CITS WP 2007-02

New Estimates of Exchange Rate Pass-Through in Japanese Exports

Craig R. Parsons
Yokohama National University
Kiyotaka Sato
Yokohama National University

March 2007

Center for International Trade Studies (CITS) Working Paper
Downloadable from:
http://www.econ.ynu.ac.jp/CITShomepage/research.html

Center for International Trade Studies, Faculty of Economics
Yokohama National University

New Estimates of Exchange Rate Pass-Through in Japanese Exports [†]

Craig R. Parsons
Yokohama National University

Kiyotaka Sato
Yokohama National University

Abstract

Recently, the issue of a decline in exchange rate pass-through has gained much more attention. Taylor (2000) conjectures that a worldwide decline in exchange rate pass-through is related to the low and stable inflation in many industrialized countries since the early 1990s. Developments of "new open-economy macroeconomics" also cast renewed attention on exchange rate pass-through. Theoretical research shows that the choice of an optimal exchange rate regime and the transmission of monetary policy impacts depend crucially on the exporter's price setting behavior. There are many studies on the pass-through of Japanese exports, yet most studies simply use the industry breakdown data on export price indices, which is insufficient to assess pass-through patterns in regional trade. Significantly, highly disaggregated (HS 9-digit level) commodity data is used here to evaluate the extent of pass-through by commodity and by destination. We investigate and compare the extent of pass-through to East Asia, Europe, and the US. We also examine whether there is any difference in the degree of pass-through in the pre- and post-Asian crisis era. Results suggest the most PTM (pricing-to-market) occurs in exports to the US market followed by significant, but less PTM in Europe. Virtually no PTM is found in Japanese exports to East Asia. Also, there is no clear evidence of either increasing or decreasing pass-through over time.

Keywords: exchange rate pass-through, pricing-to-market, East Asia, Japan
JEL Classification: F12, F15, F31, F41

[†] Address correspondences to Craig R. Parsons at International Graduate School of Social Sciences, Yokohama National University, 79-1, Tokiwadai, Hodogaya-ku, Yokohama, 240-8501, Japan. Tel: +81-45-339-3539, Fax: +81-45-339-3574, e-mail: parsons@ynu.ac.jp or Kiyotaka Sato at sato@ynu.ac.jp. The earlier version of the paper was presented at the 10th International Convention of the East Asian Economic Association in Beijing, China. The authors are grateful for helpful comments provided by Joon-Kyung Kim, Colin McKenzie, Eric Ramstetter and other conference participants. The authors would also like to thank Nagendra Shrestha for his capable research assistance. This study is financially supported by the Japan Society for the Promotion of Science through the Grant-in-Aid for Scientific Research (B), 116330059.

1. Introduction

Exchange rate pass-through and pricing-to-market (PTM) gained a lot of attention in the 1980s against the background of a record US current account deficit related expenditure-switching policies implemented at that time. Whereas the current account balance is determined by the saving and investment decisions of economic agents, the change in exchange rates and its impact on tradable and non-tradable goods prices have to do with the adjustment mechanism of the current account balance. Most studies on exchange rate pass-through focus on exports or imports of the developed countries, especially exports to the United States. See, for instance, Knetter (1989, 1993), Feenstra (1989), Ohno (1989), Marston (1990), Saxonhouse (1993), and Takagi and Yoshida (2001).

Recently, the literature has turned to the issue of a possible decline in exchange rate pass-through (among others, Taylor, 2000; Campa and Goldberg, 2005; Otani, Shiratsuka and Shirota, 2005). Taylor (2000) argues that a widespread and on-going decline in exchange rate pass-through implies an increasing difficulty for firms to pass through the exchange rate changes to importers under an environment of low and stable inflation as experienced in many industrialized countries since the early 1990s. Our study investigates exchange rate pass-through by Japanese exporters by commodity and by destination, while most studies look at pass-through from the import side. In particular, we analyze to what extent the extent of pass-through differs across commodities traded and how it differs across destinations. We look at three major export destinations for Japan: the US, EU and East Asia. In addition, we conduct estimations for pre- and post-crisis periods and then compare the results between them, which will reveal whether or not the degree of pass-through changes (declines) for the case of Japanese exports.

Our estimates also serve as a necessary step towards answering questions of regional monetary arrangements in East Asia. In recent years, as the “new open-economy

macroeconomics" develops and becomes widely used, renewed attention has been cast on both theoretical and empirical exploration of exchange rate pass-through. Specifically, the new open-economy macroeconomics model indicates that the transmission of macroeconomic policy impacts depends crucially on the exporter's price setting behavior. In applying such theoretical models to an analysis of the optimal exchange rate regime, especially regional monetary arrangements in East Asia, it is necessary to obtain the empirical estimates of exchange rate pass-through in regional trade. Whereas, as pointed out above, there have been a large number of studies on exchange rate pass-through of Japanese exports and imports, there are only a few studies on pass-through of East Asian trade as well as that of exports to East Asia.[1] Our study estimates exchange rate pass-through of Japanese exports to East Asia, which may have important implications for the feasibility of regional monetary arrangements.

The novelty of our paper is three-fold. First, our paper uses the destination-breakdown data on highly disaggregated Japanese exports (at 9-digit H.S. level), whereas most studies use just the commodity-breakdown trade data or the destination/source country-breakdown data for empirical investigations. Exchange rate pass-through by destination using the disaggregated export products is rarely investigated in recent studies with the exception of Takagi and Yoshida (2001).[2] We use far more sample commodities than Takagi and Yoshida (2001) and look at 13 major destination countries for our pass-through estimation. Second, we aim at examining the differences in the degree of exchange rate pass-through across destination countries, with particular

[1] One of a few exceptions is Takagi and Yoshida (2001), which examines exchange rate pass-through of Japanese exports and imports by commodity and by destination/source country from 1988 to 1999. Recently, several empirical investigations have been made of exchange rate pass-through in developing countries' trade. The following studies examine the case of at least some East Asian economies: Toh and Ho (2001), Parsley (2004), Parsons and Sato (2006), and Ito and Sato (2006).

[2] Sato (1999, 2003) examines currency invoicing behavior of Japanese firms in their exports to East Asia as well as the United States using the data on H.S. 9-digit export products.

attention to the difference between East Asian countries and developed countries. Third, we focus on the pass-through behavior from the late-1990s to the present as the Japanese exporters' pass-through behavior in the regional trade is likely to be affected by the growing integration in East Asia. As several East Asian countries were hard-hit by the currency crisis in 1997-98, we estimate exchange rate pass-through for the post-crisis period spanning from 1999 to the present. The results are compared with the estimated pass-through ratios for the pre-crisis period from 1988 to 1996 to explore the possible changing pattern of pass-through behavior.

The paper is organized as follows. Section 2 presents the empirical model. Section 3 describes the data for empirical exercise. Section 4 discusses and interprets the results of estimation. Section 5 concludes.

2. The Empirical Model

Exchange rate pass-through is defined as (or can be measured by) the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporter's and importer's currencies (Goldberg and Knetter, 1997). In a world of imperfect competition and market segmentation, exporters can differentiate the selling prices across different markets (destination countries). The extent of exchange rate pass-through is likely to reflect the exporter's pricing behavior. The standard regression equation can be derived from a profit maximization problem of exporting firms and the following regression equation is proposed by Knetter (1989) and expressed more explicitly here:

$$\ln p_{it}^{x} = \delta_1 + \lambda_i + \delta_2 d2_t + \delta_3 d3_t + \cdots \delta_T dT_t + \beta_i \cdot \ln e_{it} + u_{it}, \qquad (1)$$

where $i = 1,...,N$ and $t = 1,...,T$ index the destination of exports and time, respectively; p^x is the export price in terms of the *exporter's* currency (i.e., the Japanese yen); e is the bilateral exchange rate (expressed as yen per unit of the destination currency) multiplied by the destination market price level; and u_{it} is an error term. δ_1 is the intercept; combinations of $d2_t,\ldots,dT_t$ and $\delta_2,\ldots,\delta_T$ capture the time dummies and their respective parameters; and λ_i are country effects.

It is generally pointed out that differences not only in the quality of traded goods but also in marginal costs affect the extent of exchange rate pass-through. Since we use highly disaggregated export data at the H.S. 9-digit level, however, such problems caused by product heterogeneity should be mitigated. As we consider the Japanese exporter's pass-through to multiple destination markets, the cost measurement problem will also be alleviated. Other differences across destinations can be captured by destination-specific slope coefficients or by country effects, so long as they are constant over time but differ only across destinations. Any changes in the quality of the good that may occur over time, so long as they are similar across destinations, can be captured by time dummies (i.e., period effects) if necessary.

When using the above specification, Eq.(1), for estimating exchange rate pass-through, we need to consider the stationarity of commodity prices and exchange rates. Indeed, our preliminary unit-root tests reveal that most commodity prices and exchange rates are non-stationary I(1) variables in level. Thus, the following specification was employed:

$$\Delta \ln p_{it}^{x} = \alpha_0 + \beta_i \cdot \Delta \ln e_{it} + \varepsilon_{it}, \qquad (2)$$

where Δ denotes the first difference operator and the error term, ε, is assumed to be independently and identically distributed with mean zero and constant variance, σ_ε^2.[3] Whereas the first-differenced equation is generally used in the pass-through analysis, such as Knetter (1993) and Gil-Pareja (2002), the following two issues need to be taken into account. First, our main interest is in the coefficient β_i, which measures the extent of change in export price in terms of exporter's currency (the yen) in response to the change in exchange rate of the exporter's currency (the yen) vis-à-vis the importer's currency. Since the data on yen-denominated export prices are available and used in this study, our definition is somewhat different from Knetter (1993) but the same as Gil-Pareja (2002). We allow for possible differences in the slope coefficient, β_i, across destination markets. Second, Knetter (1993) and Gil-Pareja (2002) include period effects (time dummies), θ_t, in the first-differenced model (equation (2)). While period effects were also experimented with in our earlier regressions, in general, they were found to be insignificant, caused the pass-through coefficients to become meaningless, or both. This may be partly because we are using quarterly data. Any quality changes that may occur over time are not likely to be quarterly, let alone annually. The final results presented in section 4 do not include period effects. Also note that while we still include an intercept term, as is typical, we now denote it with α_0 as it is no longer the same intercept as in the levels (equation (1)) form.

β can be interpreted as follows. Under the imperfect competition model where price discrimination may occur, a value of β equal to zero ($\beta = 0$) implies that the export price in terms of the exporter's currency does not respond to fluctuations in the bilateral exchange rate of the exporter's currency vis-à-vis the importer's currency.

[3] Theoretically, the time-dummies, $\alpha_3 d3_t + \ldots + \alpha_T dT$ ($t = 2,3,\ldots,T$), also enter into the first-difference model (equation (2)). As will be discussed below, however, when time-dummies were included they were found to be insignificant or cause meaningless estimates of pass-through coefficients. Thus, only the intercept term is included in equation (2).

Hence, changes in exchange rates are fully passed through to importers.[4] Positive and significant values of β indicate a positive linkage between export prices in terms of the exporter's currency and exchange rates, which indicates incomplete pass-through. In this case, exporters tend to stabilize the export price in terms of the importer's currency at least to a certain extent and hence are likely to adopt a PTM strategy.[5]

3. Data

We use the commodity- and destination-breakdown data on Japanese exports at the 9-digit Harmonized System (HS) based level, which is obtained from the web site of the Ministry of Finance, Japan. All data are quarterly ranging from 1988Q1 to 2005Q4. 13 destination countries are taken up in this study. We calculated the unit values for each commodity by dividing the total yen value of exports by the total volume. It is often argued that unit value series do not account for quality changes in the product over time. However, such series of unit values used in this study are the only measure of export prices which are highly disaggregated and at the same time distinguished by destination market. The advantages of this approach should far outweigh the disadvantages for estimation of exchange rate pass-through.

Quarterly series of nominal bilateral exchange rates (vis-à-vis the US dollar) are taken from the IMF, *International Financial Statistics*, CD-ROM (henceforth, IFS). We then construct the cross rate, i.e., the bilateral exchange rate of the yen vis-à-vis the destination country's currency. Bilateral exchange rate vis-à-vis each European currency

[4] Under the imperfect competition model, $\beta = 0$ implies constant elasticity of demand with respect to the local currency price in the destination markets, where the price charged to each destination market is a *fixed* markup over marginal cost.

[5] A positive and significant β implies that the demand schedule is less convex than a constant elasticity schedule.

is computed using the euro conversion rates.[6] All nominal exchange rate series are adjusted by multiplying by the producer/wholesale price index or consumer price index in the destination country to allow for the effect of price inflation in the respective destination markets.[7]

We chose 27 commodities for the estimation of exchange rate pass-through based on the following criteria. We first attempted to select commodities whose volume of transaction is relatively large. Then, we checked whether the commodities are exported to many countries. Although using the highly disaggregated commodity data at the H.S. 9-digit level, the selected commodities for the estimation can be considered as "representative" ones for each industry and each destination market. Details on the commodities are listed in the Appendix.

4. Estimation Results

Results of the various pooled and individual estimates are presented in Table 1. While the original data set included a much larger number of countries and commodities, the final results presented are based on 27 commodities and 13 countries. There are several reasons for the reduction in sample size. First, some countries simply had too many missing years of data to make analysis and interpretation either statistically or economically meaningful. In other cases, either in single countries or in various pooled estimates, results were not significant, or rather very little significant relationships

[6] The euro conversion rates were obtained from the European Central Bank's website (http://www.euro.ecb.int/en/section/conversion.html).

[7] The price indices of the destination countries are taken from IFS except for China and Taiwan. Chinese data (CPI) was computed from *China Monthly Statistics* and the CEIC Asia Database as well as from the IFS. Taiwanese data (WPI) was obtained from the web site of the National Statistics, Republic of China.

between yen-based export prices and the bilateral exchange rate could be found under various specifications.

In this last point, several issues arise. One is of the poolability of various destination countries. There are, of course, potential efficiency gains if one can pool across several countries, but the ability to pool across very different countries, often with large differences in the unit-value prices may not be appropriate. While in theory first-differencing the panel (or adding fixed effects) may capture these differences and allow for pooling, if the quality of the product is changing over time in different ways across nations, this will not be captured, and pooling will be inappropriate.[8] For example, if we think of the nature of exports of, say, diodes from Japan to Malaysia and to the Philippines over a ten year period, the evolution of the nature of those products (and unit-values) may be very different. One can imagine similar stories for the changes in the nature of auto parts exports and assembly which have changed dramatically in some countries and not in others. Thus, in various combinations of pooled samples, estimates of various commodity pass-through coefficients were often not significant, and tests of poolability across destination countries often failed.

A second poolability issue arises when we consider the currency that a country typically invoices in. While the US largely imports in US dollars, the mix can be quite varied across countries (see Table 2).[9] When considering European countries, for example, continental Europe tends to import from Japan primarily in euros while the yen and dollar occupy smaller shares. The UK, however, may have a far more varied mix, as

[8] All regressions across commodities, countries and groups were done in differenced logs without cross or period fixed effects. While differencing may obviate the need for cross effects, this is not necessarily the case. Period effects may capture technological differences which occur simultaneously across destination. Both were found to be insignificant, the latter possible due to the fact that we are using quarterly data.

[9] As of the first half of 2006, 88 percent of Japanese exports to the United States were invoiced in US dollars (see Table 2).

pounds play a major role, along with euros, dollars, and yen.[10] Indeed experiments with a larger Euro-pool including the UK failed to give significant results, while restricting Europe to only those in the European Monetary Union (EMU) (and 1999 onwards) yielded far more significant relationships. This issue may also be severe in East Asia, where a third vehicle currency, the US dollar, is widely used.

This last point may also explain why single equation regressions in East Asia (or the UK) also found little or no evidence of correlation between yen/destination exchange rate and the yen-based exports. Simply put, if Taiwan imports a great deal of semiconductor devices, etc. which are typically priced and invoiced in US dollars because of their commodity-like nature, we should expect to find little or no correlation with Japan-Taiwan bilateral rates. Indeed, in nearly all single-equations, we did not.

Thus, after numerous experiments with single and pooled regressions, both with and without cross and period effects, the following three sets of regressions were estimated: US only, EU-6, and East Asia-6 (EA-6). Both US and EA-6 were estimated in sub-samples before and after the Asian crisis, while the EU-6 was only estimated in the post-crisis period where all six continental countries were fixed to, and soon after using, the euro. EA-6 includes: Indonesia, Malaysia, the Philippines, South Korea, Taiwan, and Thailand.[11] EU-6 includes: Belgium, France, Germany, Italy, the Netherlands, and Spain. Thus, interpretation of these three sets of destination can give a reasonable comparative study across both commodities as well as three major economic regions.

Looking across the three sets of countries, one thing immediately becomes apparent (Table 1). Very few pass-through coefficients are found to be significant in the

[10] Table 2 implies this invoicing pattern because the share of UK pound invoicing is 5.9 percent in Japanese exports to EU countries.

[11] China and India were also included in pools and estimated separately and failed to get meaningful results. In addition to the problems that plague East Asian countries, both countries experienced massive liberalization and lowering of tariffs which are not accounted for in these estimations. Thus, unfortunately, these important countries are not included.

East Asian group, while there are numerous commodities with significant coefficients (and almost always positive) in the US, and to a lesser extent Europe. One interpretation of positive coefficients could be evidence of PTM, or of LCP (local currency pricing). In the US pre-crisis sample, 24 out of 27 commodities were found to have significant pass-through coefficients. In the post-crisis sample 18 out of 27 were found to be significant. All significant coefficients were positive and though some are quite large, over unity, such results are quite reassuring given the very simple pass-through equation implemented here and the use of unit values.[12]

For Europe (only post-crisis), about half, 14 out of 27 categories, had significant coefficients, one being perversely negative, and some a bit too large. Nonetheless, quite a bit of evidence of possible PTM behavior of Japanese export pricing in Europe seems evident. Indeed, the major cause for such difference may lie in the simple fact that European imports are invoiced in a mix of euro and, to a lesser extent, the yen and US dollar, while the US imports largely in US dollars. Another possibility, of course, is that pooling European countries biases estimates, or for some commodities is not entirely appropriate.

For East Asia, both in pre- and post-crisis, far fewer significant coefficients were found. Six commodities are found to be significant in the pre-crisis period and nine in the post-crisis period. However, many of the significant coefficients are negative and/or very small (i.e. close to zero.) Thus one could interpret this as proof of a great deal of pass-through in East Asia, reflecting the currency invoicing pattern of Japanese exports to East Asia, where about 50 percent is traded in yen. However, it must be noted that the bulk of international trade in this area is generally invoiced in US dollars (Parsons and

[12] Unit values are obtained by dividing the total amount of exports (of a particular product) by its total volume (quantity). Either the actual number of units or the weight, e.g. kilograms, is (and sometimes both are) available. We computed unit values for each commodity and destination in a consistent way.

Sato, 2006), and in particular electronics products may be traded in US dollars (Sato, 1999, 2003).[13] Thus virtually no PTM in East Asian countries is occurring in destination market currencies. Our results suggest what is likely to be a mixed phenomenon: first, exchange rate risk is actually passed through by Japanese exporters and second there is pricing aimed towards the *world* prices of these goods, those prices being denominated in US dollars.

Across commodities some similarities seem to emerge. Steel, the first category, seems to be priced-to-market in the US, EU, and even East Asia, at least before the crisis. There also appears to be a good deal of PTM in auto, transportation, and related parts exports. Gears, Autos, Suspensions, etc. all seem to exhibit PTM both in EU and the US. It has often been remarked that it may be easier to segment markets and conduct price discrimination (and concordantly PTM) in the auto industry where regulations vary across borders and the bundling of the product with country-specific service guarantees and the like make arbitrage difficult. Why this is different in East Asia is not immediately apparent, though it may be conjectured that while much of the sales of autos and auto-related goods in Europe and the US are for final consumption, auto exports in East Asia may be more intermediate in nature, and even intra-firm trade. But without more detailed investigation this is hard to say.

In summary, it appears that there is (still) a great deal of PTM or LCP in the American market while there is also PTM activity in EU but to lesser extent. In East Asian PTM by Japanese exporters seems largely non-existent.

[13] See the results of exchange rate pass-through in exports to East Asia reported in Table 1. When looking at the electric machinery industry, the pass-through ratio is positive and large, though not significant, in the pre-crisis period. In contrast, the pass-through ratio is closer to zero in the post-crisis period. This result reflects the fact that several East Asian countries abandoned a *de facto* US dollar peg system and adopted a more flexible exchange rate policy after the currency crisis. As electric machinery products are likely to be invoiced in US dollars, the post-crisis exchange rate policy might dilute correlations between yen-based export prices and bilateral exchange rates of the yen with East Asian currencies.

5. Concluding Remarks

Several important conclusions seem to emerge from the results found here. First, it seems apparent that pass-through behavior in Japanese exports varies widely across regions and countries. Full (apparent) pass-through seems very common in exports to East Asia, and only occurs about half of the time, or less in the US and Europe. This has important implications for the classic pass-through questions such as the degree of market power across industries and the extent to which the current account may or may not adjust to exchange rate movements.

Second, in answer to the increasingly ubiquitous research question of whether or not pass-through rates have been falling since the 1990s, the answer seems to point in neither direction. If we just consider the US data, perhaps the most reliable estimate in this study, at least from the perspective of the very detailed Japanese data used here, about as many pass-through coefficients go up as down. Thus, we have not found an obvious, declining tendency of the exchange rate pass-through in Japanese exports to the US and, hence, any strong statement one way or the other seems premature.

Finally, the fact that pass-through seems so much higher in East Asia may also help to address some questions in the new open-macroeconomic literature, particularly with respect to optimal currency areas, still a hot topic in policy circles in East Asia. However, the challenge of separating out the various confluence of factors, market structure, invoicing, intra-firm trade, etc., which may explain this apparently prevalent pass-through is not an easy one. These certainly warrant further study.

References

Campa JM. and Goldberg LS. 2005. Exchange Rate Pass-Through into Import Prices: A Macro or Micro Phenomenon? *Review of Economics and Statistics* 87(4): 679-690.

Feenstra RC. 1989. Symmetric Pass-Through of Tariffs and Exchange Rates under Imperfect Competition: An Empirical Test. *Journal of International Economics* 27: 25-45.

Gil-Pareja S. 2002. Export Price Discrimination in Europe and Exchange Rates. *Review of International Economics* 10(2):299-312.

Goldberg PK. and Knetter MM. 1997. Goods Prices and Exchange Rates: What Have We Learned. *Journal of Economic Literature* 35:1243-1272.

Ito T. and Sato K. 2006. Exchange Rate Changes and Inflation in Post-Crisis Asian Economies: VAR Analysis of Exchange Rate Pass-Through. NBER Working Paper Series, No.12395, National Bureau of Economic Research (July).

Knetter MM. 1989. Price Discrimination by U.S. and German Exporters. *American Economic Review* 79(1): 198-210.

Knetter MM. 1993. International Comparison of Pricing-to-Market Behavior. *American Economic Review* 83(3):473-486.

Marston RC. 1990. Pricing to Market in Japanese Manufacturing, *Journal of International Economics* 29: 217-236.

Ohno K. 1989. Export Pricing Behavior of Manufacturing: a US-Japan Comparison. *International Monetary Fund Staff Papers* 36:550-79.

Otani A. Shiratsuka S. and Shirota T. 2005. Revisiting the Decline in the Exchange Rate Pass-Through: Further Evidence from Japan's Import Prices. IMES Discussion Paper Series, No. 2005-E-6, Institute for Monetary and Economic Studies, Bank of Japan.

Parsley DC. 2004. Pricing in International Markets: a Small Country Benchmark. *Review of International Economics* 12(3):509-524.

Parsons CR. and Sato K. 2006. Exchange Pass-Through and Currency Invoicing: Implications for Monetary Integration in East Asia. *The World Economy* 29(12): 1759-1788.

Sato K. 1999. The International Use of the Japanese Yen: The Case of Japan's Trade with East Asia. *The World Economy* 22(4):547-584.

Sato K. 2003. Currency Invoicing in Japanese Exports to East Asia: Implications for the Yen Internationalization. *Asian Economic Journal* 17(2):129-154.

Saxonhouse G.R. 1993. Pricing Strategies and Trading Blocs in East Asia, J.A. Frankel and M. Kahler, eds., *Regionalism and Rivalry: Japan and the United States in Pacific Asia*, Chicago and London: University of Chicago Press, 89-119.

Takagi S. and Yoshida Y. 2001. Exchange Rate Movements and Tradable Goods Prices in East Asia: An Analysis Based on Japanese Customs Data, 1988-1999. *IMF Staff Papers* 48(2):266-289.

Taylor J. 2000. Low Inflation, Pass-Through, and the Pricing Power of Firms *European Economic Review* 44(7):1389-1408.

Toh MH. and Ho HJ. 2001. Exchange Rate Pass-Through for Selected Asian Economies. *Singapore Economic Review* 46(2):247-273.

Appendix

No.	Product Name	Detailed Description
a) Base Metal:		
1	Flat-rolled products Iron	Flat-rolled products of iron or non-alloy steel, of a width of 600mm or more, clad, plated or coated, otherwise plated or coated with zinc, excluding those of corrgated. (H.S. 7210.49-000: 1988Q1-2004Q4). Other flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, clad, plated or coated, otherwise plated or coated with zinc, excluding those of corrgated (Excluding Rejected sheets and plates). (H.S. 7210.49-099: 2005Q1-2005Q4).
b) General Machinery:		
2	Piston Engines	Spark-ignition reciprocating internal combustion piston engines of a kind used for the propulsion of vehicles of Chapter 87 , of a cylinder capacity exceeding 1,000 cc, other than those for motorcycles (H.S. 8407.34-900: 1988Q1-2005Q4).
3	Compressors	Compressors of a kind used for air conditioning machines of motor vehicles (H.S. 8414.30-100: 1988Q1-2005Q4).
4	Filters	Oil or petrol-filters for internal combustion engines (H.S. 8421.23-000: 1988Q1-2005Q4).
5	Fork-lift trucks	Fork-lift trucks with compression-ignition internal combustion piston engine (H.S. 8427.20-110: 1988Q1-2005Q4).
6	Lathes	Horizontal lathes, for removing metal , numerically controlled (H.S. 8458.11-000: 1988Q1-2005Q4).
7	Magnetic Disk Units	Magnetic Disk Units (H.S. 8471.93-300: 1988Q1-1995Q4 and H.S. 8471.70-300: 1996Q1-2005Q4).
8	Gears	Gears, other than toothed wheels, chain sprockets and other transmission elements presented separately (H.S. 8483.40-200: 1988Q1-2005Q4).
9	Bearings	Plain shaft bearings (H.S. 8483.30-200: 1988Q1-2005Q4).
c) Electric Machinery		
10	Electric motors	Electric motors, of an output not exceeding 10W (H.S. 8501.10-191: 1988Q1-2005Q4).
11	Spark plugs	Sparkling plugs for motor vehicles (H.S. 8511.10-100: 1988Q1-2004Q4 and H.S. 8511.10-000: 2005Q1-2005Q4).
12	Microphones	Microphones (H.S. 8518.10-100: 1998Q1-2004Q4 and H.S. 8518.10-000: 2005Q1-2005Q4).
13	TV Cameras	Television cameras for colour, other than those incorporating video recording apparatus (H.S. 8525.30-190: 1988Q1-2005Q4).
14	Video projectors	Video projectors (H.S. 8528.30-000: 1996Q1-2005Q4).
15	Fixed resistors	Fixed resistors for a power handling capacity not exceeding 20W, other than carbon resistors (H.S. 8533.21-000: 1988Q1-2005Q4).
16	Variable resistors	Variable resistors, other than those of wirewound type (H.S. 8533.40-000: 1988Q1-2005Q4).
17	Printed circuits	Printed circuits (H.S. 8534.00-000: 1988Q1-2005Q4).
18	Diodes	Cased Diodes with average forward current rating 100 mA or more, other than photosensitive or light emitting diodes (H.S. 8541.10-920: 1998Q1-2005Q4).
19	Silicon Transistors	Cased Silicon Transistors with a dissipation rate of less than 1 W, other than photosensitive transistors (H.S. 8541.21-910: 1988Q1-2005Q4).
20	Monolithic ICs	Cased other monolithic integrated circuits (H.S. 8542.19-900: 1988Q1-1995Q4, H.S. 8542.30-900: 1996Q1-2001Q4 and H.S. 8542.29-900: 2002Q1-2005Q4).
d) Transport Equipment		
21	Automobile I	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.
22	Automobile II	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.
23	Suspensions	Suspension shock-absorbers (H.S. 8708.80-000: 1988Q1-2005Q4).
e) Precision Instruments		
24	Other LCDs	Other liquid crystal devices, etc. (H.S. 9013.80-000: 1988Q1-2005Q4).
25	Upright pianos	Upright pianos (H.S. 9201.10-000: 1988Q1-2005Q4).
26	Grand pianos	Grand piano (H.S. 9201.20-000: 1988Q1-2005Q4).
27	Ball point pens	Ball point pens (H.S. 9608.10-000: 1988Q1-2001Q4) and Ball point pens, n.e.s. (H.S. 9608.10-900: 2002Q1-2005Q4).

Table 1: Estimates of β across Destinations and Products

		USA: 1988Q1-1996Q4 (yen/US$)			USA: 1999Q1-2004Q4 (yen/US$)			EU: 1999Q1-2004Q4 (yen/euro)			EA: 1988Q1-1996Q4 (yen/EA currency)			EA: 1999Q1-2004Q4 (yen/EA currency)		
No.	Product:	β	s.e.		β	s.e.		β	s.e.		β	s.e.		β	s.e.	
a) Base Metal:																
1	Flat-rolled products Iron	1.060	0.110	***	0.975	0.284	***	1.437	0.459	***	0.937	0.109	***	0.000	0.014	
b) General Machinery:																
2	Piston Engines	0.924	0.128	***	1.065	0.300	***	1.205	0.861		-0.414	0.440		-0.111	0.050	**
3	Compressors	0.902	0.112	***	0.692	0.140	***	0.378	0.243		0.400	0.440		0.007	0.011	
4	Filters	0.808	0.402	**	0.905	0.419	**	0.900	0.144	***	0.325	0.186	*	-0.045	0.038	
5	Fork-lift trucks	0.923	0.252	***	1.066	0.239	***	0.799	0.313	***	-0.421	0.389		0.007	0.009	
6	Lathes	0.559	0.159	***	0.511	0.175	***	0.320	0.160	**	-0.580	0.498		0.059	0.017	***
7	Magnetic Disk Units	0.817	0.482	*	1.247	0.848		0.891	1.299		-0.017	0.785		0.192	0.059	***
8	Gears	0.810	0.195	***	0.716	0.223	***	0.715	0.322	**	0.277	0.314		0.028	0.021	
9	Bearings	0.446	0.172	***	0.912	0.310	***	0.700	0.286	***	0.170	0.213		-0.049	0.014	***
c) Electric Machinery																
10	Electric motors	0.663	0.331	**	0.430	0.564		0.264	0.604		0.403	0.245	*	-0.021	0.039	
11	Spark plugs	0.829	0.244	***	1.115	0.216	***	1.291	0.647	**	0.540	0.406		0.066	0.019	***
12	Microphones	0.420	0.385		1.284	0.616	**	-0.571	0.427		0.853	0.678		0.030	0.033	
13	TV Cameras	1.007	0.283	***	0.154	0.535		0.673	0.494		0.933	1.261		0.002	0.028	
14	Video projectors	n.a.	n.a.		0.819	0.288	***	0.549	0.294	*	n.a.	n.a.		-0.031	0.026	
15	Fixed resistors	0.709	0.195	***	0.436	0.277		0.634	0.421		0.046	0.373		-0.031	0.013	**
16	Variable resistors	0.823	0.271	***	0.440	0.269		-0.048	0.818		0.892	0.235	***	0.000	0.010	
17	Printed circuits	0.867	0.333	***	-0.375	0.556		0.296	0.648		0.683	0.234	***	-0.014	0.006	**
18	Diodes	1.085	0.541	**	0.753	0.365	*	3.223	1.074	***	0.676	0.531		-0.007	0.019	
19	Silicon Transisters	1.430	0.355	***	0.734	0.498		2.804	1.059	***	0.241	0.838		-0.017	0.034	
20	Monolithic ICs	1.298	0.252	***	1.098	0.387	***	-0.206	0.767		-0.043	0.375		0.019	0.018	
d) Transport Equipment																
21	Automobile I	0.621	0.090	***	0.893	0.235	***	0.802	0.137	***	0.513	0.413		-0.027	0.022	
22	Automobile II	0.791	0.115	***	0.957	0.170	***	0.993	0.227	***	0.010	0.283		0.006	0.013	
23	Suspensions	0.809	0.485	*	0.796	0.299	***	1.284	0.492	***	-0.111	0.620		0.007	0.018	
e) Precision Instruments																
24	Other LCDs	0.978	0.467	**	1.453	0.677	**	-1.784	1.062	*	1.456	0.772	*	-0.034	0.029	
25	Upright pianos	0.767	0.241	***	0.811	0.217	***	0.110	0.317		-0.143	0.578		0.004	0.005	
26	Grand pianos	0.717	0.181	***	0.296	0.311		0.359	0.324		0.486	0.703		-0.075	0.024	***
27	Ball point pens	-0.457	1.444		0.593	0.194	***	0.209	0.138		-1.436	1.638		-0.015	0.009	*

Note: *** at 1%; ** at 5%; * at 10%. β denotes the pass-through coefficient, "s.e." the standard errors, and "n.a." not available.

Table 2: Currency Invoicing Pattern: Japanese Exports (1st-Half of 2006; Percentage Share)

To World	Currency:	US Dollar	Yen	Euro	UK Pound	Can Dollar	Others
	Invoice Ratio:	49.8	38.5	8.2	0.9	0.8	1.8
To USA	Currency:	US Dollar	Yen	Euro	Can Dollar	A Dollar	Others
	Invoice Ratio:	88.0	11.9	0.1	0.0	0.0	0.0
To EU	Currency:	Euro	Yen	US Dollar	UK Pound	S Krone	Others
	Invoice Ratio:	51.5	28.5	13.8	5.9	0.2	0.1
To Asia	Currency:	Yen	US Dollar	Thai Baht	NT Dollar	K Won	Others
	Invoice Ratio:	50.7	47.5	0.6	0.3	0.2	0.7

Note: Can Dollar (Canadian Dollar); A Dollar (Australian Dollar); S Krone (Swedish Krone); NT Dollar (New Taiwan Dollar); and K Won (Korean Won).

Source: Ministry of Finance, Japan.