) Test Method: "J-test" denotes the Johansen test, and "H-test" denotes the Hendry's dynamic single equation method for cointegration test.
3) Dependent variable is the relative export price or the first-differenced relative export price.
4) Long-run PTM: (i) Normalized cointegration vectors are reported for J-test and the coefficient of the long-run model is reported for H-test. (ii) EXR denotes the yen-US dollar exchange rate. IPEA and IPJP denote East Asian industrial production and Japan's industrial production, respectively.
5) Error-Correction Model: (i) EC(-1) denotes error correction term. (ii) For R-sq. of J-test, the square of the correlation of actual and fitted values in the relative export price equation is reported. (iii) LM test denotes the Lagrange-multiplier test for serial correlation of the relative export price equation, which is valid for equations and systems with lagged dependent variables. *PcFiml* reports the F-statistic and the null hypothesis is no autocorrelation. The numbers in square bracket are p-values.