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IN SEARCH OF SOME CRITERIA FOR SELECTING TARIFF POLICIES*

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Economic effects of the ad valorem and specific tariffs on the changes in import composition and total import reduction within a product category are analyzed and compared. The effects on the change in total imports depend on the current import composition of a product category consisting of two close substitutes (high and low qualities), and are responsive to price gaps between the different qualities and cross-price elasticities. Also, the empirical analysis reestablishes the Falvey's result that specific tariff has a tendency to shift the import composition in favor of high quality while ad valorem tariff is neutral.

I. INTRODUCTION

The most essential outcomes that the Uruguay Round negotiations in agriculture have brought are tariffication of all quantitative restrictions on agricultural imports and progressive reduction of import tariff rates. All quantitative restrictions on the agricultural products imported such as import quota and import levies are subject to the conversion into equivalent tariff levels, i.e., tariff equivalents. Member countries must progressively reduce the tariff rates over the given time periods.

Since under the new world trade rule no quantitative restrictions are permitted for importing agricultural products, tariff may be the sole policy instrument for the importing countries to protect domestic agricultural sector. Then the concern that the net importing countries might have is how to effectively support domestic producers under the new world trade environment. In other words, how well the domestic low income producers can be protected with the policy tools of import tariffs may be the critical question to be answered.

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Tariff rates for all agricultural commodities are already bound and the initial levels of tariffs are scheduled to be progressively reduced. Also, for some agricultural products, import tariff can be imposed in terms of either *ad valorem* or specific basis.[1] Importing countries can choose between *ad valorem* tariff and equivalent specific tariff, depending on the trade policy goals they are pursuing.

It has been generally believed that the effects of the two tariff modes (*ad valorem* and specific tariffs) on the composition of trade within a product category are different. The specific tariff has a tendency to shift the import composition within a product category in favor of the more expensive grade (Borcherding and Silberberg, 1978; Falvey, 1979). This might provide a meaningful clue to the policy problems facing the importing countries because the change in the composition of product grades of imported goods will have a direct effect on domestic price and, in turn, on the total amount imported. Here some important questions naturally arise from the importing country's point of view. Given the policy goal such as producer supports, what are the criteria to choose between *ad valorem* and specific tariffs? Also, how differently will the two modes affect the total amount of imports?

The purpose of this paper is to make contributions to addressing the questions raised above. This paper also extends the results obtained by Borcherding and Silberberg, and Falvey in order to examine the effects of *ad valorem* and specific tariffs on the changes in total imports, analytically and empirically.

Ⅱ. THE MODEL

Alchian and Allen theorem (1972) tells us that a common charge on two close substitute goods leads to a relative increase in the consumption of the higher to lower quality commodity (Borcherding and Silberberg). Falvey used this theorem to demonstrate that specific tariff on a product category would lead to the composition of import toward more expensive grade (high quality good) while *ad valorem* tariff has no bias of import composition within a product category in either direction. This is because the relative price of high grade to low grade decreases when specific tariff is imposed on a product category imported whereas it does not change with *ad valorem* tariff.

In this paper I will first start with Falvey's model and then extend the model further in order to analyze the difference between the effects of the two tariff

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[1] For example, Korea newly adopted specific tariffs for 63 items(in terms of 10 digit headings of the Harmonized System) such as barley, soybean and honey. Also, the U.S. introduced specific tariffs for cotton, cheese and butter while the EU adopted compound duties for beef and mutton where both specific and *ad valorem* tariffs are simultaneously imposed. Japan introduced specific tariffs for wheat, barley, peanut and cocoon which have been protected through non-tariff barriers, and the compound duties for skim milk.

modes on the total amount imported. Let m_1 and m_2 be the excess demands for the high grade (expensive) good and low grade (cheap) good, respectively, within an identical agricultural product category imported. Both grades are close substitutes each other. And p_1, p_2 stand for the world prices, which are assumed to be given, for each grade, respectively ($p_1 > p_2$), and y is income. Let M denote total amount imported of the product category in question (i.e., $M = m_1 + m_2$). Now let us express the excess demand for each grade as functions of the two world prices and income; that is, $m_1 = m_1(p_1, p_2, y)$, $m_2 = m_2(p_1, p_2, y)$. Then, for small changes in prices and income, we can derive the following relationship between the rate of change in excess demand and the rate of change in each price and income.

$$\frac{dm_i}{m_i} = e_{i1}\frac{dp_1}{p_1} + e_{i2}\frac{dp_2}{p_2} + e_{iy}\frac{dy}{y} \qquad i = 1, 2. \tag{1}$$

where e_{ij} is the excess demand elasticities of ith grade with respect to the price of jth grade, i.e., $e_{ij} = (\partial m_i/\partial p_j)(p_j/m_i)$, and e_{iy} is the income elasticity, $e_{iy} = (\partial m_i/\partial y)(y/m_i)$. The rate of change in import of each grade depends on the own price elasticity, cross price elasticity, income elasticity, and the rate of change in each price and income. Now we assume that income remains constant ($dy/y = 0$). From equation (1) we can derive the formula for the difference between the two rates of changes in excess demands as follows, assuming that $e_{11} + e_{12}$ is approximately equal to $e_{22} + e_{21}$ (see Falvey, p. 1108), which is a function of the difference between the two rates of changes in world prices.

$$\frac{dm_1}{m_1} - \frac{dm_2}{m_2} = (e_{11} - e_{21})\left(\frac{dp_1}{p_1} - \frac{dp_2}{p_2}\right). \tag{2}$$

We know that $e_{11} < 0$ and $e_{21} > 0$ since the two grades are close substitutes within a product category, implying that the sign of first parenthesis is always negative, i.e., $e_{11} - e_{21} < 0$. Therefore, the change in the composition of imported agricultural product is inversely related to the difference between the rates of price changes in two grades. The sign of left hand side is determined by the sign of second part of right hand side ($dp_1/p_1 - dp_2/p_2$). For example, if the rate of increase in the price of high grade is greater than that of low grade so that $dp_1/p_1 > dp_2/p_2$, then the sign of left hand side becomes negative, $dm_1/m_1 < dm_2/m_2$, and thus the composition of imports tend to bias toward low grade, and vice versa. If the prices change at the same rate, i.e., $dp_1/p_1 = dp_2/p_2$, the import composition of both grades in a product category will remain unchanged (i.e., $dm_1/$

$m_1 = dm_2/m_2$) even though the total amount imported will change.

Now I extend the above model to further examine the effects of tariff on the change in total amount imported in a product category. Since $M(p_1, p_2, y) = m_1(p_1, p_2, y) + m_2(p_1, p_2, y)$, the rate of change in total imports can be derived as follows, being expressed as a function of the rates of price changes of each grade.

$$\frac{dM}{M} = \{\delta e_{11} + (1-\delta)e_{21}\}\frac{dp_1}{p_1} + \{\delta e_{12} + (1-\delta)e_{22}\}\frac{dp_2}{p_2}. \quad (3)$$

where $\delta(0 \leq \delta \leq 1)$ and $1-\delta$ are the weights of high grade and low grade of total amount imported, respectively; that is, $\delta = m_1/M$ and hence $1-\delta = m_2/M$. Since the income elasticity is positive for the normal goods, the homogeneity condition implies that $|e_{11}| > |e_{12}|$, $|e_{22}| > |e_{21}|$ with only two goods in question being considered.[2] From equation (3), we know that if the prices for both grades increase (decrease) at the same rate from current equilibrium, total amount imported always decreases (increases) regardless of the import composition within a product category. Suppose that the prices of high and low grades have increased at the same rate r at the margin. Then $dM/M = r[\delta(e_{11} + e_{12}) + (1-\delta)(e_{22} + e_{21})]$, which is always negative. If either the price of high grade or low grade increases with the other price held constant the total imports will decrease unless the weight of the increased grade is sufficiently small. However, it is interesting to note that if the import weight is very small and cross price elasticity is sufficiently large, there is high possibility that the increase in price for the grade will lead to increase in total imports. An extreme example can be provided. Suppose that the price of high grade, of which current import weight (δ) is very small, increases with the other price remaining unchanged. Then it will cause import reduction to a considerably small extent due to small weight. On the other hand, this price increase will substitute the consumption of low grade for high grade since the relative price of low grade becomes cheaper than before. When such a substitution effect is large enough (in case of its large import weight and large cross elasticity) to exceed the import reduction in high grade, the amount imported as a whole in

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[2] Denoting the prices for n goods by $p_1, \cdots p_n$, and income by y, the homogeneity condition is derived as follows from the general functional form of demand for ith good $X_i = f(p_1, \cdots p_n, y)$.

$$e_{ii} + \sum_{\substack{j=1 \\ j \neq i}}^{n} e_{ij} + e_{iy} = 0.$$

Assuming that good i is normal good, the income elasticity $e_{iy} > 0$. Hence, the absolute value of e_{ii} is greater than the sum of all cross elasticities (e_{ij}). In this paper I assume that $n = 2$.

this product category can rise despite the price increase in high grade. This result is theoretically possible as equation (3) shows even though it may be controversial in reality.

Ⅲ. EFFECTS OF *AD VALOREM* AND SPECIFIC TARIFFS

1. Effects on the Changes in Import Composition and Total Imports

This section examines the effects of the imposition of *ad valorem* and specific tariffs on the changes in the composition of a product category and the total amount imported. Let p_{w1}^0 and p_{w2}^0 be the world prices, which are given, for high grade and low grade, respectively, before tariff is imposed ($p_{w1}^0 > p_{w2}^0$). Current imports for each grade are m_1^0 and m_2^0, respectively, and current total import is $M^0(= m_1^0 + m_2^0)$. The initial import composition is $\delta_0 = m_1^0/M^0$, $1-\delta_0 = m_2^0/M^0$, and therefore $\delta_0/(1-\delta_0) = m_1^0/m_2^0$.

With the imposition of *ad valorem* tariff rate t the border prices will be $p_1^t = p_{w1}^0(1+t)$ and $p_2^t = p_{w2}^0(1+t)$, respectively. Then in equation (2) the difference between the two price increase rates will be zero, i.e., $dp_1/p_1 - dp_2/p_2 = t - t = 0$. There is no change in import composition of a product category at all ($dm_1/m_1 = dm_2/m_2$).

From equation (3) the rate of change in total amount imported under such an *ad valorem* scheme (dM_a/M_a) can be expressed as follows.

$$\frac{dM_a}{M_a} = t(\beta_1 + \beta_2) < 0 \tag{4}$$

where $\beta_1 = \delta e_{11} + (1-\delta)e_{21}$, $\beta_2 = \delta e_{12} + (1-\delta)e_{22}$. Since $\beta_1 + \beta_2 = \delta(e_{11} + e_{12}) + (1-\delta)(e_{22} + e_{21}) < 0$ from the restriction of homogeneity condition with the assumption of normal good, total imports always decreases when *ad valorem* tariff t is imposed. Given the world prices, the imposition of *ad valorem* tariff will not change any composition of the product category while total imports decrease. The magnitude of import reduction depends on the own price elasticities, cross price elasticities, and δ of the two grades. The larger the own price elasticities and the smaller the cross elasticities, the more significant the import reduction due to *ad valorem* tariff *ceteris paribus*. Moreover, the larger the import weight of which excess demand is elastic with respect to prices, the more reduce the total imports. Also, if cross elasticities are so large that the difference between cross price elasticities and own price elasticities becomes small enough, the imports reduce relatively less. This is because the decrease in excess demand resulting from price rise in one grade is to some extent offset by the increase in excess demand

for the other grade. In general, when there exist close substitutes in a product category such as in agriculture, the change in total imports resulting from the increase in prices becomes smaller than it would otherwise. However, there will be no change in the import composition of the product category.

Now we examine the effects of specific tariff T (T dollars per unit imported), which is equivalent to t in terms of total tariff revenue. The border prices for high grade and low grade with T dollars of tariff will be $p_1^s = p_{w1}^0 + T$ and $p_2^s = p_{w2}^0 + T$, respectively. Since $p_{w1}^0 > p_{w2}^0$, we know, from equation (2), that $dp_1/p_1 - dp_2/p_2 = T(1/p_{w1}^0 - 1/p_{w2}^0) < 0$. Then $dm_1/m_1 - dm_2/m_2 > 0$, implying that the composition of the product category will shift in favor of high grade.

From equation (3), the change in total amount imported associated with specific tariff (dM_s/M_s) can be determined by the following expression.

$$\frac{dM_s}{M_s} = T\left(\frac{\beta_1}{p_{w1}^0} + \frac{\beta_2}{p_{w2}^0}\right) = \frac{T(\beta_1 p_{w2}^0 + \beta_2 p_{w1}^0)}{p_{w1}^0 p_{w2}^0} < 0\ (>0). \tag{5}$$

Since T, p_{w1}^0 and p_{w2}^0 are all positive and given, the change in total import associated with specific tariff will be determined by the values of β_1 and β_2. β_1 and β_2 can independently be negative. Equation (5) tells us that the change in total import caused by specific tariff depends on the sum of β_1 and β_2 considering the weights of p_{w1}^0 and p_{w2}^0. In general, the sign of equation (5) will be negative, resulting in the decrease in total imports. Nevertheless, if the weight of high grade is very high so that δ approaches one, there can exceptionally be the case where total imports rather increase by imposing specific tariff. That is, when $\delta \to 1$ if $\beta_1 p_{w2}^0 < \beta_2 p_{w1}^0$ and therefore $e_{11} p_{w2}^0 < e_{12} p_{w1}^0$ then $dM_s/M_s > 0$. Suppose, for example, that price difference between the two grades is considerably large and e_{12} is also large enough, then the sign of equation (5) can be positive. When specific tariff is imposed on a same product category, the price for low grade rises relatively more than does the high grade. When the price for low grade, of which current import weight is very small, increases significantly due to specific tariff, excess demand for high grade can be substituted for low grade. In this case, if substitution effect of high grade for low grade is sufficiently large so that it dominates the import decrease in low grade total imports can be increased. On the contrary, if the portion of low grade is relatively large total imports always decreases as the demand theory indicates because the import reduction in low grade is very large.

2. Comparison in the Effects of the Two Tariffs

Let us compare the effects of two tariff modes on the changes in total im-

ports. Suppose that the specific tariff is imposed on a product category consisting of two distinct grades, high and low grades. Since world prices per unit are given as p^0_{w1} and p^0_{w2}, respectively, we can convert the specific tariff into *ad valorem* term (t_1, t_2) with which tariff paid per unit imported is equal to T. That is, $T/p^0_{w1} = t_1$ and $T/p^0_{w2} = t_2$ ($t_1 < t_2$). The specific numbers t_1 and t_2 are lower and upper bounds, respectively, that *ad valorem* tariff t can take.

To compare the effects of the *ad valorem* and specific tariffs on the change in total imports, we need to subtract equation (5) from equation (4), and substituting t_1 and t_2 for T/p^0_{w2} and T/p^0_{w1}, respectively. Then we have:

$$\pi = \frac{dM_a}{M_a} - \frac{dM_s}{M_s} = \beta_1(t - t_1) + \beta_2(t - t_2) \tag{6}$$

The *ad valorem* tariff rate t ranges between t_1 and t_2, i.e., $t_1 \leq t \leq t_2$. We will examine the effects by changing *ad valorem* tariff rate t. If t equals t_1, i.e., $t = t_1$ ($T = t p^0_{w1}$) $< t_2$, $\pi = \beta_2(t - t_2)$. Since $t - t_2 < 0$, the sign of π is determined solely by $\beta_2 (= \delta e_{12} + (1-\delta) e_{22})$. In such case, if high grade accounts for small parts of the total imports so that it approaches 0 ($\delta \to 0$), $\beta_2 < 0$ and hence $\pi > 0$ ($dM_a/M_a > dM_s/M_s$). This implies that the import decrease associated with specific tariff is greater than that resulting from *ad valorem* tariff when high grade is of small part in a product category imported. In contrast, if high grade accounts for larger part of total imports, with δ approaching one ($\delta \to 1$), $\beta_2 > 0$ and $\pi < 0$ ($dM_a/M_a < dM_s/M_s$), which implies that the effects of *ad valorem* tariff is larger.

Now what will happen if t equals t_2? If $t = t_2 (T = t p^0_{w1}) > t_1$, then $\pi = \beta_1(t - t_1)$. Since $t - t_1 > 0$, the sign of π is determined by $\beta_1 (= \delta e_{11} + (1-\delta) e_{21})$. In this case, if $\delta \to 0$, $\beta_1 > 0$ and $\pi > 0$. That is, the reduction effects of specific tariff is greater. If $\delta \to 1$, $\beta_1 < 0$ and $\pi < 0$, implying that the effects of *ad valorem* tariff is greater. In any case, the effects of the two tariff modes on the changes in total imports are dependent on the composition of a product category imported. The less (more) the weight of high (low) grade, the larger the effects of specific tariff on the decrease in total imports, and the less (larger) the weight of low (high) grade, the greater the effects of *ad valorem* tariff on the change in imports as a whole.[3]

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[3] The same conclusion can be drawn when $t_1 < t < t_2$. That is, from $\pi = \beta_1(t - t_1) + \beta_2(t - t_2)$ since $(t - t_1) > 0$ and $(t - t_2) < 0$, if $\delta \to 0$, then $\beta_1 > 0$, $\beta_2 < 0$ and hence $\pi > 0$, implying that the effects of specific tariff is greater. If $\delta \to 1$, since $\beta_1 < 0$, $\beta_2 > 0$, and hence $\pi < 0$, implying that the effects of *ad valorem* is greater.

Ⅳ. AN EXAMPLE

This section provides an example for the theoretical analyses discussed earlier, using actual data on the Korean beef market.

Total imports of beef have substantially increased due mainly to rapid growth of consumer income in Korea. Most high quality beef is imported from the U. S. while low quality beef from Australia and New Zealand. The portion of high grade has ranged from 26.1 to 48.4 percent during the most recent period (1988-1993). The import prices for high grade were approximately 17 to 56 percent higher than those of low grade (Korea Rural Economic Institute; KREI, 1994).

For an example in this section, we will use the constant-elasticity import demand functions. That is, $m_1 = \alpha_1 p_1^{e11} p_2^{e12}$, $m_2 = \alpha_2 p_1^{e21} p_2^{e22}$ where α_1 and α_2 are relevant coefficients. Using 1988-1993 average data, the coefficients of α_1 and α_2 are estimated. Total imports, on average, is 109,545 tons of which high grade accounts for 42,414 tons (38.7%) and low grade 67,131 tons (61.3%). Domestic consumption and production are 219,718 tons and 105,664 tons, respectively. The 1993 actual border prices are used as the proxies for the import prices for high grade and low grade which are, respectively, 4,250 dollars and 2,728 dollars per ton.

Since government has continued to restrict beef imports via quota scheme the amount actually imported cannot be regarded as reflecting the consumer true excess demand for foreign beef. This might be a major reason for the lack of estimates for excess demand elasticities of beef. Moreover, empirical studies on import demand elasticities by quality are not found. Therefore, the import demand elasticities (own price and cross price) for each grade are approximately estimated by using the simple relationship $e_M = \eta(D/M) - \varepsilon(S/M)$, which always holds when import demand depends solely on price, where e_M is import demand elasticity, η and ε are domestic demand and supply elasticities, and D and S are domestic demand and supply. Previous studies show that domestic demand and supply elasticities of beef range from -0.23 to -1.64, and 0.55 to 1.25, respectively. Also, income elasticity ranges from 0.27 to 1.45 (KREI, 1993; Ko, 1994). Assuming that high quality beef is most consumed by high income group and low quality beef by low income group, and that high income group is less responsive to price and income changes in the choice of beef consumption, for high quality beef, $\eta = -0.5$ $\varepsilon = 0.55$ e_y (income elasticity) $= 0.3$ are used to calculate the necessary import demand elasticities, and for low quality beef $\eta = -1.5$ $\varepsilon = 0.55$ $e_y = 1.0$ are used. As a result, I obtained the estimates for the own price and cross price elasticities for each grade as: $e_{11} = -1.47$, $e_{12} = 1.17$, $e_{21} = 2.40$, and $e_{22} = -3.40$.

For a finite change in price due to import tariff we can examine the changes in total import and import composition. We examine the effects of 20 and 40 percents of *ad valorem* tariff rates, and their equivalent specific tariffs calculated as 663.5 $/ton and 1,326.9 $/ton, respectively, considering the import composition

weights of the high and low grades. In presenting an example to confirm the theoretical results derived in previous section, we will impose the tariffs assuming that all current relevant quantities and prices of imports occurred under free trade situation.

The results are presented in Table 1. In the upper part, the results of *ad valorem* tariff rate of 20 percent and its equivalent specific tariff of 663.5 $/ton are shown. Total imports decrease due to the imposition of tariffs, which is composed of two parts: the reduction of high quality beef and the reduction of low quality beef. The size of reduction in high quality beef becomes large as δ_0 (initial ratio of high quality beef of total imports) increases while the size of low quality reduction contracts as δ_0 increases. When $\delta_0 = 0.05$, with *ad valorem* tariff the import reduction of high quality and low quality are 292 tons and 17,345 tons, respectively, and total imports reduce by 17,636 tons (16.1% of total imports before tariff). With an equivalent specific tariff, high quality beef increases by 232 tons and low quality beef reduces by 33,751 tons, totaling to 33,519 tons (30.6%). Why does high quality beef import increase after specific tariff is imposed? This is because there exists very strong substitution effects within a product category under our assumption of close substitutes, which are embodied into the high cross-elasticities in this example, and large difference between the two grade prices. In other words, since the specific tariff makes the relative price of high quality cheaper, demand for high quality beef can be increased despite the tariff imposition. The larger the difference between high and low quality import prices, the greater the change in relative price which leads to larger increase in imports of high quality.[4] The increase in imports of high quality associated with specific tariff becomes more significant as δ_0 gets higher. For example, when $\delta_0 = 0.8$ so that currently high quality is imported by 87,636 tons and low quality 21,909 tons, high quality import increases by 3,710 tons while low quality decreases by 7,105 tons, and total import reduction is 3,395 tons as a result of 663.5 $/ton of specific tariff. We know here that when high quality is of a small portion of total imports, the effects of specific tariff on import reduction is larger (nearly two times higher when $\delta_0 = 0.05$).

As δ_0 grows the impacts of tariff on high quality imports becomes large while the impacts of tariff on low quality becomes smaller, and total import change becomes smaller by both *ad valorem* and specific tariffs (Compare, for example, the symmetric cases under *ad valorem* $\Delta m_1 = -5{,}539$ tons when $\delta_0 = 0.95$ with $\Delta m_2 = -17{,}345$ tons when $\delta_0 = 0.05$). This is because the demand for high quality is less responsive to price change than is for low quality (We assume here that $e_{11} =$

[4] If the difference between the two prices is relatively small, which seems to be more realistic, the imports of high quality cannot be increased with specific tariff. But this result is not reported here.

[Table 1] Comparison of the Effects of the Ad valorem and Specific Tariffs on Total Imports and Import Composition.*

δ_0	Change in Imports(tons)						δ_t	
	ad valorem			specific			*ad valorem*	specific
	Δm_1	Δm_2	ΔM	Δm_1	Δm_2	ΔM		
⟨In case $t=20\%$, $T=663.5$ \$/ton⟩								
0.05	−292	−17345	−17636	232	−33751	−33519	0.056	0.075
0.10	−583	−16432	−17015	464	−31974	−31511	0.112	0.146
0.20	−1166	−14606	−15772	928	−28422	−27494	0.221	0.278
0.30	−1749	−12780	−14529	1391	−24869	−23478	0.327	0.398
0.40	−2332	−10955	−13287	1855	−21316	−19461	0.431	0.507
0.50	−2915	−9129	−12044	2319	−17764	−15445	0.532	0.607
0.60	−3498	−7303	−10801	2783	−14211	−11428	0.630	0.698
0.70	−4082	−5477	−9559	3246	−10658	−7412	0.726	0.783
0.80	−4665	−3652	−8316	3710	−7105	−3395	0.820	0.861
0.90	−5248	−1826	−7073	4174	−3553	621	0.911	0.933
0.95	−5539	−913	−6452	4406	−1776	2629	0.956	0.967
⟨In case $t=40\%$, $T=1{,}326.9$ \$/ton⟩								
0.05	−526	−29734	−30260	364	−52156	−51792	0.062	0.101
0.10	−1052	−28169	−29221	728	−49411	−48683	0.123	0.192
0.20	−2104	−25039	−27142	1455	−43921	−42466	0.240	0.348
0.30	−3155	−21909	−25064	2183	−38431	−36248	0.352	0.478
0.40	−4207	−18779	−22986	2911	−32941	−30030	0.458	0.588
0.50	−5259	−15649	−20908	3639	−27451	−23812	0.559	0.681
0.60	−6311	−12519	−18830	4366	−21961	−17594	0.655	0.762
0.70	−7363	−9390	−16752	5094	−16470	−11376	0.747	0.833
0.80	−8414	−6260	−14674	5822	−10980	−5158	0.835	0.895
0.90	−9466	−3130	−12596	6550	−5490	1059	0.919	0.951
0.95	−9992	−1565	−11557	6913	−2745	4168	0.960	0.976

* The historical data are used for the base quantities and prices before tariffs; that is, total import is 109,545 tons of which high grade accounts for 42,414 tons (38.7%) and low grade 67,131 tons (61.3%), high grade price is 4,250 \$/ton and low grade price 2,728 \$/ton. Also, $e_{11}=-1.47$ $e_{12}=1.17$ $e_{22}=-3.4$ $e_{21}=2.4$. The *ad valorem* tariff rates are 20 and 40 percent and their equivalent specific tariffs are 663.5 and 1,326.9 \$/ton, respectively.

-1.47, $e_{22} = -3.4$).

When $\delta_0 = 0.95$ with *ad valorem* tariff the import reduction of high quality and low quality are 5,539 tons and 913 tons, respectively, and total import reduces by 6,452 tons (5.9% of total imports). With an equivalent specific tariff, on the other hand, high quality beef increases by 4,406 tons and low quality beef decreases by 1,776 tons, and interestingly enough, total imports increase by 2,629 tons. The substitution effect of high quality associated with the relative price change for low quality exceeds the import reduction due to the (absolute) price increases. This reverse results can occur when δ_0 is large enough ($\delta_0 \geq 0.9$ in this example) under some limited conditions such as relatively large price difference between high and low qualities and relatively large cross-price elasticities. The magnitude of import reduction due to specific tariff is larger than *ad valorem* when low grade is large (i.e., low δ_0), and vice versa.

The changes in import composition owing to the two different tariffs are shown in the last two columns (δ_t) of the table. Theoretical analysis in the previous section demonstrates that *ad valorem* tariff does not change import composition while specific tariff makes import composition in favor of high grade. Our example supports the analyses (Compare δ_t with δ_0.). However, the values of δ_t under *ad valorem* are slightly higher than those of δ_0. This result stems from the relatively large difference between $e_{11} + e_{12}$ and $e_{22} + e_{21}$ in our example (see equation (2)). If $e_{11} + e_{12}$ and $e_{22} + e_{21}$ in our example are exactly the same the values of δ_t under *ad valorem* would be equal to the values under δ_0. The values of δ_t under specific tariff become higher than those of δ_0, implying that specific tariff shifts import composition in favor of high quality good. When $\delta_0 = 0.5$, for example, the import composition of high grade increases by 10.7% point after specific tariffs are imposed.

The results, when 40 percent *ad valorem* tariff rate (equivalent specific tariff of 1326.9$/ton) is imposed, are presented in the bottom part of the table. All effects are more significant than those with 20 percent tariff rate.

In sum, we can conclude that specific tariff always makes import composition in favor of high grade and that the impacts of *ad valorem* and specific tariffs on the total import reduction are different depending on current import composition *ceteris paribus*. The results of the simulation example is consistent with our theoretical analyses discussed above. From the viewpoint of net agricultural importing countries who want to protect domestic producers, this study provides very important policy implications that *ad valorem* tariff is better when high grade accounts for larger part of total import while specific tariff is better when low grade accounts for larger parts. The separating line in choosing between *ad valorem* and specific tariffs will depend on other economic parameters such as own price and cross price elasticities of import demand and price differences.

V. CONCLUSIONS

Since the world trade organization (WTO) was launched in 1995 tariff policies have become a central issue to many net agricultural importing countries because, under the new world trade rule, tariffs are in principle only legitimate policy instrument to be used for protecting domestic agriculture from the influence of world market. Both *ad valorem* and specific tariffs were allowed in the Uruguay Round negotiations as long as they are equivalent in terms of total tariff revenue.

The effects of two different kinds of tariff modes on the changes in import composition and total import reduction within a product category consisting of two grades (high quality and low quality) are analyzed and compared. In particular, focuses are placed on the impacts on the reduction in total imports when the two different kinds of tariffs are imposed.

Falvey's result that specific tariff has a tendency to shift the import composition in favor of high quality while *ad valorem* tariff is neutral under the assumption of $e_{11} + e_{12} = e_{22} + e_{21}$ is confirmed. More importantly, this study shows that the effects of the two tariff modes on the change in total imports are quite different, depending on the composition of current imports. When high quality consists of relatively large portion of a product category imported the effect of *ad valorem* tariff on import reduction is greater than that of specific tariff. On the contrary, when low quality is of larger part total imports are reduced more by specific tariff rather than *ad valorem* tariff. This is because when specific tariff is imposed the relative price of high quality to low quality becomes cheaper. This, in turn, leads to strong substitution of high quality for low quality within a product category. Furthermore, this study shows that there exists possibility, although not high in reality, that total imports can be rather increased by imposing specific tariff under some limited circumstances. The extent of import reduction depends on the substitution effect which is determined by the difference between the import prices for the two grades and the cross-price elasticities between two close substitutes.

Consequently, this study provides some useful criteria for selecting a correct tariff mode in order to effectively achieve the policy goals (such as protecting domestic agricultural producers) providing that market information on import composition, price differences between the two grades, and own price and cross price elasticities is known *a priori*. Given other market parameters, specific (*ad valorem*) tariff is more preferable when low (high) quality consists of larger part of the total imports if the policy goal is to protect domestic agricultural producers by restricting imports, under the assumption that the world prices remain unchanged. This might be the reasons why many GATT member countries (e.g., Korea, Japan, and E.U.), in the Uruguay Round negotiations, tried to introduce the specific tariffs rather than *ad valorem* for their strategic agricultural products with low productivities and hence comparative disadvantages.

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