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(Citation)
神戸大学経済学研究科 Discussion Paper,805

(Issue Date)
2008

(Resource Type)
technical report

(Version)
Version of Record

(URL)
https://hdl.handle.net/20.500.14094/81000055

Comparing marginal commodity tax reforms in Japan and Korea

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Abstract

We examine the impact of marginal commodity tax reforms in Japan and Korea using data from the official household surveys of the two countries. Based on the estimations of two demand systems (*LES and AIDS), we compare the marginal costs of taxing major commodity groups, examine distributive gains from tax reforms based on concentration curves, and assess the impact on poverty based on consumption dominance curves. In particular, we find that revenue-neutral marginal tax reforms incorporating a reduced tax on food* & *beverages are more likely to face an efficiency-equity tradeoff in Korea than in Japan.*

Key words**:** marginal commodity tax reform, concentration curve, consumption dominance curve

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I. Introduction

Japan and South Korea, both of which are among the richest countries in Asia following their strong economic performance in the latter half of the twentieth century, present similar socio-economic trends such as low fertility and rapidly aging population. In recent years, the two countries have been experiencing additional challenges in common: rising poverty and widening income inequality, which seem ironic given their high levels of national income per capita. Indeed, recent OECD studies show that from the mid-1980s to 2000 the relative poverty rate[1] rose from 12.0 percent to 15.3 percent in Japan and from 9 percent to 13 percent in Korea, more than the OECD average increase from 9.4 percent to 10.6 percent over the same period (see Jones, 2007 and OECD, 2007). These developments point to the need for a serious consideration of the distributive impacts of taxation and other public policies in both countries.

The tax systems of Japan and Korea also have some similarities. In particular, the value-added tax (VAT) rates are now five percent in Japan and ten percent in Korea, much lower than the average of approximately twenty percent levied in European countries. Besides, VAT and other commodity taxes share about one-third of the total tax revenues of the central governments in both countries—35.6 percent in Japan and 33.5 percent in Korea in 2005.[2] In addition, there is a possibility that a VAT tax increase will be considered as a plausible policy option in both countries, because demographic pressures due to population aging will continue to put pressure on government spending over the coming decades. Especially in Japan, many policymakers and analysts now are explicitly arguing for an increase in the VAT rate to finance mounting social security spending. However, the regressive nature of VAT is often criticized from an equity viewpoint.

This paper aims to explore and compare the distributive outcomes and the impacts on poverty of *marginal* VAT reforms—rather than derive *optimal* VAT systems—in Japan and Korea, based on data from household surveys carried out in both countries. To be sure, many preceding studies have attempted to calculate the optimal tax rates required to balance equity and efficiency in the commodity tax system. It is almost impossible, however, to make the leap to an optimal system from the existing system, even if the former is theoretically attractive. Tax changes are always slow and piecemeal for political and/or institutional reasons, making the policy implications of designing an optimal tax system limited and unrealistic.

Marginal commodity tax reforms were initially proposed by Ahmad and Stern (1984), who illustrated them with the case of India. They focused on the marginal cost in terms of social welfare of raising an extra unit of revenue by increasing the tax on a specific commodity. The tax on a good with a higher marginal cost should be lowered while that on a good with a lower marginal cost should be raised. And, a welfare-improving tax reform is defined as a set of tax changes that increases social welfare without decreasing tax revenue. As comprehensively surveyed by Santoro (2007), the literature on marginal tax reforms has rapidly grown by applying and extending Ahmad and Stern's framework. In particular, a number of papers attempt to rank commodities by marginal cost in terms of the impact on social welfare of an extra unit of revenue from taxation (see Decoster and Shokkaert, 1990; Madden, 1995; and Ray, 1999).

On the other hand, welfare-improving tax reforms have been discussed on the basis of *concentration curves*, which yield the cumulative consumption proportion of commodities held by individuals ranked by ascending order of incomes, following seminal analyses by Yitzhaki and Thirsk (1990) and Yitzhaki and Slemrod (1991). They show that the necessary and sufficient condition for one commodity i to *dominate* commodity *j* in terms of improving welfare is correlated with the shape of the concentration curve of each commodity. Alternatively, Makdissi and Wodon (2002) introduced the concept of the *consumption dominance curve*, which can be generally used to test the impact of a change of commodity tax rates on poverty. In addition to the practical preference for small tax changes over large ones, far fewer data requirements than optimal tax rates have inspired many empirical analyses as pointed out by Ray (1997).

To our knowledge, however, there has been no attempt to quantitatively discuss marginal commodity tax reforms in Japan or Korea. There have been a large number of empirical and theoretical analyses on the optimal tax system and its distributive impact in Japan, where Consumption Tax, a Japanese version of VAT, was introduced in April 1989 (see Fukushima and Hatta, 1989; Kaneko and Tajika, 1989; Oshio, 1990; Murasawa, Yuda, and Iwamoto, 2005). However, they did not discuss marginal commodity reforms. In Korea, there seems to have been no attempt to address either optimal or marginal reforms as far as we know. Accordingly, no Japan-Korea comparison has been attempted to date. The governments of the two countries, however, publish almost the same types of household survey, making it easy to compare tax reforms and discuss their policy implications in the two countries, based on a common framework of empirical analysis.

We believe this paper is the first attempt to empirically compare the impact of marginal commodity tax reforms in Japan and Korea. In particular, the same methodology and comparable survey data enable us to investigate the similarities and the differences of the impacts of reforms between the two countries. The remainder of the paper is construed as follows. Section 2 provides the basic model of marginal commodity tax reform and relates the concepts of concentration and consumption dominance curves to it. Section 3 discusses the data source on which our empirical analysis is based, and calculates effective tax rates for major commodities, which are the key inputs for our estimation. Section 4 explains the estimation results of the demand systems and the outcomes of tax reforms. Section 5 offers some concluding remarks.

2. Theoretical setting

2.1 Marginal cost of taxation

This section starts by providing a basic model, following Ahmad and Stern (1984). We assume that there are H households and N commodities, and consider the problem of maximizing social welfare $W(V_1(q, y_1),\ldots, V_H(q, y_H))$, where V_h and y_h are the indirect utility function and income, respectively, of household h (h=1,…,H) and $q=(q_1,\ldots, q_N)$ consumer prices. We assume that the producer prices of all commodities are normalized as unity and fixed, and that the government collects tax revenue R through commodity taxes. Denoting x_i^h, X_i, and t_i the amount of commodity i purchased by household h, total consumption and the tax on commodity i, respectively, we have

$$q_i = 1 + t_i,$$

and

$$R = \sum_{i=1}^{N} t_i X_i = \sum_{i=1}^{N}\sum_{h=1}^{H} t_i x_i^h .$$

The marginal cost in terms of the impact on social welfare of an extra unit of revenue generated by increasing the tax on commodity i, denoted by λ_i, is defined as

$$\lambda_i \equiv -\frac{\partial W / \partial t_i}{\partial R / \partial t_i} ,$$

(1)

where numerator and denominator represent change of social welfare and change of tax revenue, respectively, in response to an additional rise of tax on commodity i. If $\lambda_j>\lambda_i$, the government can enhance social welfare by raising t_i and reducing t_j, while keeping aggregate tax revenue constant. In other words, the tax system is optimal if the marginal cost is equal across all commodities.

It is a straightforward matter to rewrite the formula (1) to:

$$\lambda_i = \frac{\sum_{h=1}^{H} \beta^h x_i^h}{X_i + \sum_{k=1}^{N} t_k \frac{\partial X_k}{\partial t_i}} = \frac{\sum_{h=1}^{H} \beta^h s_i^h}{\alpha_i} ,$$

(2)

where

$$\alpha_i \equiv 1 + \frac{1}{X_i} \sum_{k=1}^{N} t_k \frac{\partial X_k}{\partial t_i}, \quad \beta^h \equiv \frac{\partial W}{\partial V^h} \frac{\partial V^h}{\partial y^h}, \text{ and } s_i^h \equiv \frac{x_i^h}{X_i}.$$

Here, α_i is the reciprocal of the marginal efficiency cost of raising public funds by taxing commodity i. β_i is the marginal social valuation of one unit of income accruing to household h to take into account distributional considerations. And s_i^h is the share of the consumption of commodity i of household h. $\sum_{h=1}^{H} \beta^h s_i^h$ can be interpreted as the *distributional characteristic* of commodity i; the higher it is, the more highly the commodity is evaluated in terms of equity.

In addition, by multiplying both the numerator and denominator by q_i, equation (2) can be rewritten as:

$$\lambda_i = \frac{\sum_{h=1}^{H} \beta^h q_i x_i^h}{q_i X_i + \sum_{k=1}^{N} \varepsilon_{ki} t_k q_k X_k}$$

(2)’

where ε_{ki} is the uncompensated elasticity of demand for commodity k with respect to a change in the consumer price of commodity i. Equation (2) or (2)' indicates that the marginal cost of taxation has both efficiency and equity aspects: a commodity that has a higher own price elasticity (in absolute value terms) and is highly evaluated in terms of equity generates a higher social cost when it is taxed.

It is important from the viewpoint of an empirical analysis that the data requirements for estimating λ_i are less data-demanding than those for estimating optimal tax rates. Equation (2)' indicates that what we need are: (i) aggregate spending on each commodity (q_iX_i); (ii) the spending of each household (or in practice, the spending of each income class) spending on each commodity ($q_ix_i^h$); (iii) existing (effective) tax rate on each commodity (t_i), (iv) uncompensated price elasticities of aggregate demand (ε_{ij}), and (v) welfare weight of each household (β_h). Of these five items, (i) q_iX_i and (ii) $q_ix_i^h$ can be obtained directly from the household survey, and (iii) t_i can be calculated from the household survey and existing tax rules (as explained in the next section). (iii) ε_{ij} is computed from the estimated demand system, but it should be noted that we need to estimate the demand system for total spending that is aggregated over all households rather than for each household (or income class). Finally, for (iv) β^h, we follow Ahmad and Stern, who assume

$$\beta^h \equiv \left(\frac{y^1}{y^h}\right)^{\sigma} , \qquad (3)$$

where y^1 is the expenditure of the lowest income class and β^1 is normalized as unity and σ is the inequality aversion parameter.[3] We assume $\beta^1 \geq \ldots \geq \beta^H$, meaning that the welfare of lower-income households is more highly evaluated. The higher σ is, the smaller the welfare weight of a higher income household is. In the special case of σ=0—that is, if there is no equity consideration—the distributional characteristic is equal to one for all commodities. Again, it is a straightforward task to obtain β^h from the household survey and with the exogenously given value of σ.

Comparing and ranking marginal cost λ_i among commodities are the most important aspects of the empirical analysis. If the government is required to raise total tax revenue for some policy purpose, it should raise the tax rate on a commodity with a lower marginal cost more than on a commodity with a higher one. The results should be affected by the assumed value of welfare weight or inequality aversion. In addition, especially if we get policy implications from the estimation results, we have to check how they are sensitive to the choice of demand systems as demonstrated by Decoster and Schokkaert (1990) in the case of Belgium.

2.2 Concentration curves

The impact on social welfare of marginal tax reform can be graphically interpreted using concentration curves and differences among them. Now, consider the marginal tax reform of marginally subsidizing commodity j and marginally taxing commodity i under the fixed tax revenue; that is, $\alpha_i X_i dt_i + \alpha_j X_j dt_j = 0$, $dt_i > 0$ and $dt_j < 0$. Then, simple calculations based on this revenue neutrality condition and Roy's identity show that a change in social welfare is given by

$$dW = \sum_{h=1}^{H} \beta^h dy^h = -X_j dt_j \sum_{h=1}^{H} \beta^h \left(s_j^h - \alpha_{ji} s_i^h \right)$$

(4)

where $\alpha_{ji} = \alpha_j / \alpha_i$ indicates the ratio of the efficiency lost by raising an extra unit of public funds by taxing commodity i to that by taxing commodity j. Because $dt_j < 0$, the necessary and sufficient condition for an increase in social welfare is given by

$$\sum_{h=1}^{H} \beta^h \left(s_j^h - \alpha_{ji} s_i^h \right) \geq 0,$$

(5)

This condition (5) is equivalent to $\lambda_j \geq \lambda_i$, because from (2) we have:

$$\lambda_j - \lambda_i = \frac{1}{\alpha_j} \sum_{h=1}^{H} \beta^h \left(s_j^h - \alpha_{ji} s_i^h \right).$$

Now, we can discuss the relationship between welfare improvement and concentration curves. Yitzhaki and Slemrod (1991) showed that recalling $\beta^1 \geq \ldots \geq \beta^H$, the sufficient condition for (5) is given by

$$\sum_{h=1}^{k} s_j^h - \alpha_{ji} \sum_{h=1}^{k} s_i^h \geq 0, \ \ for\ k = 1, \ \cdots, \ H,$$

(6)

which means that the concentration curve of commodity j with respect to income is at least as high as that of commodity i multiplied by a constant (α_{ji}) at each point in the income distribution.

Yitzhaki and Slemrod (1991) focused on differences among concentration curves (DCC), which correspond to LHS in (6). A DCC curve is depicted as representing the cumulative distribution income on the horizontal axis. Three things are worth mentioning regarding this DCC curve. First, if the curve is above (below) the horizontal axis, then commodity j (i) dominates i (j), while if it intersects the horizontal axis, neither commodity dominates the other. Second, the efficiency gain from the tax reform can be seen from the height of the DCC curve at the right end of the income distribution—that is, 1-α_{ji}. If it is positive, then the tax reform brings about an efficiency gain for society as a whole. This is because (5) holds if α_{ji}<1 and β_h is identical for all households (with no equity consideration). Third, distributive gains can be seen from the curvature of the DCC curve. If the curve is increasing (decreasing), then a household from the viewpoint of income distribution gains (loses) from the reform. Hence, even if $\alpha_{ji} \geq 1$, there is a possibility of a tax reform being welfare-improving.

2.3 Consumption dominance curves

In almost the same way, we can interpret the marginal commodity tax reform as a poverty-reducing policy and interpret it graphically (see Makdissi and Wodon, 2002). Consider that the government intends to reduce the aggregate poverty measure:

$$P = \int_0^z p\left(y_E\left(q,\ y\right),\ z\right) f\left(y\right) dy,$$

where z, y_E, $f(y)$ are poverty line, equivalent income, and density function of income. Assume a marginal tax reform for marginally subsidizing commodity j and marginally taxing commodity i under the fixed tax revenue. If we assume that the vector of reference prices used for computing equivalence is equal to that before the reform, differentiating with respect to y and y_E is equivalent (see Besley and Kanbur, 1998). Then, the marginal impact on poverty measure is calculated as

$$dP = -X_j dt_j \int_0^z \frac{\partial p}{\partial y_E}\left[s_j\left(y\right) - \alpha_{ji} s_i\left(y\right)\right] f\left(y\right) dy,$$

(7)

where $s_i(y)$ is the share of consumption of commodity i of a household with income y of the total consumption of that commodity. Hence, remembering dt_j<0, the necessary and sufficient condition for a decrease in poverty is given by

$$\int_0^z \frac{\partial p}{\partial y_E}\left[s_j\left(y\right) - \alpha_{ji} s_i\left(y\right)\right] f\left(y\right) dy < 0.$$

(8)

(7) and (8) in poverty reduction are counterparts to (5) and (6), respectively, in welfare improvement.

Makdissi and Wodon (2002) define the lth-order consumption dominance curve (CDC) (l=1, 2,…) such that

$$C_i^1(y)=s_i(y),\ C_i^2(y)=\int_0^y C_i^1(y)dy,\cdots,C_i^l(y)=\int_0^y C_i^{l-1}(y)dy,\cdots,$$

In particular, we assume that poverty is defined as in *FGT*(γ):

$$p=\left(\frac{z-y_E}{z}\right)^{\gamma},\quad \gamma\geq 0.$$

Then, the poverty-reducing condition (8) is rewritten as:

$$\int_0^z\left(\frac{z-y^E}{z}\right)^{\gamma-1}\left(s_j(y)-\alpha_{ji}s_i(y)\right)f(y)dy>0.$$

(9)

If $\gamma=1$, then $p=FGT(1)$ is the poverty gap and the poverty-reducing condition (8) is reduced to

$$C_j^2(z)-\alpha_{ji}C_i^2(z)>0,$$

(10)

which indicates the difference between consumption dominance curves (DCDC), and is analogous to (6) recalling $C_i^2(y)=\int_0^y C_i^1(y)dy$. Hence, discussions on reducing poverty based on the DCDC of order two are almost equivalent to discussions about distributional gains based on DCC.

And, if $\gamma=2$ and we measure poverty based on FGT(2), the condition is reduced to:

$$C_j^3(z)-\alpha_{ji}C_i^3(z)>0$$

(11)

by partial integration. This condition means that the DCDC curve of order three lies above the horizontal line. We can derive the poverty-reducing condition in the same way for l=4, 5,.... If the poverty line is movable, we check where conditions such as (10) and (11) are satisfied for different values of z. This corresponds to checking whether the CDC of commodity j lies above the curve of commodity i multiplied by α_{ji}, or checking whether the DCDC curve lies above the horizontal axis.[4]

3. Preparations for estimations

3.1 Consumption structures

The main data on which our empirical analysis is based are *Family Income and Expenditure Survey* released by the Statistical Bureau of the Ministry of Internal Affairs and Communications for Japan and *Household Income and Expenditure Survey* released by the Korea National Statistical Office for Korea. Fortunately, these two household surveys have almost the same category structure, questionnaire design, and sampling methodology, making it easy to compare the estimation results under a common analytical framework. We use annual data in 2006 to grasp the basic spending structure and estimate the effective tax rates and their quarterly series (1985Q1-2007Q2) to estimate demand systems. The only problem when comparing the two countries is that we use nationwide data for Japan but use urban-area data for Korea, considering the availability of their long-term series.

We first collect annual data on average household spending for ten major commodity groups: food & beverages, housing, fuel, light, & water charges, furniture & household utensils, clothes & footwear, medical care, transportation & communication, education, culture & recreation, and others for salary and wage earners' households. Table 1 summarizes the compositions of household spending in Japan and Korea in 2006. There is no substantial difference in the composition of consumption expenditures between the two countries. Food & beverages has the largest share, followed by transportation & communication and culture & recreation. The correlation of the shares between the two countries is high at 0.895.

Table 2 shows the concentration ratio of each commodity required to grasp the degree of inequality of spending across households of different income levels. This ratio, denoted by θ_i, is calculated as

$$\theta_i = 2\operatorname{cov}\left[s_i, F(y)\right],$$

where $F(y)$ is the cumulative distribution of income. The concentration ratio corresponds to twice the area between the 45-degree curve and the concentration curve (see Yitzhaki and Slemrod, 1991). The higher this ratio is, the more concentrated consumption of the commodity is on higher-income households. We calculate the concentration ratio of each commodity based on annual spending data by decile income class in 2006 in both countries.

This table also presents differences in the concentration ratios between each commodity (except for housing, see below for the reason to exclude it) and food & beverages ("Difference A") and between each commodity and fuel, light, & water charges ("Difference B"), and compares these differences between the two countries. Food & beverages and fuel, light, & water charges have the lowest concentration ratios and are usually considered to be necessities, and it is interesting to check the magnitudes of the relative concentrations of other commodities using these commodities as a reference commodity group.

From this table, we can mention three findings. First, the pattern of concentration among commodities is very similar for Japan and Korea. The concentration ratio is higher for education, others and other commodities for arbitrary spending, while it is lower for fuel, light, & water charges, food & beverages, and housing. The correlation between the two countries is high at 0.901, pointing to similarities in the patterns of the distributive aspects of each commodity between the two countries.

Second, however, all commodities except education show higher concentrations in Korea than in Japan, indicating more uneven consumption expenditures in Korea.

In addition, the difference in the concentration ratios from that of food & beverages or of fuel, light, and water charges tends to be higher in Korea than in Japan. This implies that marginal tax reforms, which subsidize these reference commodities by taxing others, have greater distributive outcomes in Korea. Education is an exception, in that its concentration is higher in Japan in both absolute and relative terms. We explicitly discuss these issues later by comparing the DCC curves of the two countries in Section 4.

Third, the concentration ratio of housing is negative in Japan and quite low in Korea. This is because spending on housing in the household surveys does not include imputed rents of own houses, as well as because the share of own houses tends to increase as household income rises. Indeed, details of the household surveys in 2006 (not reported here) show that spending on housing bottoms out at the sixth decile in Japan, and stays within a narrow range (US$68-78 per year) until the eighth decile in Korea. These facts make it difficult to analyze spending on housing within the usual analytical framework, so we exclude this commodity when estimating demand systems.

3.2 Effective tax rates

Another important task before estimating the impact of marginal commodity tax reforms is to calculate the effective commodity tax rate t_i for each commodity. We first sort commodities that are reported in the household surveys into two types: the first includes those on which the standard VAT rate is applied, and the second includes those that are treated under other tax or special VAT rules. For example, both countries have special tax rules for liquor and tobacco, while Korea levies higher VAT rates on some electronic items and no VAT on unprocessed foods. Korea also has an education tax, which is levied additionally on some commodities along with VAT.

To the commodities of the first type, which come under the standard VAT rules, we apply implicit VAT rates of 5/105 in Japan and 10/110 in Korea, and estimate the amount of taxes paid by households. For commodities of the second type, which come under other tax or special VAT rules, we estimate the amount of tax paid by households based on statutory tax rate and actual household spending on them. Finally, we sum up the estimated taxes paid by households for each of ten commodity groups, and calculate each effective tax rate by dividing estimated tax payments by household spending on each commodity group. Detailed information about the estimation methodology is available upon request from the authors.

Table 3 reports the estimation results of the effective commodity rates in Japan and Korea. We find almost the same pattern in the two countries: tax rates are lower for education, medical care, and housing, while they are higher for transportation & communication and others. The higher tax rate on transportation & communication, which is observed commonly in both countries, reflects the higher tax on gasoline and automobiles. The higher tax rate on furniture & household utensils in Korea is due to the special tax rate of fifteen percent applied to some household electronic utensils. In both countries, the effective tax rate on food & beverages is affected by the special tax rates on liquor.[5] This table also compares our estimates of effective tax rates in Japan with those estimated by two preceding studies: Murasawa, Yuda, and Iwamoto (2005) for 2000 data and Uemura (2006) for 2003 data. Our estimates are in line with those reported by these studies.[6]

As mentioned above, we exclude spending on housing from estimating demand systems, which accounts for 6.3 percent of total consumption in Japan and 3.5 percent in Korea in 2006. Combined with the fact that mortgage payments are excluded from total consumption expenditures, these irregular features of spending on housing make it difficult to precisely gauge the price sensitivity of demand for housing.[7]

4. Estimation results

4.1 Demand systems, price elasticities, and distributional characteristics

We estimate two types of demand system: the linear expenditure system (LES) and the almost ideal demand system (AIDS) for both countries, based on quarterly data over the period from 1985Q1 to 2007Q2, to check the robustness of our estimation results and their policy implications.[8]

For LES, the expenditure function on commodity i is derived from the Stone-Geary utility function: $u = \sum_i b_i \log(x_i - a_i)$ and is expressed as

$$p_i x_i = a_i p_i + b_i \left(y - \sum_j a_j p_j\right), \ \sum_i b_i = 1, 0 < b_i < 1$$

(12)

where a_i corresponds to the basic expenditure on commodity i and $y\left(\equiv \sum_i p_i x_i\right)$ indicates total expenditure. When actually estimating the demand system, we obtain parameters μ_i, b_i, and η_{ji} ($j \neq i$) in the following demand equation for commodity i, which is derived from (12):

$$x_i^t = \mu_i + b_i \left(\frac{y_i^t}{p_i^t}\right) + \sum_{j \neq i} \eta_{ji} \left(\frac{p_j^t}{p_i^t}\right) + e_i^t \quad ,$$

(13)

where the suffix t indicates time (quarter), $\mu_i \equiv a_i(1 - b_i)$, $\eta_{ji} \equiv a_j b_i$, e_i^t is the error term, and two sets of constraints: $\sum_i b_i = 1$ and $\mu_i + \sum_{j \neq i} \eta_{ij} = 0$ (for each i) are placed across the equations. As a proxy for consumer price p_i^t, we use each commodity's component of the nationwide consumer price index (2005=100).

For AIDS, we use its linearly approximated version (LA/AIDS; see Deaton and

Muellbauer, 1980) and estimate parameters ϕ_i, γ_i and κ_i in the budget share function for commodity i:

$$w_i^t = \phi_i + \sum_j \gamma_{ij} \ln p_j^t + \kappa_i \ln\left(\frac{y^t}{P^t}\right) + \xi_i^t$$

(14)

where $w_i^t \left(\equiv p_i^t x_i^t / y^t\right)$ is the budget share of commodity i, P^t is the overall price index, and ξ_i^t is the error term,. For P^t, we use Stone's price index:

$$\ln P^t = \sum_i w_i^t \ln p_i^t$$

to avoid the problem of multi-colinearity among explanatory variables. Furthermore, the demand theory requires the following constraints to be placed on the parameters in (14):

$\sum_i \phi_i = 1,\ \sum_i \gamma_{ij} = 0,\ \sum_i \kappa_i = 0$ (adding up to total expenditure);

$\sum_j \gamma_{ij} = 0$ (homogeneity of degree zero in prices and total expenditure);

and $\gamma_{ij} = \gamma_{ji}$ (symmetry).

To assess the impact of marginal tax reforms, the key input obtained from the estimated demand system is a set of the uncompensated price elasticities, ε_{ij}, which determines the marginal efficiency cost of taxing. The uncompensated price elasticities are calculated as:

$$\text{LES:} \quad \varepsilon_{ij} = -\frac{p_j \eta_{ji}}{p_i x_i} \quad \text{for} \quad i \neq j \quad ; \quad -1 + \frac{\mu_i}{x_i} \quad \text{for} \quad i = j \quad ,$$

(15)

$$\text{AIDS:} \quad \varepsilon_{ij} = \delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\kappa_i w_j}{w_i},$$

(16)

where δ_{ij} (the Kronecker delta) is equal to unity for $i = j$ and to zero for $i \neq j$, and

x_i and p_i are evaluated at their means over the sample period.[9]

Table 4 reports the estimation results of the uncompensated own price elasticity of each commodity, ε_{ii}, estimated from (15) for LES and (16) for AIDS for Japan and Korea (the cross price elasticities are not reported to save space, but are used to calculate the marginal cost of taxation). All commodities have negative uncompensated own price elasticities, a result that is reasonable and consistent with the theory arguing that the compensated own price elasticity should be negative. There is, however, no clear correlation between LES and AIDS results for both countries and it is of interest to see how this difference affects the ranking of λ, as discussed later.

Next, we present estimates of a set of the distributional characteristics, $\sum_{h=1}^{H} \beta^h s_i^h$, which are calculated directly from household survey data and with a given degree of inequality aversion. Here, we interpret income class as household and use spending data for each decile to calculate the value of s_{ih}, which is the share of consumption of commodity i by income class h. To calculate, β_i, the welfare weight of each income class, we assume four values for the inequality aversion parameter, σ, that is, 0, 1, 2, and 5.

Table 5 reports the calculation results. When σ=0, the distributional characteristics are equal to unity for all commodities, meaning they are treated equally in terms of equity. For a higher value of σ, however, the distributional characteristics become more diversified across commodities. In particular, when σ=5, that is, if we consider equity very seriously, food & beverages, fuel, light, & water charges and medical care tend to have a higher value for the distributional characteristic. This means that the government should lower the tax rates on these commodities if it puts high priority on distributional equity. Finally, we find that the values of distributive characteristics for all commodity groups are lower in Korea than in Japan. This is because the relative level of household income of the bottom decile income class, y^1/y^h (h=2, 3,..), is lower in Korea than in Japan, lowering the level of β^h (see (3)).

Having obtained values for price elasticities and distributional characteristics, we can now estimate the marginal welfare cost of taxation, λ, for each commodity. Table 6 summarizes estimates of these costs for different degrees of inequality aversion and with different demand systems. From this table, we can infer a desirable direction for marginal tax reform with a specific pair of commodities. For example, if we look at the AIDS results for Japan with σ=2, we find that the marginal cost of taxing food & beverages is equal to 0.423, which is higher than 0.343 for clothes & footwear. Hence, we can argue that subsidizing food & beverages by taxing clothes & footwear will improve social welfare. This table also reports the ranks of marginal welfare costs (the greater the cost, the higher the rank) and its correlation between LES and AIDS results, and examines how they are affected by the degree of inequality aversion.

Among others, three things should be mentioned from this table. First, the rank correlation between LES and AIDS results tends to become higher with higher inequality aversion in both Japan and Korea, which is in line with the results of Decoster and Shokkaert (1990) in the case of Belgium. In fact, the correlation rises from 0.417 (statistically insignificant) for σ=0 to 0.967 for σ=5 in Japan and from 0.833 for σ=0 to 0.933 for σ=5 in Korea. This result is reasonable given the framework of tax reform: with higher σ, the welfare cost becomes increasingly dominated by the distributional characteristic. If the government puts more weight on distributive considerations, the tax reform becomes increasingly determined by actual spending patterns and becomes more independent of estimated price elasticities.

Second, the rank of welfare cost for each commodity depends heavily on inequality aversion in both countries. A good example is fuel, light, & water charges. This commodity ranks seventh for LES when σ=0, suggesting that taxing it is relatively desirable in terms of efficiency because it has a smaller impact on household behavior due to its feature as a necessity. As σ increases, however, the rank of fuel, light, & water charges rises to one of the top groups (with the highest cost). This is because a higher σ raises the distributive consideration of this commodity, which has the highest value for the distributive characteristic as reported in Table 4. Medical care shows almost the same pattern in both countries.

Third, it might be somewhat surprising to see that education ranks relatively low in both countries. This is because compulsory education is financed indirectly by taxes, which are not covered by the household surveys in both countries. Spending on education reported in the survey is limited to arbitrary spending on supplementary education out of school, tuitions for schools other than tuition-free ones for compulsory education, and other arbitrary spending on education. It should be noted, however, that our analysis understates the social value of education, because it neglects positive external effects of education.[10]

4.2 DCC and distributive gains

The next step is to address the impact of marginal tax reforms by income class, using differences among concentration curves (DCC). The value of λ indicates the marginal welfare cost for society as a whole, but it does not show the different ways tax reform affects each income class. The DCC, which is calculated as

$$\sum_{h=1}^{k} s_j^h - \alpha_{ji} \sum_{h=1}^{k} s_i^h, \quad i, j = 1, \cdots, 9; k = 1, \cdots, 10,$$

can graphically compare the distributive gains of tax reforms.

To draw the DCC curves, we have to calculate the ratio of the efficiency loss of taxation $\alpha_{ji}=\alpha_j/\alpha_i$, which scales the concentration curve of a commodity to be compared (commodity i). Although there can be thirty-six pairs of commodities for comparisons, we choose food & beverages as the base commodity, that is, set j=1. Food & beverages has the largest share of household spending (see Table 1), and is usually considered to comprise necessary goods, so tax reform debates often focus on the tax rates on it. In fact, unprocessed food is not taxed in Korea and many argue for a lower tax rate on food & beverages, especially if a consumption tax increase is inevitable. Furthermore, food & beverages has a relatively low concentration ratio (see Table 2), a high distributive characteristic (see Table 5), and one of the highest marginal costs of taxation for a higher inequality aversion (see Table 6). Hence, any tax reform is likely to incorporate an absolute and/or relative reduction in the tax rate on food & beverages.

Table 7 summarizes the efficiency loss when taxing each commodity, α_i, as well as its ratio relative to that of food & beverages, $\alpha_{1i}=\alpha_1/\alpha_i$, for LES and AIDS. The value of α_i is calculated as $1/\lambda_i$ in the case of σ=0 in Table 6. If α_{1i}>(<)1, the tax rate on commodity i should be reduced (raised) and that on food & beverages should be raised (reduced), as far as only efficiency is concerned.

A question to be addressed here is the distributive outcome—that is, how differently tax reforms affect each income class. Figures 1 and 2 depict the DCC curves for each commodity relative to that for food & beverages as the base commodity, based on AIDS results in Japan and Korea, respectively. The curves based on LES results (not reported here) make no substantial difference in terms of the curvature of the curve for all commodities. However, they affect the intersection with the horizontal axis—and correspondingly the efficiency assessment—for fuel, light & water charges (i=2) and culture & recreation (i=8) in Japan, because

α_{12}=0.983<1 for LES while α_{12}=1.030>1 for AIDS and α_{18}=0.985<1 for LES while α_{18}=1.082>1 for AIDS.

For Japan, in Figure 1 the DCC curves of five commodities (education, clothes & foot wear, furniture & household utensils, medical care, and others) lie above the horizontal axis, indicating that subsidizing food & beverages by taxing these commodities will yield efficiency gains for society as a whole. In addition, the DCC curves of these commodities increase from the bottom decile income class to the sixth-ninth decile income class and then decline, indicating distributional outcomes: gains for lower income classes and losses for higher income ones. In contrast, taxing culture & recreation and, to a lesser extent, transportation & communication can raise welfare of lower income classes but they fail to yield an efficiency gain for society as a whole. Taxing fuel, light & water charges is not justified in terms of either efficiency or equity, because it both makes all income classes other than top two decile inccome classes worse off and reduces overall efficiency. If we use LES results, then taxing fuel, light & water charges and culture & recreation can obtain an efficiency gain but its distributional outcome is almost the same as in the AIDS case.

Compared to the case of Japan, tax reforms that call for a lower tax rate on food & beverages are more likely to face an efficiency-equity tradeoff in Korea judging by Figure 2. In fact, taxing five commodities (culture & recreation, clothes & foot wear, furniture & household utensils, transportation & communication, and others) makes lower income classes better off but reduces overall efficiency. Also, taxing two commodities (fuel, light & water charges and medical care) raises overall efficiency but reduces welfare of lower income classes. Only taxing education can both yield efficiency gains and make lower income classes better off. LES results do not affect these outcomes.

The clue to this difference between Japan and Korea can be found in Table 2, which shows that for most commodities the relative concentration compared to food & beverages (as well as fuel, light, & water charges) tends to be higher in Korea, indicating a larger difference in the distributive features between food & beverages and other commodities. Thus, tax reforms that incorporate a reduction in the tax rate on food & beverages are more likely to have a redistributive impact in Korea.[11] In Japan, spending patterns are not as different across income classes as they are in Korea, making Japanese households face a similar impact from these tax reforms regardless of income levels.

4.3 DCDC and impact on poverty

Finally, we examine the impact of marginal tax reforms on poverty based on differences among consumption dominance curves (DCDC). As discussed in Section 2, we can discuss this issue using the DCC results insofar as we measure poverty from the poverty gap (FGT (1)). The consumption dominance curve of order two is conceptually equivalent to the concentration curve, so the DCDC is equivalent to the DCC. Because the poverty line, z, is conventionally established as one-half of the median and it seems unreasonable to allow it to exceed the median, it suffices to check whether the DCC curve lies above the horizontal axis until the cumulative distribution of income reaches 0.5. By this standard, Figure 1 confirms that subsidizing food & beverages and taxing any other commodity except transportation & communication and fuel, light & water charges can reduce the poverty gap in both Japan, even if taxes on some commodities lead to some efficiency loss for society as a whole. Figure 2 shows almost the same pattern for Korea.

Next, we check how tax reforms affect DCDC of order three, which corresponds to the poverty index of FGT (2). Figures 3 and 4 present the DCDC curves of order three for Japan and Korea, respectively, using food & beverages as the base commodity and with cumulative distribution of income between 0 and 0.5. Figure 3 shows that the DCDC curves of all commodities except for transportation & communication increase monotonically from the origin in Japan. This means that these tax reforms can reduce FGT (2). In the same way, Figure 4 shows that the DCDC curves of five commodities except fuel, light & water charges, medical care and transportation & communication increase monotonically from the origin in Korea. A higher tax on medical care, which has a relatively low concentration ratio, will slightly reduce the welfare of the lowest-income households.

5. Concluding remarks

We examined the impacts of marginal commodity tax reforms in Japan and Korea based on the official household surveys of the two countries and the same analytical framework. First, we overviewed the household spending structures in the two countries, and estimated two types of demand system (LES and AIDS). Based on the estimated parameters, we calculated the marginal cost of taxing each commodity for different degrees of inequality aversion, and examined commodity ranks in terms of the marginal cost of taxation. Then, we examined the distributive gains from tax reforms based on differences among concentration curves, and assessed the impact on poverty based on differences among consumption dominance curves.

The key findings are summarized as follows. First, the basic structure of household spending is very similar between Japan and Korea, but comparisons of concentration ratios reveal a more uneven distribution of spending across income classes in Korea. Second, in both countries the correlation of estimated commodity ranks in terms of the marginal cost of taxation between the two demand systems tends to increase as the degree of inequality aversion rises, a result that is in line with the results of preceding studies. Third, our analyses based on the concentration curves show that revenue-neutral marginal tax reforms that incorporate a reduced tax on food & beverages are more likely to face an efficiency-equity tradeoff in Korea than in Japan. This reflects more uneven spending on non-necessities across income classes in Korea, causing more income redistribution through tax rate changes. Finally, our analyses based on the consumption dominance curves confirm that the marginal tax reforms of the above-mentioned type reduce poverty, which is measured by either FGT (1) or FGT (2) in most cases in both Japan and Korea.

Our estimations are based on a simple theoretical framework and are limited to comparisons among a small number of aggregated commodity groups. Their results, however, clearly point to the importance of the impact on redistributive outcomes and poverty of marginal VAT reforms, an issue that has been fully addressed in tax debates in both countries.

Notes

1. The relative poverty ratio is defined as the share of households with (household-size adjusted) disposable income below one-half of the national median.
2. See www://www.mof.go.jp/zeisyu/h17.htm for Japan and http://www.mpb.go.kr/eng/mpb_data/statistics/list/.jsp?board_no=131 for Korea.
3. We adjust household sizes when actually calculating β^h.
4. Liberati (2003) extended consumption dominance curves to the subgroups of population, and applied them to data from Belarus.
5. Liquor, on which higher-than-standard-VAT rates are applied, shared 4.7 and 1.4 percent of food & beverages in Japan and Korea, respectively, in 2006. A portion of spending on liquor seems to be included in "meals outside," but it cannot be extracted from this sub-category. This might underestimate the effective tax rate on food & beverages. Meanwhile, tobacco, on which a tax rate of about 60 percent is applied in both countries, shared 1.6 and 5.7 percent of others in Japan and Korea, respectively, in 2006. The tax on tobacco added 0.9 and 2.9 percentage points, respectively, to the effective tax rate on others in Japan and Korea, respectively, in that year.
6. We estimate tax payments for commodities of the second type by multiplying statutory tax rates and amount of spending on them reported in the *Family Income and Expenditure Survey* to consistently compare the cases of Japan and Korea, while Uemura (2006) and Murasawa *et al*. (2005) estimate tax payments directly from national tax statistics for commodities of the second type.
7. In fact, we cannot obtain consistent and reasonable estimation results of demand systems when including housing, especially when the own price elasticities of demand for some commodity groups take positive values.

8. Most of the preceding studies on optimal tax rates in Japan were based on LES or its extended versions. Shigeno (2006) and Maki (2007) are recent examples of estimating AIDS, but they do not address tax issues.
9. When estimating both LES and AIDS, all variables are not seasonally adjusted. We adjust their seasonality by including three quarter dummies (for Q2, Q3, and Q4) as explanatory variables under the required constraints when estimating (13) and (14). For LES, we additionally adjust μ_i such that $\tilde{\mu}_i = \mu_i + (\zeta_2 + \zeta_3 + \zeta_4)/4$, where ζ_2, ζ_3 and ζ_4 are estimated coefficients for quarter dummies, and use $\tilde{\mu}_i$ instead of μ_i when calculating price elasticities in (15).
10. As an opposite example, tobacco tends to show a higher distributional characteristic reflecting a higher share of spending by lower-income households, leading to an overestimation of the marginal social cost of taxing it. This is because the conventional analysis fails to grasp the negative external effects of tobacco. Madden (1992) discusses how to estimate external effects from a study of the indirect tax system.
11. This is more likely to be the case if our estimations are based on nationwide rather than urban-area data from the household surveys in Korea.
12. In Korea, taxing medical care makes the bottom two decile income classes slightly worse off.

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Table 1. Composition of household spending in 2006

Commodity group	Japan		Korea	
	Expenditure (dollar)	Share (percent)	Expenditure (dollar)	Share (percent)
Food & beverages	7,796	23.2%	6,890	25.9%
Housing	2,127	6.3%	944	3.5%
Fuel, light & water charges	2,306	6.9%	1,242	4.7%
Furniture & household utensils	1,081	3.2%	1,201	4.5%
Clothes & footwear	1,593	4.7%	1,433	5.4%
Medical care	1,212	3.6%	1,282	4.8%
Transportation & communication	4,809	14.3%	3,071	11.5%
Education	1,961	5.8%	1,303	4.9%
Culture & recreation	3,419	10.2%	4,715	17.7%
Others	7,258	21.6%	4,556	17.1%
Total	33,561	100.0%	26,638	100.0%

(Note) 1. Average annual consumption expenditures by salary & wage earners' households.

2. Converted by average exchange rates in 2006. (1dollar=1000won=114.5yen)

(Sources) Japan: Family Income and Expenditure Survey, Korea: Household Income and Expenditure Survey.

Bank of Japan (http://www.boj.or.jp/theme/research/stat/market/forex/kiju/index.htm).

Table 2. Concentration ratios (θ_i) in 2006

Commodity	Japan			Korea		
	θ_i	Difference A	Difference B	θ_i	Difference A	Difference B
Food & beverages	0.111			0.144		
Housing	-0.031			0.066		
Fuel, light & water charges	0.072			0.077		
Furniture & household utensils	0.164	(0.053)	(0.092)	0.246	(0.102)*	(0.170)*
Clothes & footwear	0.217	(0.106)	(0.145)	0.250	(0.106)*	(0.174)*
Medical care	0.111	(0.000)	(0.039)	0.166	(0.022)*	(0.089)*
Transportation & communication	0.129	(0.017)	(0.056)	0.203	(0.059)*	(0.127)*
Education	0.287	(0.176)*	(0.215)*	0.254	(0.110)	(0.178)
Culture & recreation	0.209	(0.098)	(0.137)	0.287	(0.143)*	(0.211)*
Others	0.254	(0.143)*	(0.182)	0.263	(0.119)	(0.187)*
Total	0.163			0.200		

(Note) Difference A=the difference in the concentation ratios between each commodity and "food & beverages."

Difference B=the difference in the concentation ratios between each commodity and "fuel, light & water charges."

* means a larger difference than in the other country.

(Source) Authors' calculations.

Table 3. Effective commodity tax rates (t_i) in 2006

Commodity group	Japan			Korea
	Authors' calculations	Uemura (2006)	Murasawa *et al.* (2005)	Authors' calculations
Food & beverages	6.21	7.10	7.23	8.87
Housing	2.15	1.66	1.68	5.59
Fuel, light & water charges	5.52	5.36	5.33	9.09
Furniture & household utensils	4.76	4.76	4.76	12.85
Clothes & footwear	4.76	4.76	4.76	9.09
Medical care	1.93	2.09	2.17	3.24
Transportation & communication	12.56	10.70	11.25	16.81
Education	1.14	1.09	1.20	5.69
Culture & recreation	4.76	5.07	4.83	10.63
Others	5.63	8.65	7.09	12.00
Total	5.98	6.50	NA	10.29

(Source) Authors' calculations.

Table 4. Uncompensated own price elasticties (ε_{ii})

Commodity group	Japan		Korea	
	LES	AIDS	LES	AIDS
Food & beverages	-0.914	-0.254	-0.982	-0.676
Fuel, light & water charges	-0.909	-0.224	-0.997	-0.201
Furniture & household utensils	-0.999	-1.249	-0.749	-0.581
Clothes & footwear	-0.943	-0.944	-1.059	-0.292
Medical care	-0.953	-0.488	-1.011	-1.049
Transportation & communication	-1.020	-0.747	-0.994	-1.285
Education	-1.163	-0.469	-0.962	-0.478
Culture & recreation	-1.044	-1.420	-0.981	-0.223
Others	-1.014	-1.350	-1.032	-1.589

(Source) Authors' calculations.

Table 5. Distributional characteristics

Commodity group	σ=0	σ=1	σ=2	σ=5
Japan				
Food & beverages	1.000	0.606	0.404	0.187
Fuel, light & water charges	1.000	0.619	0.420	0.201
Furniture & household utensils	1.000	0.588	0.382	0.167
Clothes & footwear	1.000	0.571	0.360	0.149
Medical care	1.000	0.606	0.404	0.185
Transportation & communication	1.000	0.599	0.393	0.173
Education	1.000	0.548	0.330	0.120
Culture & recreation	1.000	0.573	0.361	0.146
Others	1.000	0.558	0.345	0.136
Korea				
Food & beverages	1.000	0.562	0.350	0.140
Fuel, light & water charges	1.000	0.586	0.380	0.168
Furniture & household utensils	1.000	0.530	0.310	0.107
Clothes & footwear	1.000	0.528	0.309	0.107
Medical care	1.000	0.557	0.347	0.144
Transportation & communication	1.000	0.543	0.328	0.124
Education	1.000	0.526	0.306	0.104
Culture & recreation	1.000	0.516	0.296	0.100
Others	1.000	0.524	0.307	0.111

(Note) Based on the household spending data by decile income class in 2006.

(Source) Authors' calculations.

Table 6. Marginal cost of an extra unit of revenue from increasing the tax: λ_i

Commodity group	Japan				Korea			
	LES		AIDS		LES		AIDS	
	λ_i	rank	λ_i	rank	λ_i	rank	λ_i	rank
(1) σ=0								
Food & beverages	1.066	2	1.048	4	1.096	5	1.087	6
Fuel, light & water charges	1.048	7	1.080	3	1.076	7	1.012	9
Furniture & household utensils	1.051	4	1.010	7	1.135	2	1.231	2
Clothes & footwear	1.051	5	0.953	9	1.096	6	1.106	4
Medical care	1.022	8	1.021	6	1.032	9	1.037	7
Transportation & communication	1.145	1	1.139	1	1.195	1	1.255	1
Education	1.003	9	1.010	8	1.059	8	1.019	8
Culture & recreation	1.050	6	1.134	2	1.121	4	1.094	5
Others	1.059	3	1.037	5	1.131	3	1.124	3
	[Rank correlation= 0.417]				[Rank correlation= 0.883***]			
(2) σ=2								
Food & beverages	0.431	3	0.423	3	0.384	3	0.380	4
Fuel, light & water charges	0.440	2	0.454	1	0.408	1	0.384	2
Furniture & household utensils	0.401	5	0.386	6	0.352	5	0.382	3
Clothes & footwear	0.379	7	0.343	8	0.339	7	0.342	7
Medical care	0.412	4	0.412	4	0.358	4	0.359	5
Transportation & communication	0.450	1	0.448	2	0.392	2	0.411	1
Education	0.331	9	0.333	9	0.325	9	0.312	9
Culture & recreation	0.379	6	0.410	5	0.332	8	0.324	8
Others	0.365	8	0.358	7	0.348	6	0.345	6
	[Rank correlation= 0.950***]				[Rank correlation= 0.933***]			
(3) σ=5								
Food & beverages	0.199	2	0.196	3	0.153	2	0.152	3
Fuel, light & water charges	0.211	1	0.217	1	0.181	1	0.170	1
Furniture & household utensils	0.175	5	0.169	5	0.121	6	0.132	5
Clothes & footwear	0.156	6	0.142	7	0.117	7	0.118	7
Medical care	0.189	4	0.189	4	0.149	3	0.149	4
Transportation & communication	0.198	3	0.196	2	0.148	4	0.155	2
Education	0.121	9	0.121	9	0.110	9	0.106	9
Culture & recreation	0.154	7	0.166	6	0.112	8	0.109	8
Others	0.144	8	0.141	8	0.125	5	0.124	6
	[Rank correlation= 0.967***]				[Rank correlation= 0.933***]			

(Note) *, **, and *** are significant at 10%, 5%, and 1%, respectively.

(Source) Authors' calculations.

Table 7. The efficiency loss of taxing (α_i)

Commodity group	i	Japan				Korea			
		LES		AIDS		LES		AIDS	
		α_i	$\alpha_{1i}=\alpha_1/\alpha_i$	α_i	$\alpha_{1i}=\alpha_1/\alpha_i$	α_i	$\alpha_{1i}=\alpha_1/\alpha_i$	α_i	$\alpha_{1i}=\alpha_1/\alpha_i$
Food & beverages	1	0.938	1.000	0.954	1.000	0.912	1.000	0.920	1.000
Fuel, light & water charges	2	0.955	0.983	0.926	1.030	0.929	0.982	0.988	0.931
Furniture & household utensils	3	0.951	0.986	0.990	0.964	0.881	1.035	0.813	1.132
Clothes & footwear	4	0.952	0.986	1.049	0.909	0.912	1.000	0.904	1.017
Medical care	5	0.978	0.959	0.979	0.974	0.969	0.941	0.964	0.954
Transportation & communication	6	0.873	1.074	0.878	1.086	0.836	1.090	0.797	1.154
Education	7	0.997	0.941	0.991	0.963	0.944	0.966	0.981	0.937
Culture & recreation	8	0.952	0.985	0.882	1.082	0.892	1.023	0.914	1.006
Others	9	0.944	0.993	0.964	0.989	0.884	1.032	0.890	1.034

(Note) The figures are calculated from the results reported in Table 6.

Figure 1. Differences in concentration curves: Japan
(Base="Food & beverages")

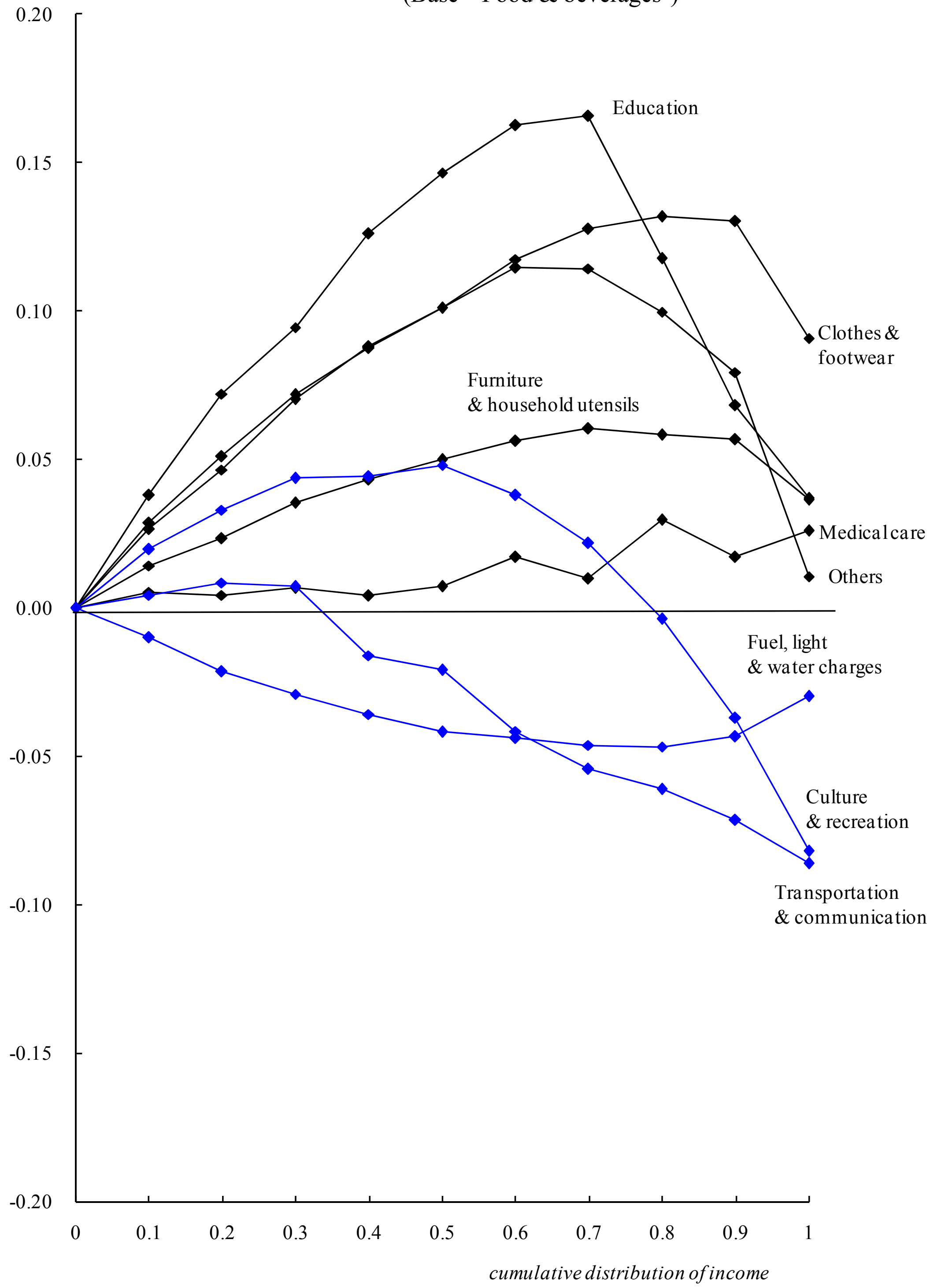

Figure 2. Differences in concentration curves: Korea
(Base="Food & beverages")

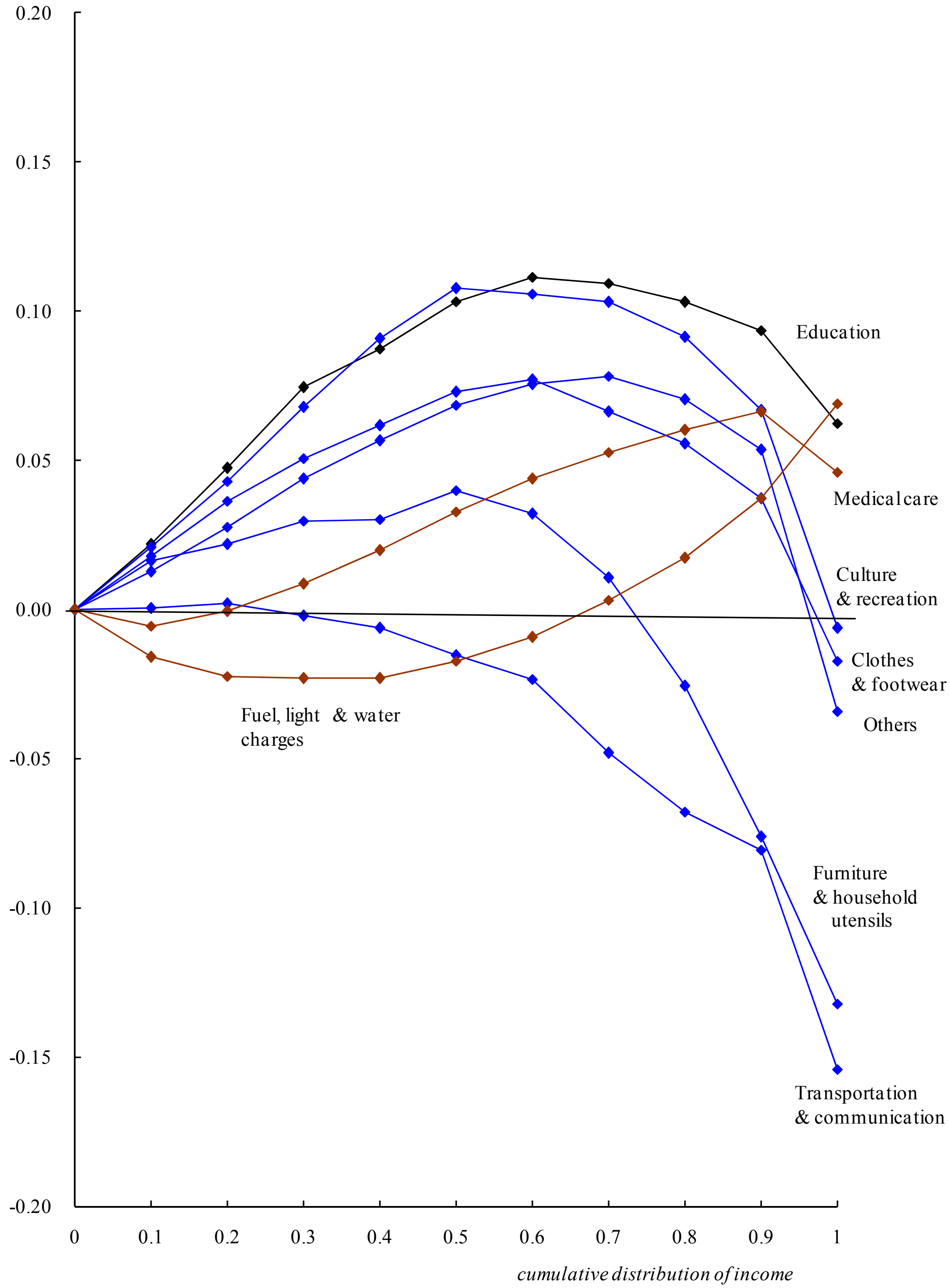

Figure 3. Differences in consumption dominance curves of order three: Japan (Base="Food & beverages")

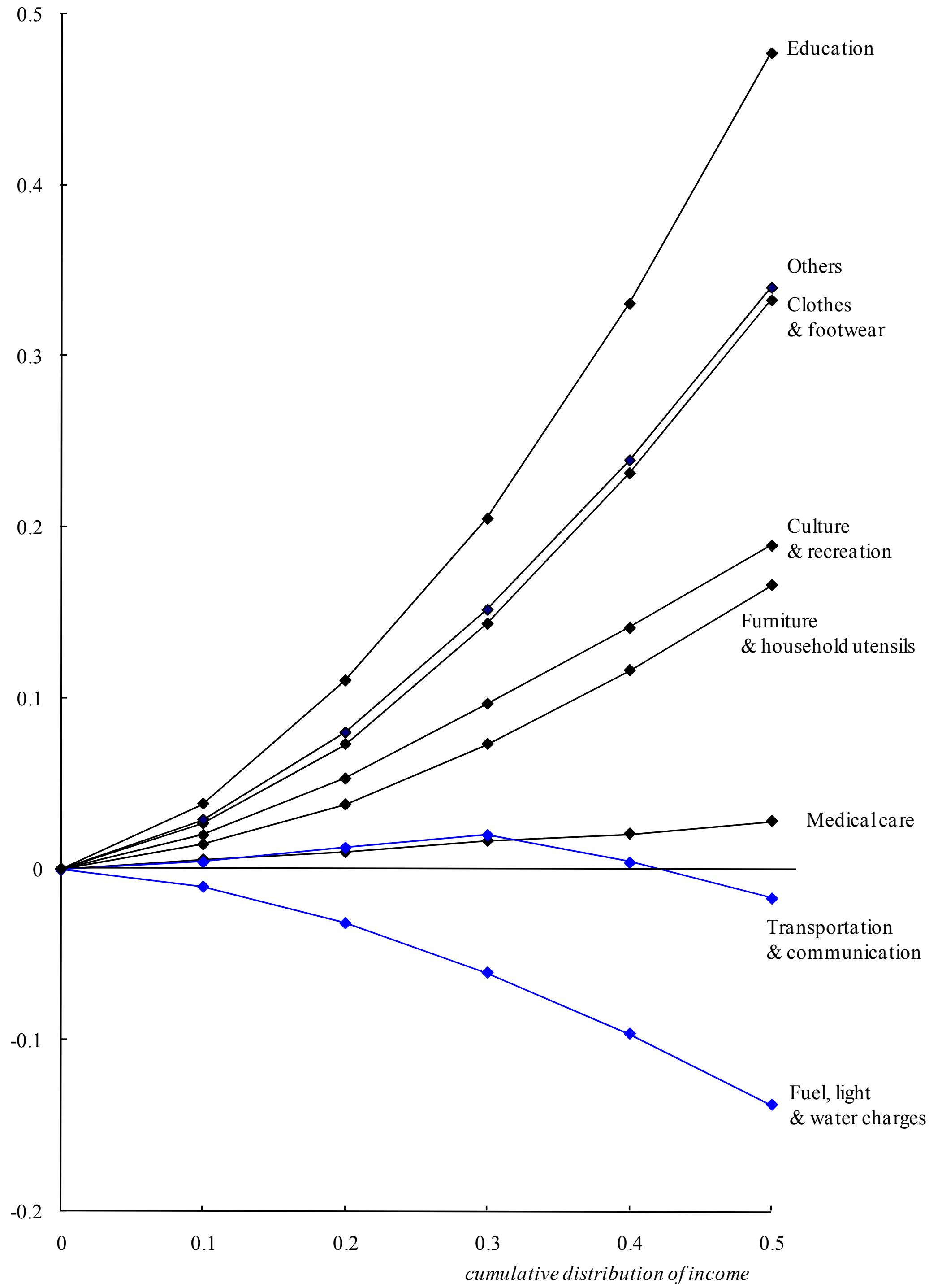

Figure 4. Differences in consumption dominance curves of order three: Korea (Base="Food & beverages")