

## IMPORTERS AND PASS-THROUGH EFFECTS OF EXCHANGE RATES\*

EIJI OGAWA

### I. *Introduction*

The US dollar has depreciated since the Plaza agreements of September 1985.<sup>1</sup> It was recognized that an overvaluation of the dollar in the first half of 1980s had caused huge trade deficits in the USA and trade surpluses in Japan. Attempts were made to depreciate the dollar with coordinated interventions in foreign exchange markets in order to improve the trade imbalances. As a result, the dollar has depreciated and the yen has appreciated. However, any effects of the exchange rate changes on the trade imbalances has not yet appeared until recently.

Recently, many economists<sup>2</sup> have studied why the exchange rate changes cannot improve the trade imbalances. Some focus on a supply side of US economy: US domestic markets have structurally changed because foreign firms entered the markets with sunk costs during the period of overvalued dollar.<sup>3</sup> A notable trend is the simplification by the US of the 'complicated' distribution systems in Japan to request Japan to open its markets and to improve the trade imbalances.<sup>4</sup>

This paper considers effects of exchange rate changes on domestic prices of imported commodities from the perspective of the distribution systems, especially importers' behavior. We can find that some imported manufactured commodities are imported both by a "sole import agent" and by the other importers. The former is called a regular import type and the latter is called a parallel import type. We focus on imported whisky which have both these type of import channels. In addition, it is the only imported manufactured commodity whose monthly data on both price indexes are available both at an import shipment stage and at a retail stage.

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\* I would like to thank members of Seminar on Money and Banking (Hitotsubashi University) for helpful comments. Also, I would like to thank Shohei Kimura (The Bank of Japan), Fukukazu Magoshi (The Bank of Japan), and Tatsuro Watanabe (The Distribution Economics Institute of Japan) for providing me useful data. I thank the Isetan Foundation for financial support.

<sup>1</sup> Ogawa (1989).

<sup>2</sup> Mann (1986), Dornbusch (1987), Krugman (1987), Baldwin & Krugman (1986), Froot & Klemperer (1989), Ogawa (1988a).

<sup>3</sup> Krugman (1987, 1989), Baldwin (1988a, b). They call the structural changes 'hysteresis.'

<sup>4</sup> We can find a suggestion that importers' price settings in Japan are different from those in the USA because most of contract currencies in Japanese import is the US dollar (Krugman & Baldwin (1987). We obtained negative results (Ogawa (1988b, c)).

In the next section, we explain the import types and their distribution channels of imported whisky. Then we compare the imported whisky price levels at each stage and their distribution margins. We find that the retail price of regular imported whisky is higher than that of parallel imported whisky by the distribution margins while their import prices are almost the same at the import shipment stage.

In the third section, we explain why prices are different among commodities of an identical brand, which explains why a 'law of one price' doesn't hold for them. We focus on three factors: geographical factors, imperfect information, and different price elasticities of demand. These factors cause price differences between a regular imported and a parallel imported commodities of an identical brand. Therefore, the price of the regular imported commodity should not be so much affected by price cuts of the parallel imported commodity.

In the fourth section, we theoretically analyze how a regular importer sets his selling price in the condition where he monopolizes a brand, and how much the price responds to an exchange rate change. A foreign producer should set his selling price to offset partially the change in consideration of a demand in the import country. On one hand, the importer should set his selling price on the basis of his purchase price set by the foreign producer and the exchange rate and in consideration of the domestic demand. Therefore, an elasticity of the foreign producer's price in respect of the exchange rate should be negative. On the other hand, an elasticity of the retail price in respect of the exchange rate should depend on a price elasticity of demand and the reaction of foreign producer's price to the exchange rate.

In the fifth section, we focus on imported whisky and empirically analyze how much an import price at the import shipment stage and a consumer price at the retail stage respond to an exchange rate change. The import price in terms of an exporter's currency has changed to offset the exchange rate change during 1980s. However, the consumer price has responded less sensitively to the exchange rate than the import price. The difference in response might have been absorbed by the importers. And the consumer price has responded less sensitively to the exchange rate than its tariff. The difference might be attributed to importers' expectations about future movements of the exchange rate and the tariff.

## II. *Import Types and Distribution Channels*

In general, manufactured commodities are imported to Japan by sole import agents, foreign producers, or their affiliate company incorporated abroad. This can be regarded as a mainstream type of import and is called a regular import. The sole import agents often play a central role in their domestic distribution channels.

However, cheaper imported commodities may be imported via a channel other than the regular import. This is the case if a selling price of the regular imported commodity is kept higher even after the yen import price or the tariff is cut down. This type of import is called a parallel import, where most of the commodities are imported via a third country. And the parallel import has another domestic distribution route<sup>5</sup>. We focus on imported

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<sup>5</sup> In addition, there are routes where consumers and quasi-consumers, for example, hotels and restaurants

whisky and consider the relationships between the import styles and the distribution channels and between the import styles and the distribution margins.

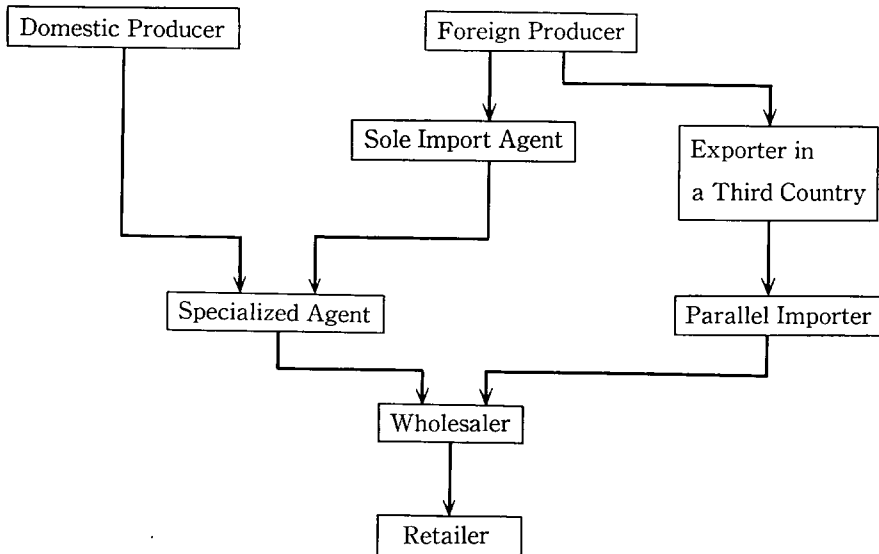
At first, we compare the distribution channels between the regular imported whisky and the parallel imported whisky.<sup>6</sup> Figure 1 shows the distribution channels of both the imported whiskies as well as that of domestic whisky.

A typical distribution channel of domestic whisky is that a producer wholesales it to a locally influential wholesaler with whom the producer is under a special agent contract. When it goes from the special agent via the second wholesaler to retailers, it is called a special agent channel.

The main distribution channel for the regular imported whisky goes through import agents. There are two channels by which foreign-owned specialized agents (sole agents) wholesale it via sales agents to a special agent channel. Domestic trading companies, Japanese producers, or large liquor wholesalers play the role of sole agents and wholesale it to a special agent channel. The special channel agent is the same as that of domestic whisky. The channel via the sales agents has more distribution stages, but prices are scarcely affected as margins of the specialized agents are squeezed.<sup>7</sup>

The parallel imported whisky is traded mainly by specialized parallel importers not by the sole import agents. Trading companies and foodstuff producers etc. also trade in

FIG. 1



Source: The Distribution Economics Institute of Japan (1989)

directly imports foreign goods. They are called a direct import. If individuals import them, they are called an individual import.

<sup>6</sup> A share of the parallel import in a whole volume of imported whisky is provisionally estimated at about 30% (Ryutu Mondai Kenkyu Kyokai (1988)).

<sup>7</sup> This fact was researched by the Distribution Economics Institute of Japan.

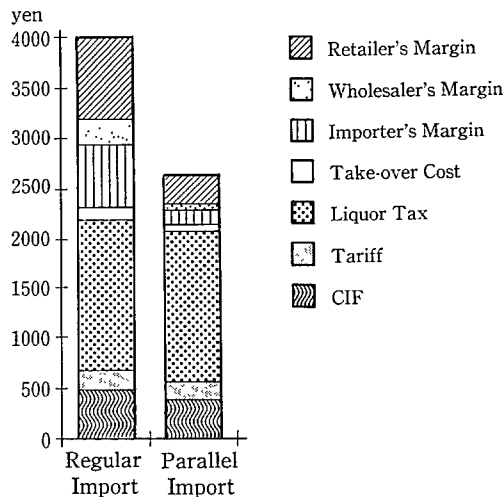
the parallel imported whisky. The parallel importers wholesale it via wholesalers to retailers.<sup>8</sup> Before the parallel import became popularized like today, a special agent class of wholesalers traded a little of parallel imported whisky because they felt the constraints as sole agents. A secondary class mainly traded it. But recently trading by the special agent class is increasing.

There are two characteristics of import types and distribution channels of whisky. First, the distribution channel of regular imported whisky is longer than that of domestic whisky because a sole import agent intermediates between a producer and a special agent. Second, the domestic distribution channel of parallel imported whisky is shorter than that of regular imported whisky because no special agents intermediates as in the former channel. However, as for the overall distribution channel between a foreign producer and a domestic consumer, the channel of parallel imported whisky is not necessarily shorter than that of regular imported whisky because a trading company in the third country intermediates in the parallel import.

Next, we look at a relationship between the import types and the distribution margins. Figure 2 shows price compositions of a regular imported whisky and a parallel imported whisky for a standard class (before March 1989). We can find some characteristics from Fig. 2.

First, CIF prices are almost the same between the regular imported whisky and the parallel imported whisky. Second, tariffs and liquor taxes are the same between them since both of them are imposed specific duties. Third, each of distribution margins (an importer's margin, a wholesaler's margin, and a retailer's margin) of the regular imported whisky is larger than that of the parallel imported whisky. Thus, the total of the distri-

FIG. 2



Source: The Distribution Economics Institute of Japan (1989)

<sup>8</sup> The parallel importers wholesale it directly to retailers in some cases.

bution margins of the regular imported whisky is larger than that of the parallel imported whisky. Therefore, yen import prices at the import shipment stage as well as the tariff and the liquor tax are almost the same. On the other hand, a retail price of the regular imported whisky is more expensive than that of the parallel imported whisky by the differences in the distribution margins.

In sum, the differences in the retail prices between the regular imported whisky and the parallel imported whisky reflect not the length of their distribution channels but the distribution margins.

### III. *Different Prices among Commodities of an Identical Brand*

Why are the retail prices of the same imported whisky different between the regular imported whisky and the parallel imported whisky? This question is equivalent to why a 'law of one price' doesn't hold among imported whisky of an identical brand. We consider conditions under which the prices are different between the regular imported whisky and the parallel imported whisky. We focus on the following three factors: geographical factors, imperfect information, and different price elasticities of demand.<sup>9</sup>

First, the geographical factors include a license system with regard to liquor sales (wholesale, retail, and import). The license system was established in order to check an overflow and disorder of trading in the distribution sector, which is regarded as an intermediate institute of tax collection, and to supervise tax collection. Also, the license system restricts the entry into liquor sales business. Especially a retail license is given on a 'distance basis', which brings about a geographical monopoly in liquor retails.

In addition, transaction costs such as a transportation cost may make a market separate geographically. Even if consumers know that cheaper parallel imported whisky are on sales at a liquor shop which is located at a distant place, they will not go to buy it at the shop. In that case, the prices can be different among each shop.

Secondly, imperfect information about prices can keep the prices different. The consumers need search costs in addition to the transaction costs if they have no information about liquor shops where parallel imported whisky is on sale and about the price at which it is on sale at each of the liquor shops. The search costs will be large, combined with the geographical factors. The consumers might need no more search costs after they find out the liquor shop. However, because there are potential search costs, customer relationships will implicitly be formed. As a result, they keep prices rigid.

Thirdly, consumers have two purposes in purchasing imported whisky. One is to drink it by themselves. The other is to give it as gift to others. In the case where they drink it by themselves, it is natural to purchase the cheapest one within an identical brand. on the other hand, the whisky imported via a regular channel is preferred to a cheaper bargain, that is, the parallel imported whisky in the case of gifts. Therefore, price elasticities of demand for imported whisky of an identical brand are different, depending on the purposes of purchase.

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<sup>9</sup> Philips (1988).

A price elasticity of demand for the regular imported whisky is likely to be smaller than that for the parallel imported whisky in the absolute value for the above reason. Suppose that a regular importer and a parallel importer can separate a market of an imported whisky of an identical brand depending on the purposes of purchase and that they are monopolies in each market. In addition, we assume that their marginal costs are equal to each other and constant. Then a price of the parallel imported whisky with less elastic demand is cheaper than that of the regular imported whisky with more elastic demand.<sup>10</sup>

The above factors bring about price differences between the regular imported whisky and the parallel imported whisky even for an identical brand. And a price of the regular imported whisky may be affected no more than partially by a cheaper price of the parallel imported whisky.

#### IV. *A Brand Monopoly and Price Settings of Importers*

The previous section showed the factors which make prices different between the regular imported whisky and the parallel imported whisky within the same brand. Imported whisky can be regarded as a brand monopoly by a regular importer. We theoretically analyze price-settings of the importer under the brand monopoly.

At first, we conjecture a market structure of imported whisky from its commodity properties. Whisky has some grades, for example, from the second grade to the special grade, and a standard class and a premium class within the special grade. In addition, a same class of whisky have different qualities. The heterogeneity of quality can easily form different brands among the same class.

Moreover, we need so-called sunk costs to buy on trial and drink a expensive commodity such as imported whisky, though the sunk costs may not be so expensive. Therefore, it is not easy to shift a favorite brand to another brand. The sunk costs tend to form brand loyalty.

<sup>10</sup> The regular importer and the parallel importer make the following profits  $\Pi^r$  and  $\Pi^p$ , respectively:

$$\Pi^r = P^r D^r(P^r) - C^r(D^r(P^r))$$

$$\Pi^p = P^p D^p(P^p) - C^p(D^p(P^p))$$

where  $P$ : a price,  $D$ : a demand for the imported whisky,  $C$ : a cost of importing, and superscripts  $r$  and  $p$  mean variables of the regular imported whisky and of the parallel imported whisky, respectively.

From the first-order conditions of profit maximizations, we get the optimal prices:

$$P^r = \frac{\varepsilon^r}{\varepsilon^r - 1} C'$$

$$P^p = \frac{\varepsilon^p}{\varepsilon^p - 1} C'$$

where  $\varepsilon$ : the absolute value of a price elasticity of demand  $\left(\frac{dD}{dP} \left| \frac{D}{P} = -\varepsilon \right.\right)$ ,  $C'$   $\left(= \frac{dC^r}{dD^r} = \frac{dC^p}{dD^p}\right)$ : the marginal costs which are equal and constant from the assumption.

From the assumption of  $\varepsilon^r < \varepsilon^p$ , we get

$$P^r > P^p$$

if both the elasticities are larger than unity.

Therefore, a market of imported whisky can be separated into sub-markets of a different brand. And each of the sub-markets is under a kind of monopoly. However, the sub-markets can affect each other, and a price of a given brand will respond to some degrees to relative prices among different brands. Therefore, a market of imported whisky as a whole is under an imperfect competition or an atomistic competition.<sup>11</sup>

The sub-markets of the imported whisky are in a state close to a monopoly not only at a production stage but also at a distribution stage, importing whisky of a given brand is nearly monopolized by the regular importers such as sole import agents.

Next, we theoretically analyze how prices are set under imperfect competitions both at the production stage and at the distribution stage and how much the prices respond to exchange rate changes.<sup>12</sup>

Suppose that a market of imported whisky of a given brand is in a state of monopolistic competition. That is, a foreign producer sets a selling price to an importer trading with him. And the importer sets a selling price to consumers in a domestic market. The assumption of monopolistic competition implies that both the foreign producer and the importer are facing a demand curve for the brand. Assuming that the importer has no inventory, they are facing the same demand curve. Therefore, both the foreign producer and the importer must set their own selling prices, taking the same demand function into consideration.

The foreign producer sets his selling price to maximize his profit subject to his cost function of producing the whisky. And the importer sets his selling price to maximize his profit subject to his purchase price and his cost function of importing it. We assume that both the foreign producer and the importer know the demand function which they are facing on and that the foreign producer knows how the importer sets the price in the domestic market.

A foreign producer's profit in terms of an exporter's currency  $\Pi^*$  and an importer's profit in terms of a home currency  $\Pi$  are:

$$(1a) \quad \Pi^* = p^* D(q) - C(D(q)) \quad ; D' < 0, D'' < 0, C' > 0, C'' > 0.$$

$$(1b) \quad \Pi = (q - ep^*) D(q) - T(D(q)) \quad ; T' > 0, T'' = 0.$$

were  $p^*$  is a foreign producer's selling price in terms of an exporter's currency.  $q$  is an importer's selling price in terms of a home currency.  $e$  is an exchange rate of the home currency in terms of the exporter's currency.  $D(\ )$  is a demand function for the imported whisky in the domestic market. Given a price of substitute domestic whisky, the demand for the imported whisky is diminishingly decreasing with the own price.  $C(\ )$  is a cost function of producing the imported whisky. The cost is increasing with outputs and the marginal cost is increasing.  $T(\ )$  is a transaction cost function in importing. For simplicity, assume that the transaction cost is increasing with trade volumes with the marginal cost constant.

The foreign producer and the importer set their selling prices,  $p^*$  and  $q$ , to maximize their own profits. The prices are derived from the first conditions of their profit maximizations and the assumption that the foreign producer knows the importer's price-settings.

<sup>11</sup> Phelps & Winter (1970).

<sup>12</sup> We use a model which was presented in Ogawa (1988b).

$$(2a) \quad p^* = \frac{\varepsilon}{\varepsilon - 1} C'(D(q)) + \frac{1}{\varepsilon - 1} \frac{T'}{e}$$

$$(2b) \quad q = \frac{\varepsilon}{\varepsilon - 1} (ep^* + T')$$

where  $\varepsilon \left( = - \frac{dD}{dq} \left| \frac{D}{q} \right. > 0 \right)$  is a price elasticity of demand in the domestic market.  $C'$  and  $T'$  are a marginal cost of production and a marginal transaction cost of importing, respectively.

From eqs. (2a) and (2b), the foreign producer and the importer set their selling prices, allowing for the marginal costs and the price elasticities of demand. In addition, the foreign producer allows for the importer's marginal transaction cost in setting the price because the importer's marginal cost includes the marginal transaction cost as well as the purchase price of the imported commodity as shown in eq. (2b). As the foreign producer knows about the importer's price setting and a fact that the demand is affected by the price, he shares a part of the importer's marginal transaction cost by himself. That is, the transaction cost is shared by both the foreign producer and the importer.

On one hand, the importer set the selling price according to eq. (2b). He allows for the price elasticity of demand as well as a purchase price in terms of the home currency and the marginal transaction cost when he sets the price. Therefore, the higher price is set than the marginal costs according to the elasticity. And the larger an absolute value of the elasticity, the price is lower.<sup>13</sup>

We consider effects of an exchange rate change on the price settings. Taking logarithms and differentiating eqs. (2a) and (2b) with regard to the exchange rate,  $e$ , and the prices,  $p^*$  and  $q$ , we get the following equations:

$$(3a) \quad \frac{d \ln p^*}{d \ln e} = \frac{\left( \frac{\varepsilon}{\varepsilon - 1} \right)^2 C'' D' - \frac{T'}{\varepsilon - 1}}{1 - \left( \frac{\varepsilon}{\varepsilon - 1} \right)^2 C'' D'} < 0$$

$$(3b) \quad \frac{d \ln q}{d \ln e} = \frac{\varepsilon}{\varepsilon - 1} \frac{1 - \frac{T'}{\varepsilon - 1}}{1 - \left( \frac{\varepsilon}{\varepsilon - 1} \right)^2 C'' D'}$$

Eqs. (3a) and (3b) represent elasticities of the prices in respect of the exchange rate. The exchange rate change has no direct effects on the foreign producer's selling price in the case where an invoice currency is an exporter's. However, eq. (3b) implies that the exchange rate change has an indirect effect on the price. A sign of eq. (3a) is negative because the price in terms of the exporter's currency is set to offset partly the exchange rate change

<sup>13</sup> This explains that a price of the regular imported whisky with a less elastic demand is higher than that of the parallel imported whisky with a more elastic demand as explained in the previous section.



by the foreign producer. It means that an elasticity of the price in terms of home currency is smaller than 1. The elasticity is represented in the second fraction of eq. (3b).

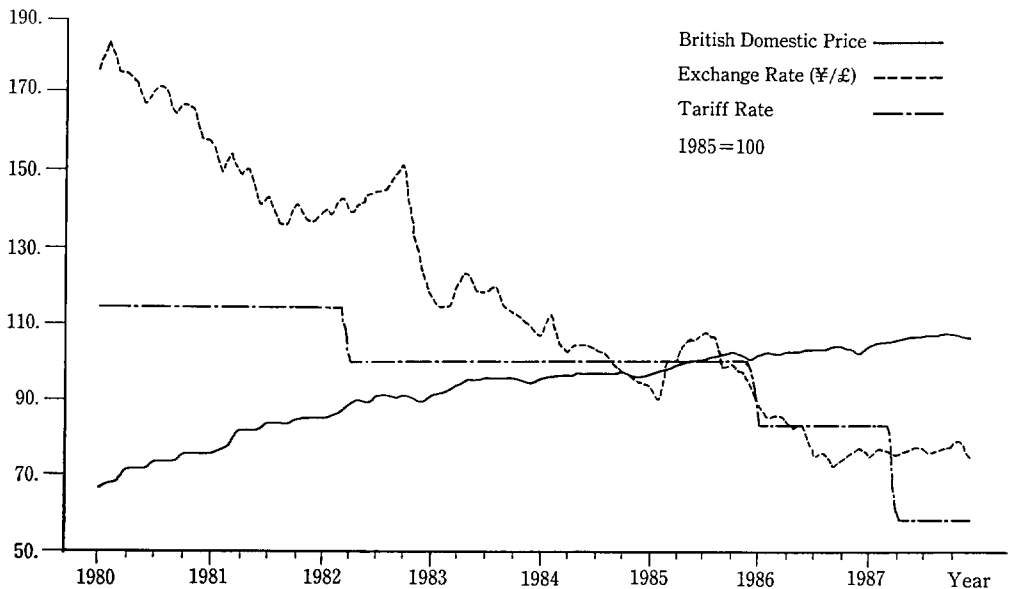
On one hand, the importer takes the price elasticity of demand into consideration and sets his own selling price based on the exchange rate as well as the purchase price in terms of the exporter's currency. Therefore, eq. (3b) is smaller or larger than 1, depending on the price elasticity of demand and a reaction of the foreign producer's price to the exchange rate. Therefore, the elasticity of the domestic price in respect of the exchange rate is larger than 1 if the foreign producer's price doesn't respond to the exchange rate so much, that is, if the second fraction in eq. (3b), which means the elasticity of the foreign producer's price in terms of the home currency in respect of the exchange rate, is close to 1.

### V. *An Empirical Study on Pass-through Effects of an Exchange Rate*

How much do domestic prices of imported whisky, in fact, respond to an exchange rate change? We empirically analyze how much the exchange rate was passed through to the domestic prices in 1980s. In this section, we explain results of empirical analysis on the pass-through effects of the exchange rate.

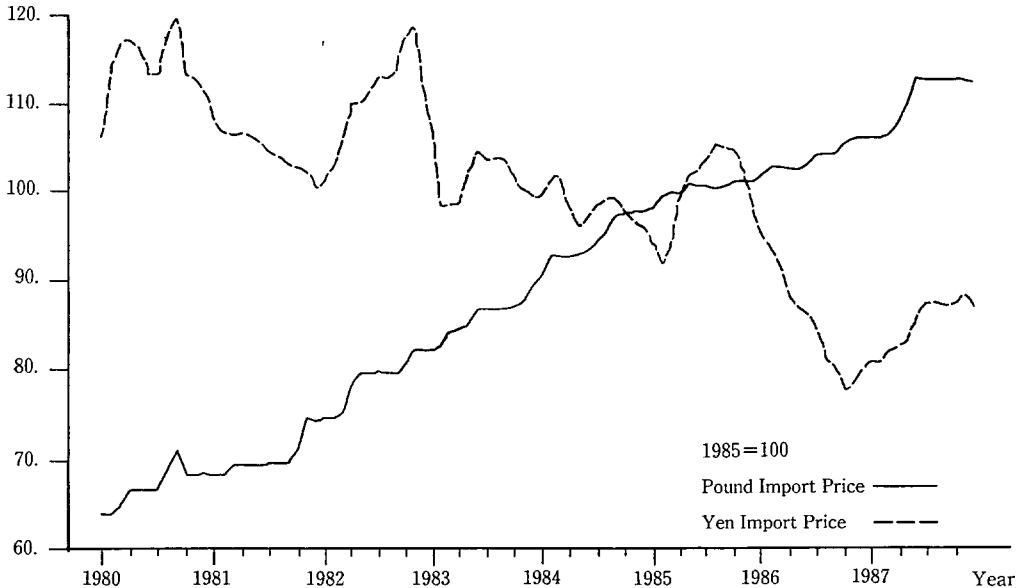
At first, we look at movements of the relevant variables such as prices of imported whisky. Figure 3 shows movements of a British domestic price of whisky,<sup>14</sup> an exchange rate

FIG. 3



<sup>14</sup> We use a retail price of alcoholic drink as a proxy of the British domestic price of whisky.

FIG. 4



(yen/pound)<sup>15</sup>, and a tariff rate during a period of 1980–87. The pound was depreciating over the whole period. The tariff rate was pulled down three times in April 1982, in January 1986, and in April 1987. Figure 4 shows movements of the import prices at the import shipment stage in terms of both the pound and the yen. The pound import price was increasing over the whole period, reflecting the British domestic price. On one hand, the yen import price tended to decrease, reflecting the exchange rate.

Figure 5 shows movements of consumer prices of both imported whisky and domestic whisky. The consumer price of imported whisky was changing, reflecting partly the consumer price of domestic whisky.<sup>16</sup> However, the consumer price of imported whisky was decreasing after 1985, which might mean that it was affected by a depreciation of the pound.

We analyze how much the pounds import price responds to the exchange rate and the tariff rate, using the following regression equation:

$$(4) \ln IWP_t^* = a + \sum_{i=0}^{12} b_i PDL(\ln E_{t-i}) + \sum_{i=0}^{12} c_i PDL(\ln TRF_{t-i}) + \sum_{i=0}^{12} d_i PDL(\ln BRP_{t-i}) + \mu_t$$

where  $IWP^*$ : the pound import price,  $E$ : the exchange rate (yen/pound),  $TRF$ : the tariff rate,  $BRP$ : the British domestic retail price of alcoholic drink, which is taken as a proxy of the British domestic price of whisky,  $PDL$ : polynomial distributed lags, and  $\mu$ : an error term. We suppose third degree polynomial distributed lags with end constraint for the three explanatory variables. And we estimate the regression, correcting for first order

<sup>15</sup> An invoice currency of imported whisky is the sterling according to a research by the Bank of Japan.

<sup>16</sup> The increases in the consumer price of domestic whisky in May 1981 and May 1984 corresponds to rises in liquor tax.

FIG. 5

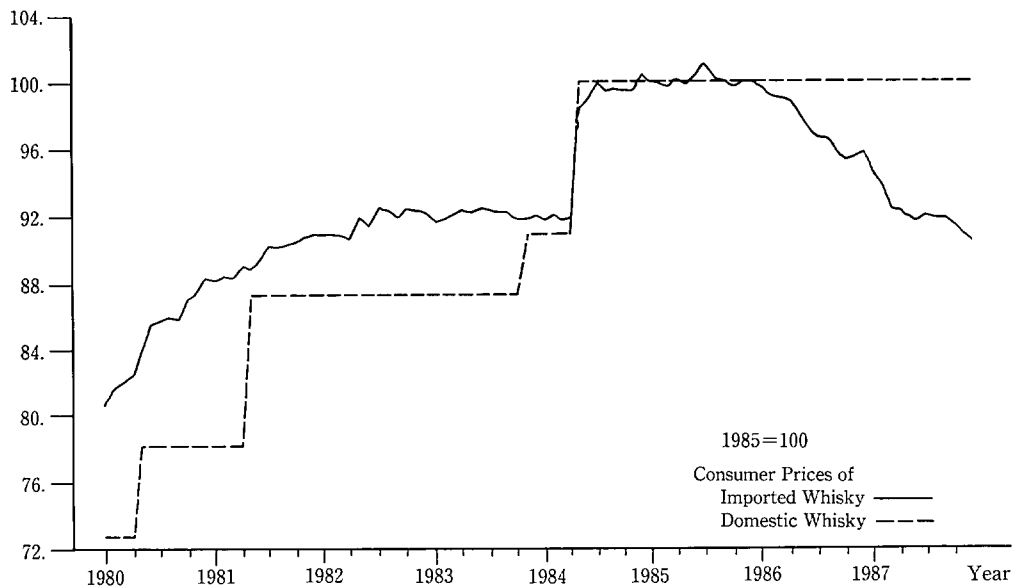


TABLE 1

IWP* (pound base) 1981: 2-1987: 12											
Accumulated Coefficients on											
E	0	-0.0057	<i>0.0222</i>	TRF	0	-0.0336	<i>0.0174*</i>	BRP	0	0.1154	<i>0.0875</i>
	1	-0.0069	<i>0.0359</i>		1	-0.0535	<i>0.0259**</i>		1	0.1684	<i>0.1394</i>
	2	-0.0071	<i>0.0398</i>		2	-0.0622	<i>0.0301**</i>		2	0.1895	<i>0.1713</i>
	3	-0.0094	<i>0.0438</i>		3	-0.0620	<i>0.0331*</i>		3	0.2032	<i>0.1933</i>
	4	-0.0155	<i>0.0477</i>		4	-0.0552	<i>0.0359</i>		4	0.2283	<i>0.2101</i>
	5	-0.0269	<i>0.0515</i>		5	-0.0438	<i>0.0383</i>		5	0.2775	<i>0.2216</i>
	6	-0.0439	<i>0.0547</i>		6	-0.0295	<i>0.0397</i>		6	0.3580	<i>0.2262</i>
	7	-0.0660	<i>0.0569</i>		7	-0.0139	<i>0.0403</i>		7	0.4707	<i>0.2228**</i>
	8	-0.0922	<i>0.0582</i>		8	0.0015	<i>0.0416</i>		8	0.6109	<i>0.2123***</i>
	9	-0.1204	<i>0.0596**</i>		9	0.0156	<i>0.0453</i>		9	0.7678	<i>0.1983***</i>
	10	-0.1477	<i>0.0618**</i>		10	0.0272	<i>0.0518</i>		10	0.9250	<i>0.1860***</i>
	11	-0.1707	<i>0.0649**</i>		11	0.0355	<i>0.0594</i>		11	1.0601	<i>0.1799***</i>
	12	-0.1847	<i>0.0674***</i>		12	0.0399	<i>0.0649</i>		12	1.1447	<i>0.1792***</i>
constant		0.0107	<i>1.0860</i>								
rho		0.8294	<i>0.0581***</i>								
RBAR**2		0.9968									
SEE		0.0085									
D-W		1.5825									

IWP\*: the pound import price, E: the exchange rate (yen/pound), TRF: the tariff rate, BRP: the British domestic retail price of alcoholic drink, PDL: third degree polynomial distributed lags with end constraint. The italics mean standard errors.

\*: a significant level of 90%.

\*\*: a significant level of 95%.

\*\*\*: a significant level of 99%.

serially correlated errors. Monthly data are used and the period of analysis is February 1981 to December 1987.

Table 1 shows results of the time series analysis. The pound import price responded to the exchange rate and the tariff rate in the opposite direction. Coefficients on the exchange rate are significantly negative after 9 month lag. An exchange rate elasticity of the price is about -0.18 in 12 month lag. On one hand, coefficients on the tariff rate are significantly negative from the current month to 3 month lag, though they are very small. The results imply that the pound import price of imported whisky was set to offset a very small part of changes in the exchange rate. Therefore, we conjecture that the exchange rate nearly fully reflects in the import price in terms of yen since the yen import price is simply the pound import price multiplied by the exchange rate.<sup>17</sup>

Next, we analyze how much a consumer price of imported whisky responds to the exchange rate, the tariff rate, and the pound import price, using the following regression equation:

<sup>17</sup> Table 2 shows the yen import price's response to the exchange rate, the pound import price, and the tariff, using the following regression equation:

$$(5) \ln IWP_t = a + \sum_{i=0}^{12} b_i PDL(\ln E_{t-i}) + \sum_{i=0}^{12} c_i PDL(\ln IWP_{t-i}^*) + \sum_{i=0}^{12} d_i PDL\left(\ln \frac{DCP_{t-i}}{ICP_{t-i}}\right) + \mu_t$$

where IWP: the yen import price, DCP: the consumer price of domestic whisky, ICP: the consumer price of imported whisky. We suppose third degree polynomial distributed lags with end constraint as for the three explanatory variables. And we estimate the regression, correcting for first order serially correlated errors.

The result means that the exchange rate fully reflects in the yen import price after 3 month lag.

TABLE 2

IWP (yen base) 1981: 2-1987: 12											
Accumulated Coefficientson											
E	0	0.3537	<i>0.0235***</i>	IWP*	0	0.3599	<i>0.0913***</i>	DCP	0	0.1743	<i>0.0694**</i>
	1	0.6086	<i>0.0347***</i>		1	0.5869	<i>0.1271***</i>	ICP	1	0.2719	<i>0.1062**</i>
	2	0.7843	<i>0.0384***</i>		2	0.7161	<i>0.1315***</i>		2	0.3130	<i>0.1239**</i>
	3	0.8983	<i>0.0388***</i>		3	0.7780	<i>0.1268***</i>		3	0.3152	<i>0.1337**</i>
	4	0.9661	<i>0.0387***</i>		4	0.7981	<i>0.1286***</i>		4	0.2936	<i>0.1425**</i>
	5	1.0011	<i>0.0396***</i>		5	0.7973	<i>0.1385***</i>		5	0.2604	<i>0.1525*</i>
	6	1.0144	<i>0.0414***</i>		6	0.7915	<i>0.1477***</i>		6	0.2253	<i>0.1630</i>
	7	1.0153	<i>0.0440***</i>		7	0.7917	<i>0.1477***</i>		7	0.1953	<i>0.1729</i>
	8	1.0108	<i>0.0475***</i>		8	0.8043	<i>0.1352***</i>		8	0.1749	<i>0.1823</i>
	9	1.0057	<i>0.0524***</i>		9	0.8308	<i>0.1123***</i>		9	0.1656	<i>0.1926</i>
	10	1.0029	<i>0.0587***</i>		10	0.8677	<i>0.0869***</i>		10	0.1667	<i>0.2045</i>
	11	1.0032	<i>0.0653***</i>		11	0.9069	<i>0.0724***</i>		11	0.1745	<i>0.2170</i>
	12	1.0050	<i>0.0700***</i>		12	0.9355	<i>0.0729***</i>		12	0.1828	<i>0.2261</i>
constant		-4.3200	<i>0.6181***</i>								
rho		0.3262	<i>0.1111***</i>								
RBAR**2			0.9861								
SEE			0.0121								
D-W			1.8342								

IWP: the yen import price, IWP\*: the pound import price, E: the exchange rate (yen/pound), ICP: the consumer price of imported whisky, DCP: the consumer price of domestic whisky, PDL: third degree polynomial distributed lags with end constraint.

The italics mean standard errors.

\*: a significant level of 90%,

\*\*: a significant level of 95%,

\*\*\*: a significant level of 99%,

$$(6) \ln ICP_t = a + \sum_{i=0}^{12} b_i PDL(\ln E_{t-i}) + \sum_{i=0}^{12} c_i PDL(\ln IWP_{t-i}^*) + \sum_{i=0}^{12} d_i PDL(\ln TRF_{t-i}) \\ + \sum_{i=0}^{12} e_i PDL(\ln DCP_{t-i}) + \text{fln} TAX_t + \mu_t$$

where *ICP*: the consumer price of imported whisky, *DCP*: the consumer price of domestic whisky, *TAX*: the liquor tax rate. We suppose third degree polynomial distributed lags

TABLE 3

ICP 1981: 2-1987: 12											
Accumulated Coefficients on											
E	0	0.0225	<i>0.0165</i>	TRF	0	0.0159	<i>0.0133</i>	IWP*	0	-0.0529	<i>0.0663</i>
	1	0.0345	<i>0.0249</i>		1	0.0327	<i>0.0190*</i>		1	-0.0247	<i>0.0914</i>
	2	0.0406	<i>0.0282</i>		2	0.0504	<i>0.0204**</i>		2	0.0548	<i>0.0926</i>
	3	0.0446	<i>0.0292</i>		3	0.0692	<i>0.0200***</i>		3	0.1607	<i>0.0858*</i>
	4	0.0495	<i>0.0297</i>		4	0.0889	<i>0.0198***</i>		4	0.2723	<i>0.0838***</i>
	5	0.0572	<i>0.0307*</i>		5	0.1092	<i>0.0201***</i>		5	0.3739	<i>0.0899***</i>
	6	0.0689	<i>0.0321**</i>		5	0.1300	<i>0.0210**</i>		6	0.4540	<i>0.0976***</i>
	7	0.0849	<i>0.0337**</i>		7	0.1505	<i>0.0226***</i>		7	0.5060	<i>0.1002***</i>
	8	0.1047	<i>0.0356***</i>		8	0.1701	<i>0.0257***</i>		8	0.5278	<i>0.0951***</i>
	9	0.1269	<i>0.0380***</i>		9	0.1880	<i>0.0308***</i>		9	0.5219	<i>0.0840***</i>
	10	0.1491	<i>0.0411***</i>		10	0.2033	<i>0.0374***</i>		10	0.4954	<i>0.0727***</i>
	11	0.1682	<i>0.0445***</i>		11	0.2147	<i>0.0440***</i>		11	0.4598	<i>0.0685***</i>
12	0.1802	<i>0.0470***</i>	12	0.2212	<i>0.0485***</i>	12	0.4316	<i>0.0710***</i>			
DCP	0	0.0595	<i>0.0700</i>								
	1	0.1242	<i>0.1075</i>								
	2	0.1869	<i>0.1234</i>								
	3	0.2421	<i>0.1269*</i>								
	4	0.2859	<i>0.1251**</i>								
	5	0.3154	<i>0.1225**</i>								
	6	0.3297	<i>0.1213***</i>								
	7	0.3291	<i>0.1221***</i>								
	8	0.3154	<i>0.1252**</i>								
	9	0.2919	<i>0.1312**</i>								
	10	0.2634	<i>0.1404*</i>								
	11	0.2362	<i>0.1510</i>								
12	0.2180	<i>0.1591</i>									
constant		-0.8357	<i>0.4702*</i>								
TAX		0.1304	<i>0.0509**</i>								
rho		0.4951	<i>0.1148</i>								
RBAR**2		0.9702									
SEE		0.0070									
D-W		1.8675									

ICP: the consumer price of imported whisky, IWP\*: the pound import price, E: the exchange rate (yen/pound), TRF: the tariff rate, DCP: the consumer price of domestic whisky, TAX: the liquor tax rate, PDL: third degree polynomial distributed lags with end constraint.

The italics mean standard errors.

\*: a significant level of 90%.

\*\* : a significant level of 95%.

\*\*\*: a significant level of 99%.

with end constraint for the four explanatory variables except for the tax rate. And we estimate the regression, correcting for first order serially correlated errors.

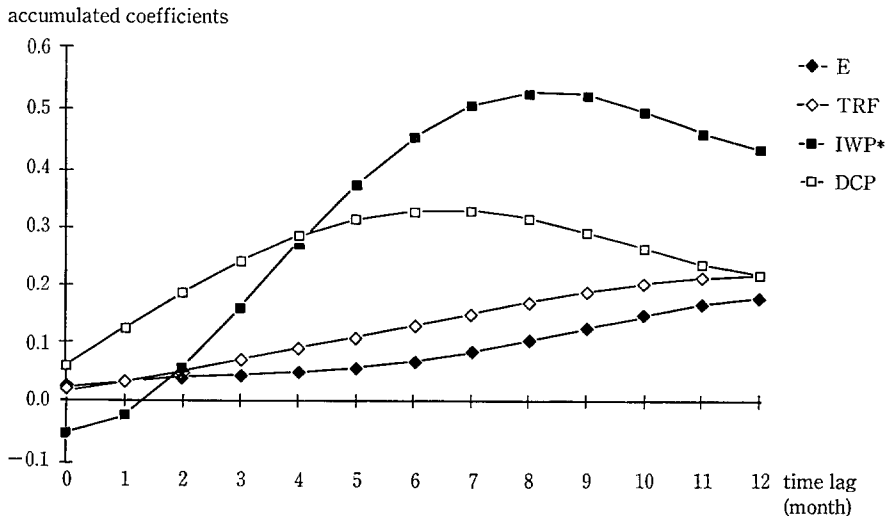
Table 3 shows results of the time series analysis. The exchange rate, the tariff rate and the pound import price significantly affected the import consumer price in one to five month lags. Also the consumer price of domestic whisky significantly affected the import consumer price, which means that they are substitute.

We compare coefficients on the explanatory variables.<sup>18</sup> The coefficients on the exchange rate and the tariff rate are 0.18 and 0.22, respectively, in 12 month lag while that on the pound import price is about 0.4 to 0.5 after 6 month lag. Figure 6 shows accumulated coefficients on the explanatory variables.

We must take a share of each cost in the consumer price into consideration to compare with the coefficients. If changes in the exchange rate are fully passed through to the consumer price, the coefficient would be 0.1 to 0.2 because a share of the CIF price in terms of yen in the consumer price is 10% to 20%. On the other hand, if changes in the tariff rate are fully passed through to the consumer price, the coefficient would be 0.05 to 0.1 because the tariff rate is a specific duty and its share in the consumer price is 5% to 10%. Therefore, the exchange rate has approximately full pass-through effect on the consumer price while the tariff has more than twice full pass-through effect on it. In addition, the pound import price has much more than twice full pass-through effect on it.

The results show that the exchange rate has different pass-through effects on the import prices between at the import shipment stage and at the retail stage. At the import shipment stage, the pound import price responds to the exchange rate to offset somewhat its changes. On the other hand, the exchange rate has a small effect on the consumer price because of the CIF price's small share in the consumer price while changes in the exchange rate are fully passed through to the consumer price.

FIG. 6



<sup>18</sup> We cannot easily compare the elasticities of the tariff rate and the tax rate with those of the other explanatory variables because the tariff and the liquor tax on imported whisky are specific duties.

Next, we compare the consumer price's response to the exchange rate with that to the tariff. The tariff was cut down three times and the exchange rate was continuously decreasing during the analysis period. Both of them could contribute to decreases in the consumer price of imported whisky. However, the exchange rate has a less pass-through effect on the consumer price than the tariff rate.

The difference in the response might be attributed to expectations of their future movements. It is easy to expect a size of revised tariff rate and a timing of tariff revision because of ex ante announcements of revision by the authorities. Thus, we can easily expect that the tariff rate remain at a revised rate for a while after the rate is revised. On the other hand, it is difficult to expect the future course of the exchange rate because of its uncertainty. In addition, if the importers' expectation of the exchange rate is regressive to a current rate,<sup>19</sup> the response of the consumer price to changes in the exchange rate would be small.

## VI. Conclusion

This paper focused on imported whisky, which is a representative imported manufactured commodity in Japan, to consider how much its domestic prices respond to the exchange rate. We found a difference in the prices' responses to the exchange rate between at the import shipment stage and at the retail stage. The difference is attributed to an interposition of distribution system, especially importers which are represented by an sole import agent, between the import shipment stage and the retail stage. The exchange rate has a small effect on the retail price because the retail price includes distributors' margins as well as the tariff and the liquor tax.

In addition, we found a difference in the retail price's responses to the exchange rate and to the tariff rate. The difference seems to be attributed to expectations of their future movements. Revisions of the tariff rate are announced in advanced by the authorities, while it is difficult to forecast correctly future movements in the exchange rate. Therefore, the importer tends to reflect changes in the exchange rate in the retail price less than those in the tariff rate. The price's response to the exchange rate is less sensitive than the tariff.

HITOTSUBASHI UNIVERSITY

### APPENDIX: Sources of Statistic Data

UK Retail Price Index of Alcoholic Drink	<i>Monthly Digest of Statistics</i> , UK Central Statistical Office
Yen Import Price Index of Whisky	<i>Price Indexes Annual</i> , The Bank of Japan
Pound Import Price Index of Whisky	The Bank of Japan
Domestic Wholesale Price Index of Whisky	<i>Price Indexes Annual</i> , The Bank of Japan
Consumer Price Index of Imported Whisky	<i>Annual Report of the Consumer Price Index</i> , Management and Coordination Agency

<sup>19</sup> Ito (1990) analyzed expectation formations with regard to exchange rates using a survey data to show a result of regressive expectations to a current rate.

Consumer Price Index of Domestic Whisky	<i>Annual Report of the Consumer Price Index, Management and Coordination Agency</i>
Arbitrated Rate of Pound (yen/pound)	<i>Economic Statistics Annual, The Bank of Japan</i>
Tariff Rate	<i>Kanzei-Kasisei no Subete, The Japan Tariff Association</i>
Liquor Tax Rate	<i>Annual Report of Statistic, The National Tax Administration Agency</i>

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