Does Japanese Liquor Taste Different?: Empirical Analysis on the National Treatment under the WTO *

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March 2011

Abstract

The national treatment obligation, along with the most favored nation obligation, is an important principle of non-discrimination adopted by the WTO. It requires that foreign products be treated no less favorably than national products. This paper empirically examines the 1996 WTO recommendation that a Japanese distilled alcohol beverage, *shochu*, is a 'directly competitive or substitutable product' to the other distilled drinks, and thus not taxing similarly is in violation of its national treatment obligation. Demand estimates obtained from a random coefficient discrete choice model reveal, contrary to the WTO conclusion, that a common production process (i.e. distillation) does not necessarily lead to strong substitution relationship. Upon the recommendation by the WTO Appellate Body, Japan made all distilled alcoholic beverages at issue be taxed at the same level in 2000. Our simulation analysis suggests that, while the tax revision contributed consumer welfare, a more desirable situation would have been actualized if the constraints by the NT obligation had been imposed based on the correct substitution relationship.

Keywords: National treatment obligation; WTO; Random coefficient discrete choice model; Alcohol demand
JEL classification: F13; L66; H21

1 Introduction

The national treatment (NT) obligation, along with the most favored nation (MFN) obligation, is an important pillar supporting non-discrimination principle at the World Trade Organization

*We thank seminar participants at RIETI for constructive comments.
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(WTO). Whereas the MFN obligation requires equal treatment among different nations, the NT obligation requires the treatment of imported goods, once they have cleared customs, to be no worse than that of domestically produced goods (See for example Jackson, 1997). It is an undertaking by the WTO to prevent domestic tax and regulatory policies from being used as protectionist means that would offset its efforts to reduce border measures. The interpretation of the NT obligation is of critical importance to the WTO members, because it has a profound impact on countries' freedom to choose domestic policies.

A major interpretative issue over the NT obligation is to determine whether the imported and domestic products are 'directly competitive or substitutable,' enshrined in Article III.2 of the General Agreement on Tariffs and Trade 1994 (hereafter GATT). While the absence of 'directly competitive and substitutable' relationship between imported and domestically produced products precludes any possibility of protective effects concerned under the NT provision, it is interesting to note that case-law has not clarified the interpretation of the terms. As Horn and Mavroidis (2004: 43) state, the WTO has no clear methodology to offer for interpreting the NT obligation, let alone for determining 'directly competitive and substitutable' products. The purpose of the paper is to provide an economic framework to assess under the NT obligation the relationship between imported and domestic products in an application to Japanese alcoholic beverages.

In June 1995, the EC (then the US and Canada in the following month) requested consultations with Japan at the WTO, under the claim that a Japanese law taxed the locally produced alcoholic beverage *shochu* more favorably than a series of other distilled drinks (*Japan–Tax on Alcoholic Beverages* (WTO, 1996b), hereafter *Japan-Tax*). In October 1996, Japan accepted the Appellate Body's recommendation that the plaintiffs' claim be appropriate, and completed the revision to the Japan's Liquor Tax Law in 2000. An integral issue of the dispute was whether *shochu* and other distilled beverages were 'directly competitive and substitutable' (hereafter DCS for short). [1] In the dispute settlement process, the Appellate Body viewed that the decisive criterion in the determination of DCS is whether two products have common end-uses, *inter alia*, as shown by elasticity of substitution (WTO, 1996b: 25). This empirical issue addressed by the WTO is relevant for the concept of market definition often employed in the fields of industrial organization and antitrust economics. Nevertheless, to our knowledge, the economics literature has devoted hardly any attention to this issue. Using the existing method available in the fields, this paper revisits the WTO dispute of *Japan-Tax*, and evaluates ex-post whether the conclusion reached by the Panel makes sense in that *shochu* and the other distilled beverages were in a DCS relationship one another.

[1] The other issue was whether *shochu* and vodka are 'like' product. While the issue of likeness could be discussed in the realm of economics, the Appellate Body decided to rely not on economics but on customs classification (WTO, 1996b). We will not take any further look into the issue on likeness in this paper.

The paper begins to perform the test of Small but Significant and Non-transitory Increase in Price, namely SSNIP, to determine whether *shochu* and other distilled beverages constitute a relevant market. The SSNIP test is a convenient method for antitrust practitioners to identify the smallest market relevant to product competition. Our test reveals that, contrary to the WTO recommendation, *shochu* forms a relevant market, independent of other beverages. Since the SSNIP test is known to be vulnerable to possible statistical biases arising from endogeneity and omitted variables, the paper proceeds to estimate Japanese consumer demand of alcoholic beverages to examine the robustness of the result obtained in the SSNIP test. We estimate a random coefficient discrete choice model by use of the method recently proposed by Dubé, Fox and Su (2009). Controlling for possible endogeneity in price, the paper finds that substitution pattern is estimated far more complicated than that inferred from the SSNIP test: *shochu* is estimated as a close substitute for both spirit and whisky, but not for liqueur.

The NT obligation is often deemed in conflict with national sovereignty. In the context of *Japan-Tax* under the study, the NT obligation placed severe constraints on Japanese government's ability to freely determine domestic alcoholic tax rates. In response to the WTO recommendation, the government revised the tax rates to be the same across all distilled alcoholic beverages. It thus appears imperative to ask whether and to what extent the WTO recommendation helps promote national welfare in the economic viewpoint. Our simulation exercises reveal that, while the revised tax rates did improve Japanese consumer welfare, different tax rates should have been proposed if the WTO bases its recommendation on the substitution pattern estimated in the paper.

The rest of this paper is organized as follows. The next section provides an overview of *Japan-Tax*. The issue of the dispute was whether *shochu* was DCS to other distilled alcoholic beverages. Then the section applies the SSNIP test often conveniently employed in antitrust economics to define the market. To check the robustness of the findings observed in the test, Section 3 estimates a random coefficient discrete choice model of Japanese demand of alcoholic beverages. Using the estimation results obtained in Section 3, Section 4 assesses the extent to which the revised tax rates following the WTO recommendation had an impact on economic welfare. Section 5 provides some concluding remarks.

2 Historical Background and Preliminary Analysis

This section begins with Subsection 2.1, which describes an overview of the WTO dispute over Japanese alcoholic drink, *shochu*. A major issue of the dispute was whether *shochu* and other distilled beverages were 'directly competitive and substitutable' (namely DCS) to each other. If they were, the plaintiff parties claimed that wide differences in Japanese liquor tax rates should be impermissible. While the WTO Appellate Body concluded that *shochu* and the other distilled

beverages were DCS, and thus not taxing similarly across the distilled beverages violated the WTO rule, the Body did not employ any precise criteria regarding the determination of DCS. In Subsection 2.2, we suggest a simple approach corresponding closely to the procedure taken by an antitrust authority, when the authority assesses the impact of, say, a proposed merger. Our analysis concludes that *shochu* independently constituted a relevant market, implying that *shochu* and other beverages were not in the DCS relationship. To check the robustness of the result obtained in Subsection 2.2, we perform a full-fledged demand analysis in the subsequent section.

2.1 Overview of the WTO Dispute

On 21 June 1995, the EC requested consultations with Japan concerning the internal taxes levied by Japan on certain alcoholic beverages pursuant to the Japan's Liquor Tax Law (WTO, 1995a). In the following month, the US (WTO, 1995b) and Canada (WTO, 1995c) joined the consultations. The three parties made essentially the same complaint in that Japan had acted inconsistently with Article III of GATT 1994 by applying higher tax rates on distilled alcoholic beverages including whisky, spirit and other distilled alcoholic beverages than the rates imposed on Japanese *shochu*.

When the three parties requested the consultations to the WTO, the Japan's Liquor Tax Law classified alcoholic beverages into nine categories, four of which are distilled beverages under the direct focus of this study, including *shochu*; liqueur; spirit; and whisky (including brandy). [2] Indeed, in 1995, the tax rates on distilled beverages per 10 liters of pure alcohol ranged from the highest of 24,558 JY on whisky to the lowest of 5,280 JY on *shochu*, as shown in Figure 1. [3] While the Law makes no distinction between domestic and imported beverages, the parties of the EC, the US and Canada complained that Japan unduly favored *shochu* over the other distilled beverages, the latter which accounted for higher shares of imports. [4]

In July 1996, the Panel agreed with the plaintiffs, and the WTO Appellate Body subsequently concluded in the final report that *shochu* and the other distilled beverages were in DCS relationship, and that Japan, by not taxing them similarly, was in violation of its obligation under Article III:2, second sentence, of the GATT 1994 (WTO, 1996b: 32). In response to the judgment of the Appellate Body, Japanese government reformed the Liquor Tax Law, and in October 2000, *shochu* was taxed at the same rate of the other distilled beverages, as shown in Figure 1.

(Figure 1)

[2] The other five categories are *sake*, *sake* compounds, *mirin*, beer and wine.

[3] *Shochu* can be sold at the retail level up to an alcoholic strength of 36 percent for *shochu* Group A and 45 percent for *shochu* Group B. For the sake of exposition, Figure 1 shows the sales-weighted average of the two groups of *shochu*.

[4] In 1994, imports accounted for 3.4% of domestic consumption in quantity for *shochu*, while 27.5% for whisky, 22.5% for spirit and 2.7% for liqueur.

During the settlement procedure, neither the WTO Panel nor the Appellate Body offered precise criteria as to how DCS should be determined. While the Appellate Body listed in the report factors relevant to the criteria, such as cross-price elasticity, elasticity of substitution, end-uses, consumer tastes and habits, and products' properties, it also added to mention that the list was not exhaustive, and did not clarify what weights to be given to each of the factors mentioned in the list.

As we understand that the concept of DCS is intended to capture the degree to which an increase in the tax on a set of products benefits another set of products in terms of an increased sales volume, the appropriate indicator for DCS must have been cross-price elasticity. In the subsequent sections of this paper, we present formal statistical methods to measure the degree of DCS between *shochu* and other beverages in *Japan-Tax*. We utilize publicly available data and attempt to address econometric issues involved in the empirical exercise. We believe that a statistical method proposed in the following sections would help understand how to determine DCS stipulated in the NT obligation.

In Section 3, we apply a discrete choice model to directly estimate cross-price elasticity and assess the validity of the claim in that *shochu* and other distilled beverages are DCS. Before introducing such a model, Subsection 2.2 presents the technique much simpler than that used in Section 3 to assess DCS between *shochu* and other beverages.

2.2 Preliminary Analysis of Market Definition

In evaluating a DCS relationship between a multiple of products, the adjudicating bodies are essentially asking whether the products are in the same relevant market. If the products are determined to be in the same market, they must highly substitute each other in the eyes of consumers. Otherwise, they are not deemed to be in direct competition. While the WTO has no clear approaches to define the relevant market, it noted in the report that "Under national antitrust [...] regimes, the extent to which products directly compete is measured by the elasticity of substitution." (Paragraph 6.31 in WTO, 1996a)

Before estimating cross-price elasticity in Section 3, this subsection proposes a much simpler statistical method often employed by a national antitrust authority to identify the smallest market relevant to product competition. To anticipate the result, the method finds that *shochu* alone constitutes an independent market, and thus is not DCS to other beverages. We also point out weaknesses in the test as well in this subsection, leading us to demand estimation discussed in the next section.

This subsection employs the Small but Significant Non-transitory Increase in Prices (SSNIP) test, which was introduced with the 1982 US Merger Guidelines and has been widely used by competition authorities to define the relevant market. Starting with the narrowest possible market

definition, if it is profitable for a hypothetical monopolist to increase the price(s) of the product(s) in this candidate market by 5 percent, the candidate market is determined as the relevant market. This is because the presence of profitable hypothetical monopolist implies that the elasticity of substitution to products outside the candidate market is considered to be small. If, on the other hand, the increase in price(s) is not profitable because consumers would substitute to products outside the candidate market, the market definition must be extended to include the closest of these substitutes, in order to ensure that any product exercising a competitive pressure on the product(s) in question is included in the market definition. Products are added to the candidate market until the price increase is profitable for a hypothetical monopolist owning all the products in the candidate market. The relevant market has then been found.

As Katz and Shapiro (2003) concisely describe, the effect of a SSNIP on the hypothetical monopolist's profit depends on the percentage of unit sales that would be lost as a result of the price increase and on the prevailing profit margin earned on each unit sold. The price increase would be profitable, if the following inequality holds:

$$\frac{\Delta q_j/q_j}{\Delta p_j/p_j} > -\frac{1}{(\Delta p_j/p_j) + M_j}, \tag{1}$$

where q_j, p_j and M_j are respectively quantity demanded, price and markup for product j. We are interested in investigating whether or not *shochu* was DCS to other alcoholic beverages, or whether Japanese *shochu* data satisfy the above equation (1).

Figure 2 shows the quantity and price data for the distilled alcoholic beverages used in this study. The publicly available data are traced back to the year of 1994, and we extend the data to 1996, when the WTO Appellate Body published the report. The annual data have regional dimension with 47 prefectures in the country. The aggregated national level data prior to 1996 indicate that the equation (1) always holds for any values of M_j: the left-hand side of (1) takes the value of 11.24, whereas the right-hand side always takes a negative value. This result would suggest that *shochu* constituted a relevant market, independent of other distilled beverages. This inference crucially depends on the observation made in Figure 2 in that price and quantity of *shochu* appeared to move in the same direction: indeed, the unconditional correlation coefficient is 0.26. As noted by Trajtenberg (1990), this positive correlation may be due to the lack of control for endogeneity in the price variable. In the next section, we address such econometric issues in the demand estimation.

(Figure 2)

3 Demand Model

This section introduces the estimation model we use to describe the market of Japanese alcoholic beverages. In Subsection 3.1, we introduce a demand system, derived from a random-utility discrete choice model of consumer behavior. Since we do not observe the individual purchasing behavior, we aggregate across individual buyers to obtain the demand for an alcoholic product, while still allowing for heterogeneity across consumers. The random coefficient logit structure used in the paper has the property to allow flexible substitution patterns, which is indispensable to examine DCS relationship among products. Following the discussion of identification issues made in Subsection 3.2, estimation results are presented in Subsection 3.3.

3.1 Random Coefficient Logit Model

This study follows the approach taken by the discrete choice literature and assumes each individual consumer as the purchasing entity. To maximize the following indirect utility, each consumer i is assumed to choose an alternative out of eight alternatives: *shochu*, liqueur, spirit, whisky, beer, wine, *sake*, and the outside option (i.e. not to buy alcohol). The indirect utility from alternative j in year t at prefecture m is

$$u_{ijtm} = \alpha \ln(y_i - p_{jtm}) + \beta_0 + \beta_{Di} D_j + \beta_{Ai} AC_j + \xi_{jtm} + \epsilon_{ijtm}, \tag{2}$$

where u_{ij} is consumer i's utility from consuming alcoholic beverage j (the time and prefecture subscripts are omitted if there is no confusion), y_i is income per day, p_j is a real price, [5] and AC_j is basic alcohol content (in fraction of one). [6] D_j is the distillation dummy, which equals one for alcoholic beverages made through distillation (specifically, *shochu*, liqueur, spirit and whisky), and zero for the others. [7] [8] Let ξ_j stand for an unobserved (by an econometrician) product quality of alcoholic product j with $E(\xi_j) = 0$, ϵ_{ij} represent the idiosyncratic taste following the type-I extreme value distribution. As usual in the literature, we set the mean utility from the outside option normalized to be zero.

[5] Income and prices are in thousand JY, and adjusted by the overall CPI.

[6] We employ the basic alcohol content which is described in the National Tax Agency Annual Statistics Report.

[7] According to processes of manufacture, alcoholic beverages divide into two groups: brewed and distilled. Brewed beverages, including wine, beer and *sake* are produced by fermenting materials, such as grapes, barley and rice. On the other hand, distilled beverages, including *shochu*, liqueur, spirit and whisky, are made through distillation after fermentation.

[8] The distillation dummy equals one for liqueur in our setting. While, in the classification of Japan's Liquor Tax Law, the category "liqueur" includes beverages without a distillation process, most liqueur undergoes the process. The plaintiffs in the WTO dispute under study regarded liqueur as a distilled beverage. Indeed, a web page of JAPAN SPIRITS & LIQUEURS MAKERS ASSOCIATION (http://www.yoshu.or.jp/statistics_legal/statistics/index.html) reports that 96% of liqueur shipped in Japan is "cocktail or *shochu*-based beverage." It is said that most cocktails are made from distilled beverages.

The term, $\alpha \ln(y_i - p_j)$, expresses that sensitivity to price differs across consumers depending on income. [9] In addition, to enable richer substitution patterns, we allow different consumers to have different intensities of preferences for different alcoholic beverage characteristics: the distillation dummy and alcohol content. We assume following distribution of coefficients:

$$\begin{bmatrix} \beta_{Di} \\ \beta_{Ai} \end{bmatrix} = \begin{bmatrix} \beta_D \\ \beta_A \end{bmatrix} + \begin{bmatrix} \pi_D \\ \pi_A \end{bmatrix} y_i + \begin{bmatrix} \sigma_D & 0 \\ 0 & \sigma_A \end{bmatrix} \boldsymbol{\nu}_i, \qquad \boldsymbol{\nu}_i \sim N(0, I_2),$$

where β_D and β_A are the means of the coefficients of D_j and AC_j respectively, π_D and π_A reflect relationships between i's income and i's taste, $\boldsymbol{\nu}_i$ is a 2-by-1 vector representing unobserved taste heterogeneity attributed to factors other than income and is assumed to follow standard normal distribution, and σ_D and σ_A reflect intensity of the heterogeneity.

Since the issue is whether or not *shochu* and other distilled beverages are DCS one another, empirical interest here is in the cross-price elasticities among distilled beverages, which are primarily affected by the distribution of the distillation dummy coefficient, β_{Di}. For an intuitive explanation, suppose the coefficient spreads widely across consumers. Then, roughly speaking, consumers divide into those who prefer distilled beverages and those who do not; consumers tend to switch their choices among distilled beverages (or among non-distilled beverages), then cross-price elasticities become large among distilled beverages (also among non-distilled beverages).

The model described above gives the probability of consumer i's choosing alternative j, conditional on y_i and $\boldsymbol{\nu}_i$:

$$s_{ijtm} = \frac{\exp\{\alpha \ln(y_i - p_{jtm}) + \beta_0 + \beta_{Di} D_j + \beta_{Ai} AC_j + \xi_{jtm}\}}{1 + \sum_k \exp\{\alpha \ln(y_i - p_{ktm}) + \beta_0 + \beta_{Di} D_k + \beta_{Ai} AC_k + \xi_{ktm}\}}.$$

Then, unconditional choice probability, denoted by s_{jtm}, is obtained by

$$s_{jtm} = \int_{y_i} \int_{\boldsymbol{\nu}_i} s_{ijtm} \, dF(\boldsymbol{\nu}_i) dG_{tm}(y_i), \tag{3}$$

where $dF(\boldsymbol{\nu}_i)$ represents the joint standard normal probability density, $dG_{tm}(y_i)$ the density of income, and we assume independence of them. Note that the cumulative distribution function of income, G, has subscripts t and m, and is allowed to differ across years and prefectures.

For each prefecture m in each year t, we have data on five variables regarding income distribution: the mean and standard deviation of male worker income, those of female worker income, and male-to-female ratio of workers. Table 1 shows simple statistics for those five variables by year: the means and standard deviations of the variables across prefectures. Table 1 represents, for example, that the mean across prefectures of male worker mean income grew from 13.72 to 13.99 (per day,

[9] This is the same specification as, say, Berry, Levinsohn and Pakes (1995).

in thousand JY, adjusted by the overall CPI) during 1994-1996. It also shows that the standard deviation across prefectures of male worker mean income increased from 1.50 to 1.55, suggesting that mean income disparity across prefectures slightly enlarged.

(Table 1)

Using such data on income distribution, we approximate integrals appeared in (3) through numerical simulation. We numerically sample 20,000 individuals (20 values of y_i, and 1,000 draws of $\boldsymbol{\nu}_i$ for each value of y_i) for each prefecture in each year: the total number of sample individuals is 2,820,000 (= 20,000 * 47 * 3). [10] For generation of y_i in prefecture m in year t, we first assign an individual's gender randomly according to the male-to-female ratio of prefecture m in year t, then derive the value of y_i from the log-normal distribution with the mean and standard deviation of the assigned gender of prefecture m in year t. [11] After generation of sample individuals, we calculate conditional choice probabilities, s_{ijtm}, for each individual, and approximate unconditional choice probability, s_{jtm}, by averaging those.

In estimation procedure, we calculate the market share predicted by the model in the aforementioned manner. Then, we match it with the observed market share defined as the fraction of potential market size, which is calculated under the assumption that an individual of over the legal drinking age chooses one 750ml bottle of alcoholic beverage every day. [12] [13] [14]

We employ the estimation procedure using the mathematical program with equilibrium constraints (MPEC) algorithm which is proposed by Dubé, Fox and Su (2009). Like the procedure proposed by Berry, Levinsohn and Pakes (1995), the MPEC algorithm also regards unobserved quality, ξ_j, as the econometric error term and forms a generalized method of moment (GMM) estimator. The population moment condition is a product of ξ_j and instrumental variables introduced in the next subsection.

[10] When we increased the number of draws, say, 40 values of y_i or 2,000 draws of $\boldsymbol{\nu}_i$, the estimation results reported below stayed about the same.

[11] If we have data on individual consumer income, we can directly estimate empirical distribution and derive y_i from it. However, since we lack such data, we follow previous papers in the random coefficient discrete choice literature, and approximate income distribution by log-normal distribution.

[12] Seim and Waldfogel (2009) make the similar assumption that each consumer chooses one bottle of alcoholic beverage every day. There, the choice is binary: to buy a bottle or not to buy.

[13] The bottle size, 750ml, is standard for wine. As for other alcoholic beverages, familiar sizes in Japan are, say, 633ml for beer, 720ml for *shochu*, 1,800ml for *sake*. When we changed the assumed bottle size to 500ml or 1,000ml, the paper's results reported below qualitatively held.

[14] While drinking of people under 20 years old is illegal in Japan, it exists in reality. The qualitatively similar results can be obtained when we redefine market size based on the number of people over 15 years old instead of 20 years old.

3.2 Instruments

As known in the literature, the price variable, p_j, is plausibly correlated with the unobserved quality, ξ_j. If ξ_j is correctly perceived by consumers and sellers in the market, then this unobserved quality error is likely correlated with price: better-quality products may induce higher willingness to pay, and sellers may be able to charge higher prices due to higher marginal costs or oligopolistic market power.

We use the liquor tax amount per bottle with basic alcohol content, LT_{jtm} (in thousand JY, adjusted by the overall CPI), as an instrumental variable for price. The liquor tax is levied on producers when they ship alcoholic beverages from plants to markets, and the tax is included in our price measure, p_{jtm}. Since the liquor tax amount is unlikely to be adjusted according to the unobserved quality, it seems a valid instrument.

In addition, we employ a variable related to prices of other products as an instrumental variable. In product differentiation models, the cost measures of rival products can also be appropriate instruments. With market power in supply, the markup of each product may depend on the costs of the other products. The liquor tax amount, which can be interpreted as a shipment-related cost, of a rival product is thus likely to be related to p_j. Since it is considered to be exogenous, it can be a candidate of an instrument. In the present study, we include in the set of instruments the average of the liquor tax amounts of the other products involving similar processes of manufacture (i.e. products having the same value of the distillation dummy, D_j).

The other instruments to construct the population moment condition for GMM estimation can be grouped into the following three sets of variables. First of all, we consider a set of exogenous variables in the indirect utility function (2): constant, the distillation dummy, D_j, and basic alcohol content, AC_j. Secondly, we employ variables on income distribution: mean income, the standard deviation for male workers, the standard deviation for female workers, and male-to-female ratio of workers. Finally, we consider cross-terms between mean income and three exogenous variables: D_j, AC_j and LT_{jtm}.

3.3 Demand Estimates

This subsection presents estimation results of the demand model discussed above. Table 2 shows estimation results. Column (2-1) is the result of the logit model which poses on indirect utility (2) the restriction that coefficients are same across individuals (i.e. σ_D, π_D, σ_A and π_A are zero). The first-stage F-statistic for the explanatory power of the instruments conditional upon the included exogenous variables is 193.18, indicating that the instruments are not weak. The logit model estimation generates an implausible positive estimate of the price coefficient.

(Table 2)

Then, we move into column (2-2), the result of the full model with random coefficients. The coefficient of $\ln(y_i - p_j)$ is estimated to be significantly positive; the marginal effect of price is plausibly negative. The *chi*-square statistic does not allow us to reject the orthogonality condition between some of the instruments and the error at the 1% level.

The full model fits the data better than the logit model. The correlation coefficient between observed and predicted shares increases from 0.90 by the logit model to 0.96 by the full model. The average of observed shares (0.039) is closer to the average of predicted shares by the full model (0.054) than that by the logit (0.095). [15] Finally, to check model fit, we calculate the reproducibility measure which is similar to R^2 in the context of regression analysis and is defined as $1 - \frac{\sum_{jtm}(s_{jtm} - \hat{s}_{jtm})^2}{\sum_{jtm}(s_{jtm} - \bar{s})^2}$ where s_{jtm} is observed share, $\hat{s}_{jtm}$ is predicted share by the estimated model, and $\bar{s}$ is the sample average of s_{jtm}. The measure dramatically increases from 0.38 by the logit model to 0.84 in the full model, implying the importance of heterogeneity of coefficients across consumers in the market under study.

Column (2-2) shows that the mean of coefficients of alcohol content is significantly negative. Since the standard deviation is significant, the coefficients spread widely across consumers. The significantly negative relationship between income and the coefficient of alcohol content suggests that a consumer with high income tends to prefer beverages with low alcohol content.

As for coefficients of the distillation dummy, the mean, the standard deviation, and the interaction with income are all insignificant. This suggests that for consumers' choices it does not matter whether a beverage is distilled or not. Contrary to the claim of the plaintiffs of the dispute under study, it is not the case that a common production process (i.e. distillation) leads to strong substitution relationship.

By use of the demand estimates of column (2-2), we can calculate the following own- and cross-price elasticities:

$$\begin{aligned}
\eta_{jktm} &= \frac{\partial s_{jtm} p_{ktm}}{\partial p_{ktm} s_{jtm}} \\
&= \int_{y_i} \int_{\boldsymbol{\nu}_i} \frac{\partial s_{ijtm} p_{ktm}}{\partial p_{ktm} s_{jtm}} \, dF(\boldsymbol{\nu}_i) dG_{tm}(y_i) \\
&= \begin{cases} \int_{y_i} \int_{\boldsymbol{\nu}_i} \frac{-\alpha p_{jtm}}{y_i - p_{jtm}} (1 - s_{ijtm}) \frac{s_{ijtm}}{s_{jtm}} \, dF(\boldsymbol{\nu}_i) dG_{tm}(y_i) & \text{if } j = k, \\ \int_{y_i} \int_{\boldsymbol{\nu}_i} \frac{\alpha p_{ktm}}{y_i - p_{ktm}} s_{iktm} \frac{s_{ijtm}}{s_{jtm}} \, dF(\boldsymbol{\nu}_i) dG_{tm}(y_i) & \text{otherwise.} \end{cases}
\end{aligned} \tag{4}$$

[15] Also, the standard deviation of observed shares (0.078) is closer to the standard deviation of predicted shares by the full model (0.105) than that by the logit (0.111).

Table 3 presents medians across years and prefectures of estimated own- and cross-price elasticities. [16] The cell entry (j, k), where j indexes row and k column, informs us of a percent change in market share of product j with one percent change in the price of k. We begin with investigating estimated own-price elasticities. Beer is less price-elastic (-0.04) than wine (-0.22) and distilled alcoholic beverages (ranged from -0.09 to -0.51). [17] [18] According to Cook and Moore (1999), "This pattern is well established though still somewhat mysterious." Based on the random coefficient model estimated above, we can propose an explanation about the pattern; a consumer with high income tends to prefer alcoholic beverages with low alcohol content; simultaneously, marginal disutility of price, $\frac{-\alpha}{y_i - p_{jmt}}$, approaches to zero as income increases; hence, beer, the beverage with the lowest alcohol content, is purchased relatively intensively by high income consumers, who are less sensitive to price than an average consumer. [19]

(Table 3)

Table 3 also reports cross-price elasticities, suggesting that substitutability among *shochu*, spirit and whisky is relatively high, while that between liqueur and them is low. For example, cross-price elasticities with respect to the price of *shochu* are 0.053 for spirit and 0.040 for whisky; on the other hand, the elasticity for liqueur is 0.009 and no larger than those for non-distilled beverages such as wine (0.011) and *sake* (0.015). This pattern stems from our estimation result. On one hand, preference for alcohol content spreads widely across consumers. On the other hand, it does not matter for consumer's choice whether a beverage is distilled or not. Hence, substitutability is high among relatively strong alcoholic beverages (*shochu*, 25%; spirit, 37%; whisky 40%), while it is not necessarily high among distilled beverages, one of which is liqueur, whose alcohol content is relatively low (12%).

The estimated substitution pattern seems to fall between the claims of plaintiffs and Japan: the former advocated that *all* distilled beverages were DCS, and the latter alleged that *shochu* was not DCS to the other distilled beverages. The Panel and the Appellate Body agreed with the plaintiffs, and Japanese government revised its Liquor Tax Law to set the tax rates of *all* distilled beverages, including liqueur, at similar rates. We evaluate this revision in the next section.

[16] While Table 3 shows medians of elasticities across years and prefectures, the results described below hold when we examine sample means instead of medians.

[17] For the whole of distilled alcoholic beverages, estimated own-price elasticity is -0.10.

[18] These estimates imply that Japanese alcoholic demand is less elastic than those found in other countries. For example, Chaloupka, Grossman and Saffer (2002) report that own-price elasticities have been found on average to be -0.3 for beer, -1.0 for wine, and -1.5 for distilled alcoholic beverages.

[19] If we can obtain consumer-level data on consumption quantities of each alcoholic beverage and on consumer's income, we can directly confirm the explanation presented here by comparing average income between consumers purchasing beer and those purchasing wine or distilled beverages. Unfortunately, we lack such data.

4 Evaluating Japan's Liquor Taxes

The NT obligation is often seen as imposing considerable constraints on national government's sovereignty. As for the Japan's Liquor Tax Law under study, Japanese government was presumably under constraint regarding their ability to freely determine domestic alcoholic taxes, and reformed the Law to make *all* distilled alcoholic beverages to be taxed at the same level upon the WTO recommendation. Did the constraints imposed by the NT obligation contribute to national welfare? This is the first question this section attacks.

In addition, the substitution pattern estimated in the previous section suggests that one sort of distilled beverage, liqueur, *was not* a close substitute to the other distilled beverages. However, since the Panel and the Appellate Body concluded that liqueur *was* DCS to the other distilled beverages, the tax rate on liqueur was raised to the same level as the other distilled beverages. If our demand estimation is valid, the intervention in the tax rate on liqueur was unnecessary from the perspective of the NT. The second question this section investigates is, thus, whether a presumably incorrect judgment of the DCS relationship impaired national welfare.

In what follows, using the demand model estimated in the previous section, we simulate and compare following three systems of liquor tax: [20]

(Actual) *The tax system in 1996 (i.e. the eve of the WTO dispute)*: This system is consistent with the claim of Japan, and consists of different tax rates across distilled beverages. [21]

(CF1) *The tax system adopted upon the WTO recommendation*: This system is consistent with the claim of the plaintiffs, which was agreed by the WTO, and consists of almost identical rates for all distilled beverages. Concretely speaking, the rates on *shochu* and liqueur are raised to the same as spirit, and that on whisky is lowered to the level of 1.03 times higher than spirit. [22]

(CF2) *The tax system same as (CF1) except for the rate on liqueur*: This system is consistent with our demand estimation results, moves the rates on *shochu*, spirit and whisky closer to each other in the same manner as (CF1). The system, however, leaves the rate on liqueur at the level in 1996.

We simulate these systems for 1996, the last year of our data used to estimate the demand model. By comparing (Actual) with (CF1), we attack the first question above: the impact of the constraints

[20] In this paper, we do not derive the optimal tax rates which maximize national welfare, rather compare three specific tax systems. The derivation of the optimal tax rates of alcoholic beverages has been investigated by previous studies (e.g. Pogue and Sgontz, 1989; Kenkel, 1996). It requires information on, say, drunk driving and costs of alcohol abuse, and needs a model incorporating them. Hence, we think the accurate derivation of the optimal tax is beyond the scope of this paper.

[21] See Figure 1.

[22] See Figure 1.

imposed by the NT obligation. Then, by comparing (CF1) with (CF2), we tackle the second: the consequence of the incorrect judgment of DCS relationship.

We compare across systems consumption quantities of each alcoholic beverages, tax revenue, and consumer surplus. [23] We measure changes in consumer surplus by the compensating variation. For consumer i, define CV_{itm}^{XY} as the income adjustment that equates maximum utility under tax system Y to that under X:

$$\max_j \alpha \ln(y_i - p_{jtm}^X) + \beta_0 + \beta_{Di} D_j + \beta_{Ai} AC_j + \xi_{jtm} + \epsilon_{ijtm}$$
$$= \max_j \alpha \ln(y_i + CV_{itm}^{XY} - p_{jtm}^Y) + \beta_0 + \beta_{Di} D_j + \beta_{Ai} AC_j + \xi_{jtm} + \epsilon_{ijtm},$$

where p_{jtm}^X and p_{jtm}^Y represent prices under tax system X and Y respectively. Then, the expected compensating variation in year t at prefecture m is as follows:

$$E\left(CV_{itm}^{XY}\right) = \int_{y_i} \int_{\boldsymbol{\nu}_i} \int_{\boldsymbol{\epsilon}_i} CV_{itm}^{XY} \, dH(\boldsymbol{\epsilon}_i) dF(\boldsymbol{\nu}_i) dG_{tm}(y_i),$$

where $dH(\boldsymbol{\epsilon}_i)$ represents the density of $\boldsymbol{\epsilon}_i$, the vector of ϵ_{ij}. Since in our specification the marginal utility of income varies as a result of price changes, we cannot utilize the well-known "log sum" formula to calculate the compensating variation with a logit-type model (cf. McFadden, 1995). Hence, we follow the procedure proposed in McFadden (1995) and numerically compute the compensating variation.

To predict prices in counterfactual situations, we assume complete pass-through of tax to price: a tax change entails the price change to the exactly same amount. Since there are many domestic and foreign producers in the market under study, [24] the assumption of perfect competition, which follows complete pass-through, seems reasonable. To confirm the validity of the complete pass-through assumption in the market under study, we conduct two examinations. First, we use the event of the reform of the Japan's Liquor Tax Law during 1997-2000. If the assumption of complete pass-through is legitimate, the ratio of the price change during the period to the tax change should be one. [25] We calculate that ratio of *shochu*, most of which was domestically produced during the period [26] and which was thus expected not to be affected by the modification of import tariffs on alcoholic beverages during 1998-2002. Since the average of the ratio across prefectures is 1.04 and the standard deviation is 0.29, we cannot reject the null hypothesis that the mean is one. [27] This

[23] As for producer surplus, we will make some comments at the end of the section.

[24] For example, according to the Census of Manufactures in 2003, 224 firms produced *shochu* in Japan, 25 firms produced whisky, and 128 firms produced the other distilled alcoholic beverages.

[25] This statement is true when costs were unchanged during the period. To deal with possible shifts of input prices, taxes and prices are adjusted by the corporate goods price index in the examinations here.

[26] See footnote 4.

[27] The t-value is 0.92.

result supports the assumption of complete pass-through. [28]

Second, using the first order condition of suppliers, we conduct another examination to confirm the complete pass-through assumption. With conduct parameter θ_j, we can derive the following equation which sums up first order conditions of L_j suppliers of alcoholic beverage j (e.g., Genesove and Mullin, 1998):

$$p_{jtm} = \frac{\sum_l c_{ljtm}}{L_j} + \theta_j \left(-\frac{1}{\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}} \right), \tag{5}$$

where c_{ljtm} represents marginal cost of supplier l and includes liquor tax. For perfect competition, θ_j equals zero, for perfect collusion or monopoly it is one, for Cournot it is $\frac{1}{L_j}$. This equation shows that complete pass-through is achieved when (i) $\theta_j = 0$ or (ii) $\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}$ is not a function of p_{jtm}. If our demand model is appropriate, then $\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}$ depends on price [29] and thus (ii) does not hold. In such a case, complete pass-through is supported only when (i) holds. For each distilled beverage, we estimate (5) [30] [31] and examine whether θ_j is significantly positive. For all distilled beverages, estimated conduct parameters are not significantly positive. [32] Therefore, the assumption of complete pass-through is supported again.

Table 4 shows our simulation results. First, considering the transition from tax system (Actual) to (CF1), we examine economic impacts of the constraints imposed by the NT obligation. Owing to the rise of the tax rate of *shochu* and the drop of that of whisky, the consumption quantity of *shochu* decreases by 4,210 kl in terms of pure alcohol and that of whisky increases by 5,790 kl. Because of the dramatic drop of the tax rate of whisky, while tax revenue declines by 3.9 billion JY, consumer surplus swells by 7.3 billion JY. These estimates suggest that the transition of tax system from (Actual) to (CF1) achieves the gain of 3.4 billion JY, and that the constraints imposed by the NT obligation contribute to Japanese consumer welfare. [33] This enhancement of consumer

[28] If the assumption of complete pass-through is legitimate, the difference between the price change and the tax change should be zero. For *shochu*, the average of that difference across prefectures is 0.04, and the standard deviation is 0.14. While we cannot reject the null hypothesis that the mean is zero at 5% significance level, can reject at 10% level. (The t-value is 1.75.) Although the mean is statistically significant, it seems economically insignificant. The average 0.04 is less than one-tenth of tax change during the period, 0.50.

[29] See (4).

[30] In practice, to construct $\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}$, we use the demand model estimated in the previous section. In our demand model, $\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}$ is a function of price, the left hand side variable of (5). Hence, we employ 2SLS estimation. Since the value of $\frac{\partial q_{jtm}}{\partial p_{jtm}} \frac{1}{q_{jtm}}$ in our demand model depends also on income distribution, we use instrumental variables related to income distribution: the mean and standard deviation of male worker income, those for female worker income, and male-to-female ratio of workers. The first-stage F-statistics indicate that the instruments are not weak.

[31] The data period for the estimation is the same as demand estimation: 1994-1996. The sample size is 141 (3 years by 47 prefectures) for each distilled beverage's estimation.

[32] The estimates (the standard errors) of θ are -0.016 (0.009) for *shochu*, 0.006 (0.013) for liqueur, 0.129 (0.090) for spirit, and -3.878 (2.020) for whisky.

[33] Previous studies pointed out negative externalities of alcohol consumption (cf. Cook and Moore, 1999). For example, through public or private insurance systems, drinkers impose a part of their health costs on others; another example is drunk driving, which hurts non-drinkers. If negative externalities are large enough, 1,260 kl increase of total alcohol consumption can overturn our conclusion: superiority of system (CF1) to (Actual). Here, we examine

welfare presumably comes from the reduction of distortion of consumption patterns; tax system (Actual) levies relatively high taxes on the beverages relatively elastic to price (whisky and spirit), [34] and is opposite to the well-known Ramsey pricing rule, which recommends to impose relatively low taxes on price-elastic products; the transition to (CF1) is in the direction towards the rule. [35]

(Table 4)

Then, comparing system (CF1) and (CF2), we evaluate the intervention in the tax rate on liqueur, which has relatively low substitutability for the other distilled beverages such as *shochu*. Since system (CF1) levies higher tax on liqueur than system (CF2), it associates with larger tax revenue by 4.8 billion JY and smaller consumer surplus by 5.0 billion JY. These suggest that the transition from system (CF2) to (CF1) causes the loss of 0.2 billion JY, and that the intervention in the liqueur tax rate, which is based on the presumably incorrect judgment of DCS relationship, impairs Japanese consumer welfare. [36] In summary, our simulation results imply that, while the constraints imposed by the NT obligation contributed to consumer welfare of Japan, the welfare would have further improved if DCS relationships had been appropriately defined.

Thus far, we evaluated the tax reform from the perspective of Japanese consumer welfare, abstracting producer surplus. Lastly, we make some comments from the perspective of economic welfare of the whole world, which we understand as the primary object of the WTO. Two examinations above support the complete pass-through assumption, which suggests perfect competition when our demand model is valid. If the market under study is almost in perfect competition, then the amount of producer surplus may be negligible compared to tax revenue and consumer surplus. However, the fact that the EC, the US and Canada made claims on Japan's liquor tax law implies that there existed in the market under study the producer surplus which plaintiffs tried to exploit. Even if it is the case, as long as profits from one unit of pure alcohol are same across alcoholic beverages, taking into account producer surplus does not change our conclusions: superiority of

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the robustness of our conclusion by using the results of Pogue and Sgontz (1989). They report that the total value of negative externalities of alcohol abuse is estimated to be 5.5 JY per ml of pure alcohol (converted using the exchange rate of the day and adjusted by the overall CPI), and also report that the ratio of abuse consumption to total consumption is estimated to be 0.41. According to them, additional 1,260 kl of pure alcohol consumption generates 2.8 $(= (1,260 * 10^6) * 0.41 * (5.5/10^9))$ billion JY of negative externalities. This is smaller than 3.4 billion JY, the gain of transition from (Actual) to (CF1). Hence, if the estimates of Pogue and Sgontz (1989) are valid, our conclusion of superiority of (CF1) to (Actual) holds even when we take into account negative externalities of alcohol consumption.

[34] Arranged in descending order of price sensitivity (i.e. the absolute value of own-price elasticity), tax-price ratios in system (Actual) are 0.277 for whisky, 0.334 for spirit, 0.097 for liqueur, 0.167 for *shochu*.

[35] Arranged in descending order of price sensitivity, tax-price ratios in system (CF1) are 0.137 for whisky, 0.334 for spirit, 0.115 for liqueur, 0.290 for *shochu*.

[36] Total alcohol consumption under (CF2) is estimated to be 30 kl larger than under (CF1). According to the estimates of Pogue and Sgontz (1989) (cf. footnote 33), negative externality under (CF2) is estimated to be 0.07 $(= (30 * 10^6) * 0.41 * (5.5/10^9))$ billion JY larger than under (CF1), and is too small to overturn our conclusion of superiority of system (CF2) to (CF1).

(CF1) to (Actual) and that of (CF2) to (CF1). Our simulation results predict that total pure alcohol consumption is larger under (CF1) than (Actual). This means the amount of producer surplus is larger under (CF1) than (Actual), strengthening superiority of (CF1) to (Actual) from the perspective of economic welfare of the whole world. The same logic can be applied to superiority of (CF2) than (CF1).

5 Conclusion

This paper evaluated the WTO dispute on the Japan's Liquor Tax Law—*Japan–Tax on Alcoholic Beverages*. The defining problem of this dispute was whether *shochu* and other distilled beverages were in DCS relationship. This paper approached to this problem in terms of consumers' preference. We estimated the demand system for Japan's alcoholic beverages market by using a random coefficient discrete choice model, and found that, while *shochu* was DCS for other two categories of distilled beverages (spirit and whisky), it was not DCS for the remaining one (liqueur). This result falls between the claims of the plaintiffs of the dispute (the EC, the US and Canada) and of Japan.

We also evaluated the tax revision after the dispute. Upon the recommendation by the WTO Appellate Body, which agreed with the plaintiffs, Japan made the liqueur tax reform, leading to almost identical specific tax rates for *all* distilled beverages at issue. Our simulation analysis revealed that, while the reform contributed consumer welfare, a more desirable situation would have been achieved if the revision had been based on the correct DCS relationship suggested by our demand estimates.

This paper provided an economic framework to assess the DCS relationship under the NT obligation. In addition, our results implied that, since an incorrect judgment on DCS relationship may give rise to welfare loss, dispute settlement bodies of the WTO should carefully make the judgment based on credible methods, such as the econometric method suggested in the paper.

Appendix: Data Sources

Estimating the model requires the data on the following: consumption quantities and prices, basic alcohol content, and distribution of income. Consumption quantities and prices are obtained from the Annual Statistical Data on Liquor & Food Industries. This data is aggregated by the category of alcoholic beverages by the Japan's Liquor Tax Law, and covers up 47 prefectures in Japan from the period of 1994 to 1996. We use the basic alcohol content which is described in the National Tax Agency Annual Statistics Report. Finally, we use the data on income distribution from the Basic Survey on Wage Structure. For each prefecture in each year, the data consist of the mean and standard deviation of male worker income, those of female worker income, and male-to-female

ratio of workers (cf. Table 1). The means and the ratio can be obtained from a web page of the Ministry of Health, Labor and Welfare. The standard deviations are reported in Shinozaki (2007).

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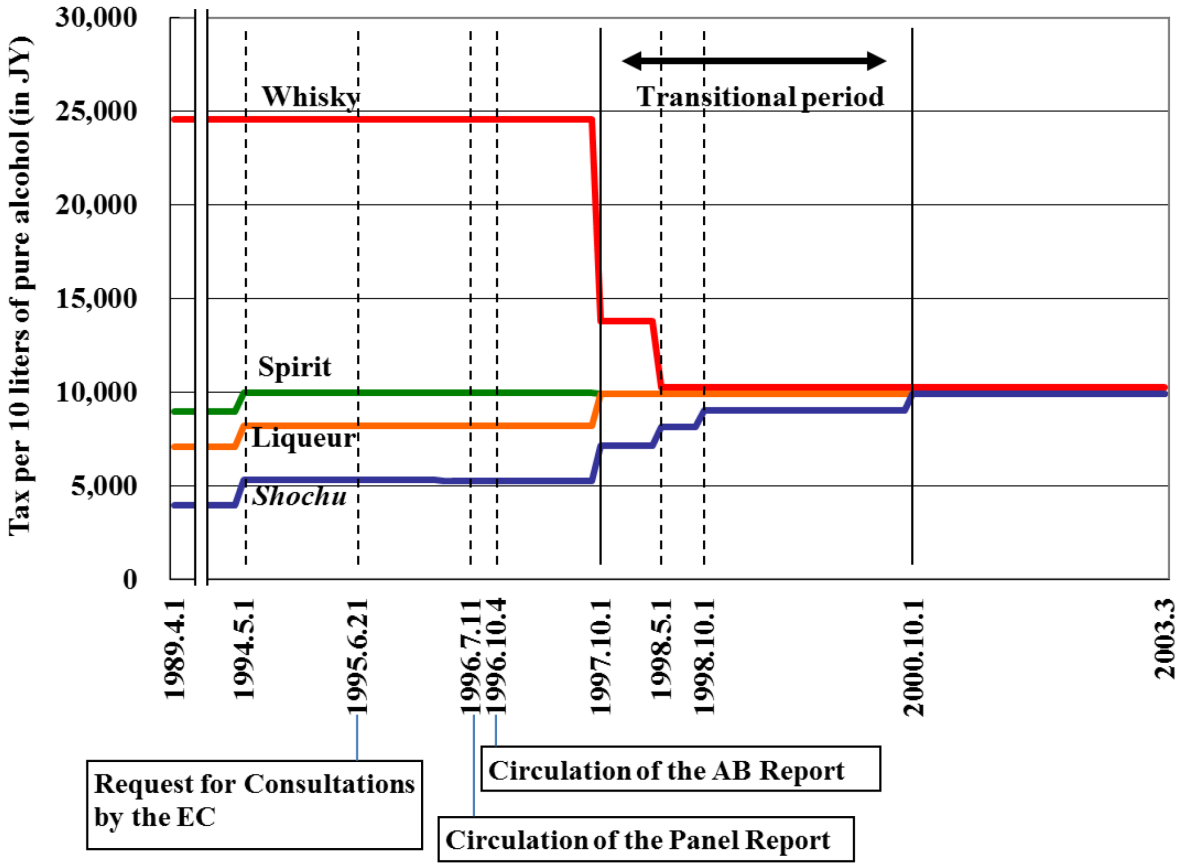
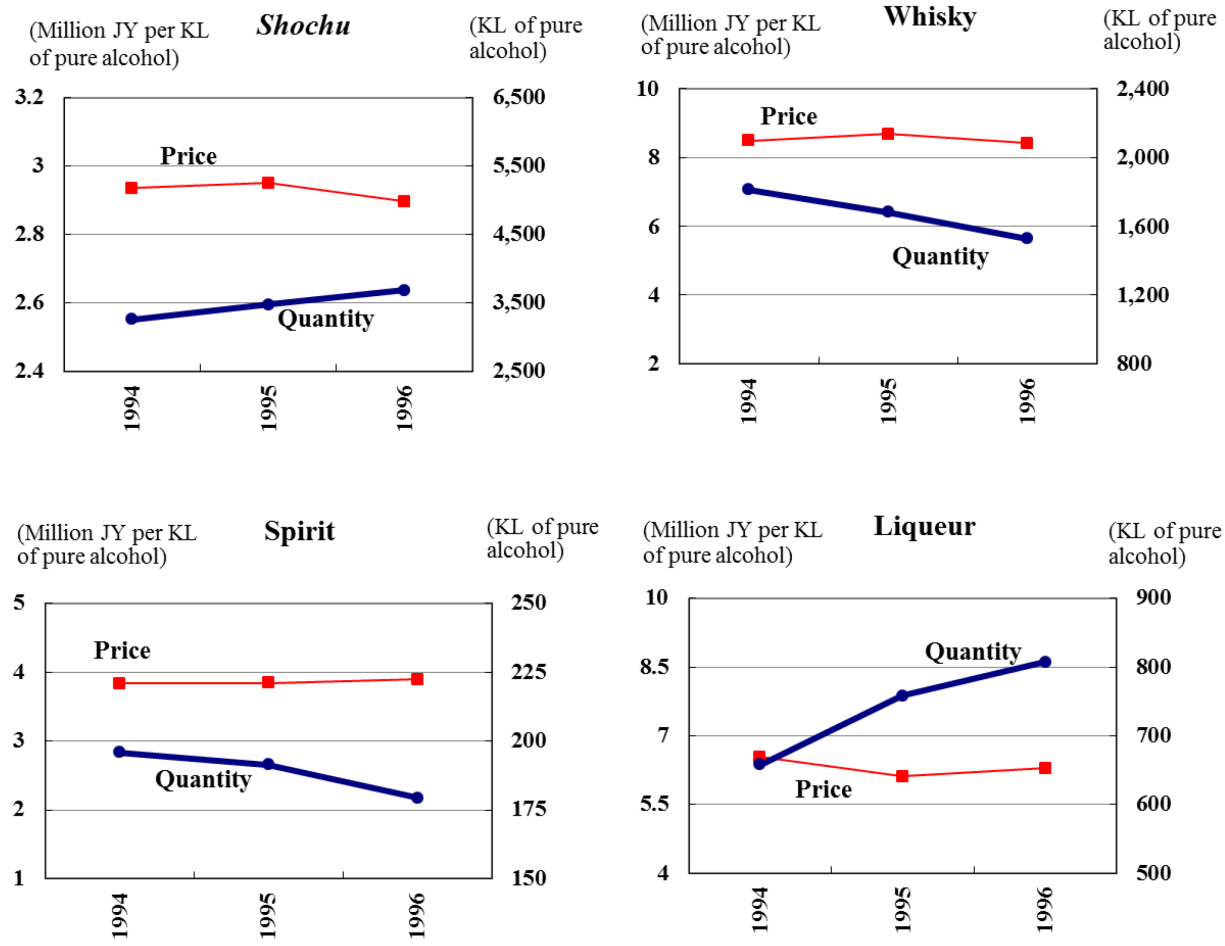
Figure 1: Legal Changes of the Liquour Tax Law



Notes: Each tax rate is a specific amount in Japanese Yen (JY) per 10 liters of pure alcohol. A tax rate of *shochu* is the sales-weighted average of s*hochu* Group A and *shochu* Group B. The tax rates in June 1995 are 5,280 JY on *shochu*, 8,217 JY on liqueur, 9,927 JY on spirit, and 24,558 JY on whisky. The tax rates in October 2000 are 9,924 JY on *shochu*, liqueur and spirit, and 10,225 JY on whisky.
Data source: The National Tax Agency Annual Statistics Report

Figure 2: Prices and Quantities



Notes: Each panel shows by year average prices and quantities across prefectures. The quantity of *shochu* is the sum of quantities of *shochu* Group A and *shochu* Group B, and the price of *shochu* is the sales-weighted average of *shochu* Group A and *shochu* Group B.
Data source: The Annual Statistical Data on Liquor & Food Industries

Table 1: Simple Statistics on Income Distribution

Year	Male worker income		Female worker income		Male-to-female ratio
	Mean	Std. dev.	Mean	Std. dev.	
1994	13.72 (1.50)	6.13 (0.66)	8.18 (0.86)	3.68 (0.38)	0.654 (0.045)
1995	13.87 (1.48)	6.17 (0.61)	8.36 (0.89)	3.73 (0.39)	0.656 (0.045)
1996	13.99 (1.55)	6.22 (0.65)	8.44 (0.89)	3.75 (0.43)	0.662 (0.044)

Notes: The figures are means across prefectures. (Standard deviations across prefectures are in parentheses.) Income variables are per day, in thousand JY, and adjusted by the overall CPI.
Data source: The Basic Survey on Wage Structure

Table 2: Estimation Results

	(2-1) Logit		(2-2) Random coefficient logit	
Variable	Est.	(Std. err.)	Est.	(Std. err.)
$ln\,(y_i - p_j)$			1.72	(0.60) **
p_j	1.35	(0.09) **		
Constant	-2.38	(0.10) **	-1.80	(1.72)
Distillation dummy				
Mean (β_D)	-0.30	(0.15) *	-0.57	(1.47)
Standard deviation (σ_D)			0.05	(14.49)
Interaction with y_i (π_D)			0.01	(0.15)
Alcohol content				
Mean (β_A)	-13.16	(0.65) **	-37.01	(11.23) **
Standard deviation (σ_A)			25.88	(3.78) **
Interaction with y_i (π_A)			-1.77	(0.57) **
First-stage F-statistics (d.f.)	193.18 (9, 975) **			
Chi-square statistics (d.f.)	18.40 (8) *		10.83 (4) *	
Number of observations	987		987	

Notes: The *chi*-square statistics are for tests of overidentifying restrictions. ** denotes significance at 1%, and * 5%.

Table 3: Price Elasticities

	Alcohol content	Average price (1,000 JY)	*Shochu*	Liqueur	Spirit	Whisky	Beer	Wine	*Sake*
Shochu	0.25	0.541	-0.087	0.004	0.004	0.096	0.011	0.004	0.056
Liqueur	0.12	0.754	0.009	-0.150	0.000	0.005	0.025	0.003	0.032
Spirit	0.37	0.816	0.053	0.002	-0.211	0.429	0.002	0.002	0.032
Whisky	0.40	2.636	0.040	0.001	0.012	-0.514	0.001	0.001	0.021
Beer	0.05	0.394	0.001	0.001	0.000	0.000	-0.043	0.001	0.009
Wine	0.13	1.021	0.011	0.004	0.000	0.007	0.024	-0.223	0.037
Sake	0.15	0.718	0.015	0.004	0.001	0.013	0.023	0.004	-0.113

Notes: The *(j, k)* element in the matrix indicates elasticity of product *j* with respect to a change in the price of product *k*. The table shows medians of elasticities across years and prefectures.

Table 4: Simulation Results

	Actual	CF1	CF2	Difference: CF1 - Actual	Difference: CF1 - CF2
Pure alcohol consumption (thousand KL)					
Shochu	177.21	173.00	172.98	-4.21	0.02
Liqueur	28.49	28.43	28.51	-0.06	-0.08
Spirit	11.10	10.61	10.61	-0.50	0.00
Whisky	69.79	75.58	75.58	5.79	0.00
Non-distilled beverages (beer, wine and *sake)*	551.42	551.67	551.63	0.24	0.03
Total	838.02	839.28	839.31	1.26	-0.03
Tax revenue (billion JY)	1966.7	1962.8	1958.0	-3.9	4.8
Consumer surplus (billion JY)				7.3	-5.0