# Determinants of Tariff Dependence in Japan's Agricultural Protection: An Empirical Investigation Using Panel-Data

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## Abstract

The agricultural sector can be protected either by tariffs or subsidies. Whereas most OECD countries have moved away from tariffs to subsidies, Japan remains extensively rely on tariffs by way of its agricultural protection. This article explores the determinants of tariff dependence in agricultural protection through a regression analysis using panel data for 10 OECD countries. Theories explaining a preference for tariffs over subsidies to be verified are threefold: (i) "revenue motive theory" emphasising the budgetary constraints by governments or lower collection costs of tariffs, (ii) "optimal obfuscation theory" arguing that taxpayers understate social costs of tariffs and overstate those of subsidies, (iii) "lobby coordination theory" focusing on the collective good nature of tariffs which leads to free-riding among interests groups, fewer lobby competition and resulting smaller welfare losses. The regression analysis reveals that the revenue motive and optimal obfuscation theories are validated given that the coefficients of government debt and higher education are statistically significant with expected signs while the lobby coordination theory is not supported. Japan's high tariff dependence is largely explained by the increased government debt and thus securing stable revenue source is indispensable if Japan is to move away from tariff to subsidy protection.

## Keywords

Tariffs, agricultural protection, political economy, panel data, OECD countries, Japan

## 1. Introduction

In the classical trade theory (i.e., the simple Ricardian Model) in which labour is the unique factor of production, the optimality of free trade is unquestionable. Labourers are fully employed in the sector which has comparative advantage in each country and therefore nobody loses out as a result of trade liberalisation. Under the setting of neo-classical trade theory (e.g., the Heckscher-Ohlin Model) in which two or more factors of production are employed however, the optimality of free trade is not automatic. As free trade creates both winners and losers in the same country as a result of incomplete specialisation of production, the Pareto optimality can be attained only if appropriate income redistribution from winners to losers is implemented. The best instrument for this purpose is so-called "lump-sum subsidy" decoupled from output or price by which the loss in the sector with comparative disadvantage is compensated just enough. The economic theory therefore suggests that the best policy mix in maximising nation's aggregated economic welfare is free trade supplemented by lump-sum subsidy. In reality, international trade is far from free however, and tariffs are widely levied as a means of protecting domestic industries. As such, there is a large discrepancy between what trade theory prescribes and how trade policies are implemented. It is widely recognised that the most serious gap of this kind exists in the agricultural sector in OECD countries in general and in Japan in particular (OECD, 2009b).

The academic discipline attempting to understand, explain and disentangle such a gap is termed the "political economy of trade policy" (Rodrik, 1995). Its distinct feature is that, by incorporating the

basic assumption of the public choice theory, the government is assumed to be selfish by pursuing its own interest, rather than altruistic by maximising social welfare. The political economy approach has been extensively applied to the agricultural sector under the banner of the "political economy of agricultural protection" and generated additional insights which cannot be gained by standard welfare economics (de Gorter and Swinnen, 2002). Existing literature on the political economy of agricultural protection is still not comprehensive enough however, in that it has focused almost exclusively on the "level" of protection rather than the "choice" of protective instruments (Karp and Perloff, 2002, p. 1966). This bias of preceding research is puzzling because it attempts to explain the level of protection maintained through inefficient policy instruments (typically tariffs) without explaining the reason why more efficient instruments (i.e., lump-sum subsidies) is not used from the outset. Understanding the choice of protective instruments deserves more attention particularly in OECD countries in which a contrasting approach on tariff/subsidy mix is increasingly apparent: European countries has moved away from tariffs to subsidies whereas Japan and Korea remain heavily dependent on tariffs by way of supporting their agriculture.

Against this background, the objective of this article is to identify the determinants of tariff dependence in Japan's agricultural protection through an empirical analysis using cross-country and time-series data covering 10 OECD countries including Japan. More specifically, the validity of several difference theories explaining tariff protection is examined by estimating an equation with tariff dependence being dependent variable and by testing the statistical significance of independent variables drawn from those theories. This article aims to extend the pioneering work by Ederington and Minier (2006) which, to the author's knowledge, made the first attempt to conduct an empirical investigation on the consistency of various theories on tariff reliance with the cross-country evidence. Their empirical analysis is characterised by the estimation of single regression equation with tariff dependence in a whole country as a dependent variable coupled with proxies drawn from existing theories on tariff protection as independent variables based on panel data of 141 developed and developing countries. In essence, this article is common to Ederington and Minier (2006) in terms of the theories on tariff protection to be tested and methodology for empirical analysis, but different in that an empirical analysis is exclusively focused on the agricultural sector in OECD countries. Although an empirical analysis on the reliance on tariffs over subsidies in the agriculture sector is long waited as suggested by Drazen and Limão (2008) in view of prevalent tariff protection and data availability, few attempts are made in practise. The motivation of this article is to fill such a gap.

The article is organised as follows. In the next section, the tariff dependence, the key concept in this article to describe the composition of agricultural protection, is defined based on an OECD's framework and database to monitor the evolution of agricultural support in OECD countries, and the peculiar feature of Japan's agricultural protection characterised by the high reliance on tariffs is presented vis-à-vis other OECD countries. In the third section, existing theories in the political economy of trade policy which explain the reason why tariffs are preferred over subsidies as a means of protection are briefly reviewed, and proxy independent variables to be included in a regression analysis are specified with a view to investigating the validity of these theories. In the fourth section, an equation to be estimated, the coverage of panel data for OECD countries, the results of estimation and discussion are presented. The main thrust of this section is to discern the validity of different existing theories on tariff protection based on the results of the regression analysis using panel data and to identify the reason for Japan's consistently high dependence on tariffs in its agricultural protection in comparison with other OECD countries. The final section provides the summary of findings and conclusions, as well as the contributions and limitations of this article and the suggestions for future research.

## 2. Definition of tariff dependence

This section is devoted to define the tariff dependence based on the OECD's framework and database to monitor the evolution of agricultural support in OECD countries and to present the peculiar feature of Japan's agricultural protection characterised by the high reliance on tariffs vis-à-vis other OECD countries. The main data source for the tariff dependence is the "PSE/CSE database" managed by the

OECD Directorate for Trade and Agriculture (OECD, 2010). According to the OECD's PSE framework which measures the level of protection and support to farmers, PSE (Producer Support Estimate) is an aggregate indicator which represents the overall level of agricultural support in each country and is defines as "the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policies that support agriculture, regardless of their nature, objective or impacts on farm production or income" (OECD, 2008, p. 107). PSE is composed of MPS (Market Price Support) and DP (Direct Payment). MPS is "the the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, arising from policy measures that creates a gap between domestic market prices and border prices of a specific agricultural commodity, measured at the farm gate level" (*ibid*, p.100), while DP is "budgetary transfers through all government institutions, both national and sub-national, are included" (*ibid*, p. 91). Specific formulae for calculating these three indicators (i.e., $PSE_i$, $MPS_i$ and $DP_i$) for country i can be defined as follows[1]:

$$PSE_i = MPS_i + DP_i \quad (1)$$

$$MPS_i = \Sigma_j\{(PD_j - PW_j * ER_i) * QP_j\} \quad (2)$$

$$DP_i = \Sigma_j DP_j + \Sigma_k DP_k \quad (3)$$

where $PD_j$ is the domestic price of commodity j expressed in domestic currency, $PW_j$ is the world price of commodity j expressed in US dollar, $ER_i$ is the exchange rate of domestic currency to US dollar, $QP_j$ is the quantity of domestic production of the commodity j, $DP_j$ is a direct payment for commodity j, $DP_k$ is a non-product specific direct payment k to be paid to the groups of commodity or on the basis of farm households.

Based on these basic indicators on the annual monetary value of gross transfers to agricultural producers, it is possible to construct derived indicators to represent the "level" and "composition" of agricultural protection. The former is "percentage PSE" (%PSE) and the latter is "tariff dependence" (TD). These indicators for country i (i.e., $\%PSE_i$ and $TD_i$) can be defined as follows:

$$\%PSE_i = PSE_i / (PV_i + DP_i) * 100 \quad (4)$$

$$TD_i = (MPS_i / PSE_i) * 100 \quad (5)$$

where $PV_i$ is the value of total agricultural production at farm gate, and the summation of $PV_i$ and $DP_i$ represents the gross farm receipts of agricultural producers. The advantage of %PSE over PSE *per se* is that such a relative indicator is not affected by the size and the structure of the agricultural sector as a whole or by the rate of inflation (*ibid*, p. 150). The ratio of $MPS_i$ to $PSE_i$ can be interpreted as tariff dependence because, in the case of an importing commodity, positive price difference between domestic and world prices can be maintained only if some forms of import barriers (typically tariffs) whose costs are borne by consumers are put in place if marketing margins and quality difference with imports are neglected. This is not the case for an exporting commodity however, since a positive price difference necessitates export subsidies whose costs must be borne by taxpayers as is the case for direct payments to producers (*ibid*, p. 61). Thus, the ratio of $MPS_i$ to $PSE_i$ may not conceptually represent tariff dependence in exporting commodities but in practice this does not preclude the usage of the ratio as a proxy of tariff dependence because export subsidies are increasingly nonexistent in OECD countries (OECD 2010) and therefore on aggregate their impact on the validity of the ratio to measure tariff dependence is judged to be minor.

Figure 1 shows, based on the indicators defined above, the changes in the level and composition of

[1] Elements of PSE and other indicators are simplified here to present their essence in a succinct manner. See OECD (2008) for strict definition and detailed explanation.

agricultural protection in 10 OECD countries between 1986-88 and 2006-08[2]. The vertical axis represents the level of protection measured by the %PSE as defined in the equation (4) while the horizontal axis denotes the composition of protection measured by the tariff dependence as defined in the equation (5). The frame is divided into 4 quadrants on the basis of median values of %PSE (in the vertical axis) and tariff dependence (in the horizontal axis) as a watershed. This classification suggests that those countries in the upper right corner (quadrant 1) have relatively high level of agricultural protection mainly by tariffs whereas those countries in the lower left corner (quadrant 3) have relatively low level of agricultural protection primarily through subsidies. It is evident therefore that the former groups face great difficulties in liberalising their agricultural markets while the latter groups have little difficulties to do so. By turning the attention to the changes in the level and composition of agricultural protection from 1986-08 to 2006-08, %PSE was highly correlated with tariff dependence in 1986-88 with a correlation coefficient being 0.74, suggesting that agricultural protection in OECD countries was provided mainly through border measures. In 2006-08 on the other hand, the correlation between % PSE and tariff dependence was weakened with a correlation coefficient being declined to 0.52, reflecting the conversion from tariffs to subsidies primarily in European countries and resultant decrease in tariff dependence. The notable exceptions are Japan and Korea whose tariff dependence has changed little from the 1986-88 level and remains to be 86 percent and 89 percent even in 2006-08.

**Figure 1 Changes in the level and composition of agricultural protection (1986-88 vs. 2006-08) (page 10)**

## 3. Theories on tariff preference over subsidies

This section aims to outlines briefly existing theories in the political economy of trade policy which explain the reason why tariffs are preferred over subsidies as a means of protection and to specify proxy independent variables to be included in a regression analysis with a view to investigating the validity of these theories. As existing theories are extensively surveyed by Rodrik (1995) and concisely summarised by Ederington and Minier (2006), this section mainly concentrates to connect existing theories to specific proxy variables taking account of the special features of the agricultural sector without duplicating the previous works. Ederington and Minier (2006) enumerate the following four distinct theories to explain tariff/subsidy mix: (i) revenue considerations, (ii) optimal obfuscation, (iii) lobby coordination and (iv) time inconsistency.

Among these theories, time inconsistency explanation first developed by Staiger and Tabellini (1987) is excluded from the empirical analysis in this article. Its essence is that a benevolent government prefer tariffs over production subsidies because the former is inefficient but time-consistent in the sense of Kydland Prescott (1977) and thereby reducing the equilibrium amount of redistribution, whereas the latter is efficient but time-inconsistent which leads to excessive amount of protection. To translate such a scenario into an empirical analysis, Ederington and Minier (2006) selects proxy independent variables on government credibility (as more credible governments have less need to reply on inefficient instruments) and mobility of workers across sectors (the government prefers the more efficient subsidy when it is costly to reallocate labour across sectors). These variables seem to be inapplicable given that this article focuses highly credible OECD countries and the single sector (i.e., agriculture) which makes inter-sectoral labour mobility invalid. Consequently, the first three theories are to be tested and specific proxy variables are to be matched with each theory.

Firstly, the revenue consideration theory predicts that governments prefer tariffs over subsidies because the former generates government revenue while the latter costs government revenue (*ibid*, p. 7). There are two interpretations of this theory. One of them is that budgetary constrained governments

[2] Mexico and Turkey which are both OECD member countries are excluded from Figure 1 and subsequent analysis because their Market Price Support takes negative value in some years between 1986 and 2008 and thus cannot be interpreted as a proxy for tariff dependence as defined in the equation (5).

favour tariffs as a protective instrument and thus "government debt" (general government gross financial liabilities as a percentage of GDP) can be used as its proxy. Another interpretation of this theory is that those countries with limited administrative capacities and thereby with high tax collection costs tend to rely on easy-to-collect tariff revenues and therefore "income tax" (taxes on income and profits as a percentage of GDP) may serve as a close approximation. Ederington and Minier (2006) also employ these two indicators derived from the World Bank's World Development Indicators, whereas this article draws similar indicators from OECD (2009) which provides more consistent data for longer periods. It is predicted that the government debt is positively correlated with tariff dependence whereas income tax is negatively associated with it.

Secondly, the optimal obfuscation theory developed by Magee et al. (1989) postulates that a self-interested government may use a less direct (and hence less efficient) means of redistribution because the effects are less likely to be observed by the voters who bear the costs (Ederington and Minier, 2006, p. 9). This theory implies that larger the share of uninformed voters in total population who fail to recognise higher welfare loss of tariffs compared with subsidies, greater the reliance on tariffs as a means of protection. Therefore, variables correlated with the informational resource base and education base of the population are necessary. The former can be approximated by "newspaper subscription" (daily newspapers per 1,000 people) and the latter by "higher education" (tertiary attainment for age group 25-64 as a percentage of the population of that age group), as suggested by Ederington and Minier (2006). Data on newspaper subscription can be available in World Bank (2010) and higher education in OECD (2009). The expected sigh is that both variables will be negatively correlated with tariff dependence.

Thirdly, the lobby coordination theory proposed by Rodrik (1986) and Grossman and Helpman (1994) argues that tariffs can be superior to subsidies in terms lower deadweight costs because the former's "collective goods" nature induces free riding among lobby groups and thereby reduces costly lobby competition among themselves whereas this is not the case for subsidies which are private goods. Such a scenario necessitates variables capturing the degree of lobby competition among the population. In this article, one of the proxy variables to be employed is "voter turnout" (total vote as a percentage of registration in parliamentary elections) from the International Institute for Democracy and Electoral Assistance (2009) following Ederington and Minier (2006). The other proxy variable is "production concentration" (value of top commodity as a percentage of total agricultural production) to be obtained from FAO (2010) as a counterpart of a Herfindahl index on the degree of industry concentration in their article. The prior expectation is that the voting rate in parliamentary elections is positively correlated with tariff dependence (i.e., a heavy poll is a reflection of high lobby competition leading to tariffs to avoid a large deadweight loss) whereas agricultural production concentration is negatively associated with it (i.e., the existence of the dominant product reduces lobby competition among different commodity groups thereby resulting in subsidies).

In addition to above 6 independent variables, two control variables which are not found in Ederington and Minier (2006) will be included in a regression equation. The first is "trade dependence" (trade in goods and services as a percentage of GDP) which is available in OECD (2009a). The rationale behind the inclusion of this variable is that, since a country with high trade dependence necessitates more a reduction in trade barriers of trading partners to increase its national income and in exchange the country is forced to reduce its own trade barriers to get concessions in a reciprocal basis, the transition from tariffs to subsidies will be facilitated in such a country. It is therefore postulated that trade dependence contributes to a decrease in tariff dependence. The second control variable to be employed is a "dummy variable" representing the implementation of the Uruguay Round Agreement. This variable takes 1 from 1995 to 2000 and 0 for other years. The Uruguay Round Agreement on Agriculture could have a potential to facilitate the shift from tariffs to subsidies since it obliged the WTO member countries to reduce tariffs, export subsidies and trade distorting domestic subsidies leaving non-trade distorting domestic subsidies intact. It is thus hypothesised the negative correlation between the dummy variable on the UR Agreement and tariff dependence. Table 1 summarises relevant information on these independent variables.

**Table 1 Summary information on independent variables (page 10)**

**4. Estimation results and discussion**

This section presents an equation to be estimated, the coverage of data, the results of estimation and discussion. Its main thrust is to discern the validity of different existing theories on tariff protection based on the results of the regression analysis using panel data and to identify the reason for Japan's consistently high dependence on tariffs in its agricultural protection in comparison with other OECD countries. An equation to be estimated is defined as follows:

$$TD_{it} = a + a_i + b_1GD_{it} + b_2IT_{it} + b_3ED_{it} + b_4NS_{it} + b_5VR_{it} + b_6PC_{it} + b_7TR_{it} + b_8D_t + e_{it} \qquad (6)$$

where $TD_{it}$, $GD_{it}$, $IT_{it}$, $ED_{it}$, $NS_{it}$, $VR_{it}$, $PC_{it}$, $TR_{it}$ and $D_t$ represent government debt, income tax, higher education, newspaper subscription, voter turnout, production concentration, trade dependence and dummy variable for the implementation periods of the Uruguay Round Agreement as defined in Table 1. Suffix *i* and *t* indicate country and year, respectively. a, $a_i$, $b_{1\text{-}8}$ and $e_{it}$ correspond to a constant term (common to all countries and years), constant terms representing country effect (common to year but different in country), coefficients of each independent variable and an error term, respectively.

The single equation formulation in (6) which incorporates all independent variables from different theories is identical with Ederington and Minier (2006). The rationale behind this is that existing theories are not mutually exclusive but complementary each other by highlighting different aspects of tariff reliance and hence the proposed equation makes it possible to verify the validity of each theory by controlling the effects of other theories. The principle in choosing independent variables is differ, on the other hand, from Ederington and Minier (2006), in which more than 20 independent variables drawn from different theories are included in a single equation. In this article, independent variables are limited to two indicators which are considered to be the closest approximation of each theory while also taking consideration of data availability. The main motivation for such a difference approach is to conduct the Hausman Test to ascertain as to whether the country effect is fixed or random in the equation (6) and, to make the test possible, the number of independent variables must be less than the number of countries (i.e., 10 in this case). The formulation has also merit to avoid the risk of multicolinearity stemming from the inclusion of highly correlated independent variables.

The equation (6) is estimated by panel data composed of cross-country elements and time series components. Cross-country data cover 10 OECD member countries: Australia, Canada, Iceland, European Union, Japan, Korea, New Zealand, Norway, Switzerland and United Sates. Since the availability of time-series data varies depending on independent variables while data on dependent variable are available for 23 years from 1986 to 2008, several equations are to be estimated in accordance with data availability. As for government debt (GD), higher education (ED), newspaper subscription (NS) and voter turnout (VR), data are missing in some years, and balanced-panel data are obtained by taking average if data in previous and following years are available or by estimating an equation with time trend as an independent variable if only the data in former or latter years are available. The European Union cover 12 countries until 1994, 15 from 1995 to 2003 and 25 from 2004, and its data are those of the EU as a whole if available but a simple average of member countries in a given year if not. Due to the constraint of data availability however, data on government debt (GD) and newspaper subscription (NS) are those of the Euro Zone in all years. The equation is estimated by the least square method using the EViews software version 6.

The estimation results of the equation (6) are presented in Table 2. Among 4 regressions estimated, the regression 1 tries to strikes a balance between the numbers of independent variables to be incorporated (i.e., all but newspaper subscription rate) and the longer period of estimation covering for 15 years from 1991 to 2004. The regression 3, on the other hand, gives priority to cover all independent variables approximating different theories whereas, in exchange, the estimation period is shortened to

8 years from 1997 to 2004 due to limited data availability of newspaper subscription rate[3]. The dummy variable on the Uruguay Round Agreement is not included in the regression 3 given that its implementation started before the estimation period. The regressions 2 and 4 are the results of incorporating only those independent variables with statistically significant in regression 1 and 3, respectively. The Hausman Test is applied to all 4 regressions in order to discern whether a country effect is random (null hypothesis) or fixed (alternative hypothesis). As a result, the fixed effect model is adopted in the regression 3 with the null hypothesis being rejected with 1 percent level of statistical significance while the random effect model is supported in the regression 1, 2 and 4 given that the null hypothesis is not rejected.

**Table 2 Estimation results of regressions on tariff dependence (page 11)**

The verification of different theories on tariff dependence is conducted by the regression 3 since it covers all independent variables except the dummy variable on the UR Agreement, which is judged to be statistically insignificant from the regression 1. As for the revenue consideration theory, the government debt is statistically significant with expected positive sign whereas the income tax is not statistically significant. With respect to the optimal obfuscation theory, the higher education is statistically significant with expected negative sign while the newspaper subscription is not significant. As far as the lobby coordination theory is concerned, both voter turnout and production concentration are not statistically significant. Finally, the trade dependence as a control variable is statistically significant with expected negative sign. It is therefore concluded that the revenue consideration and optimal obfuscation theories are supported by the presence of statistically significant proxy variables whereas the lobby coordination theory is not consistent with data. These results are largely compatible with the findings of Ederington and Minier (2006) and show the lack of realism of the lobby coordination theory which presupposes a policy choice based on an aggregate social welfare.

These results make it possible to conduct a decomposition analysis which identifies the relative contributions of independent variables to the change in the tariff dependence in each country for a given period. Such an analysis is an additional attempt by the author which is not performed by Ederington and Minier (2006). Specifically, a growth decomposition analysis is conducted based on the regression 4 in which statistically significant independent variables are distilled from the regression 3. A decomposition exercise in a country basis is designed to differentiate the relative contributions of independent variables to tariff dependence in Japan from those in other OECD countries, which cannot be obtained by the similar analysis covering the 10 OECD countries as a whole. The decomposition analysis can be made by the following equation:

$$\Delta TD_i = \Delta GD_i + \Delta ED_i + \Delta TR_i + \Delta RE_i \qquad (7)$$

where $\Delta TD_i$, $\Delta GD_i$ ,$\Delta ED_i$, $\Delta TR_i$ and $\Delta RE_i$ are the annual percentage change in tariff dependence, government debt, higher education, trade dependence and residual term, respectively. The residual term denotes the difference between the annual change in actual figures of tariff dependence and of its estimated figures, which is derived by multiplying the coefficients in the regression 4 (common to all countries and years) by actual figures of independent variables (different in each country and year) and by adding the constant term (common to all countries) to them. The results are presented in Table 3, in which an annual contribution of each independent variable from 1991 to 2006 is estimated by a regression with a time trend as an explanatory variable. The unit in the Table 3 is a percentage point given the fact that the original regression deriving the coefficients of independent variables is not a double logarithm form. The figures in the Table 3 show that, for example in Australia, tariff dependence declined by 5.27 percentage point annually from 1991 to 2006 and 0.20 point is explained by the decrease in government debt.

[3] Although the regression 1 and 3 are also estimated with a double logarithmic form, the adjusted $R^2$ decline to 0.22 and 0.61, respectively. Consequently, regression equations without taking logarithm are adopted thereafter.

**Table 3 Decomposition analysis of tariff dependence (1991-2006) (page 11)**

Table 3 provides several interesting insights on the determinants of tariff dependence in agricultural protection. As for the OECD countries as a whole, the largest contributing factor to the declining tariff dependence is the increase in the higher education in all countries when residual term is excluded. If the residual term is taken into consideration however, its contribution to the change in tariff dependence in absolute term is the largest in 6 countries (Australia, Canada, European Union, Korea, Switzerland and United States), suggesting the existence of other factors which are not covered by the theories and derived proxy variables examined in this article. By turning attention to Japan, the small residual term (0.09 point) implies that the regression 4 captures well the relevant factors contributing to the change in tariff dependence. Moreover, the remarkable feature of Japan drawn from Table 3 is that the increase in government debt (1.28 point) hampers the tariff dependence from declining by offsetting the increase in higher education and in trade dependence, which contribute to the decrease in tariff dependence by 1.32 point and 0.22 point, respectively. In conclusion, Japan's consistently high tariff dependence in agricultural protection is largely explained by the increasing government debt compared with other OECD countries, and this makes especially difficult for Japan to convert from tariffs that generate revenue to subsidies that cost government revenue. Such a conclusion also counters a longstanding belief that the reliance on tariffs resulting from budgetary constraint is applicable primarily to developing countries.

## 5. Summary and conclusions

This article aims to identify the determinants of Japan's consistently high tariff dependence in its agricultural protection through a cross-country comparison and, to meet such an objective, a regression analysis is performed to verify the validity of different existing theories on tariff protection. It is found from the hypothesis testing on the coefficients of independent variables approximating respective theories that the revenue consideration and optimal obfuscation theories are supported whereas the lobby coordination theory is not consistent with data. It becomes also evident that Japan's consistently high tariff dependence is largely explained by the increasing government debt in comparison with other OECD countries. Based on these findings, the discrepancy between trade theory and trade policy identified at the outset can be understood as follows as far as Japan is concerned. The standard trade theory presupposes the availability and feasibility of an income transfer from winners of trade liberalisation to losers by lump-sum subsidy under perfect information by all stakeholders and no transaction costs, and, under these assumptions being met, budgetary constraints by governments do not impede the conversion from tariffs to subsidies. Such an ideal income transfer is not feasible in reality because of the lack of information on gains and losses by trade liberalisation and thus governments are forced to compensate to losers on behalf of winners. As such, expenditures for compensation subsidies to losers of trade liberalisation compete with other expenditures and consequently budgetary constrained governments have little room for renouncing tariff revenues and instead for introducing additional subsidies. The main policy implication to be drawn is that a sufficient amount of resources for compensation payments needs to be secured if Japan is to reduce tariffs so as to harmonise its agricultural protection with further trade liberalisation.

The article is concluded by identifying its additional contributions, limitations and future research agenda. This article made an original and additional contribution to the domain of political economy of trade/agricultural policies by providing the first case of an econometric investigation on the determinants of tariff dependence in agricultural protection for OECD countries. Such an exploratory nature of this article, at the same time, entails several limitations in terms of its methodology. One of them relates to the consistency between theoretical models and an empirical analysis. In this article, independent variables in the regression analysis are not derived directly from formal models but drawn from proxies suggested by existing theories by mainly following Ederington and Minier (2006) since existing theories on tariff protection simply outline general conditions under which tariffs would be preferred over subsidies. Another limitation lies in the correspondence between existing theories and proxy variables to be employed in an econometric analysis. As is encountered in the optimal obfuscation theory by relying on higher education and newspaper subscription as proxies, it is not easy

to find appropriate proxy variables which neatly approximate the thrust of theories due to such factors as the ambiguity of theories and the limited availability of data. Overcoming these limitations would be potential areas of future research both in theory and empirics.

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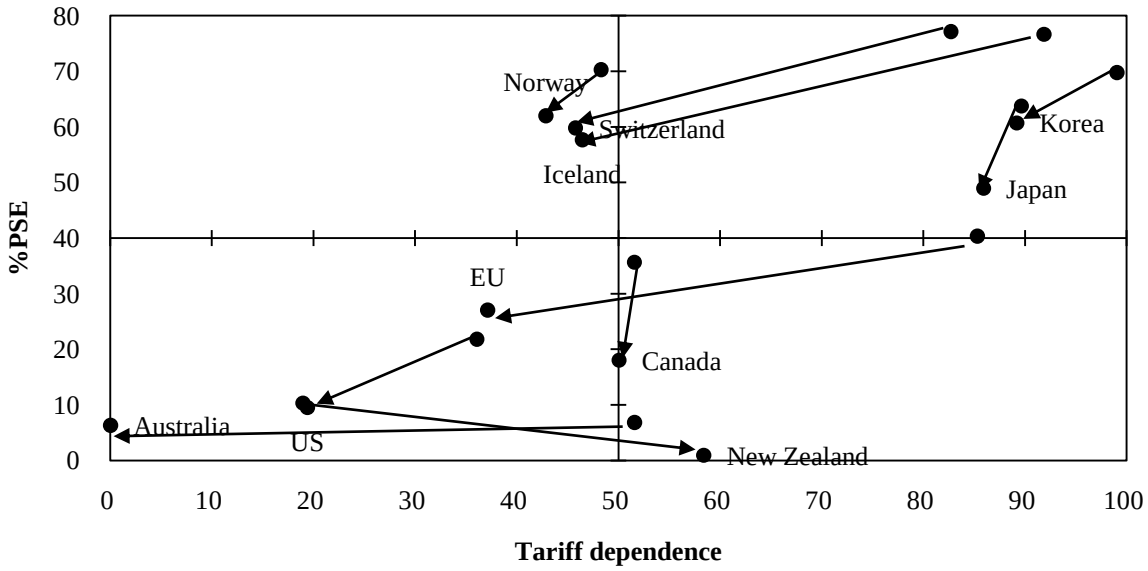
**Figure 1 Changes in the level and composition of agricultural protection (1986-88 vs. 2006-08)**




Source: OECD (2010)

**Table 1 Summary information on independent variables**

| Theories | Independent variable | Definition | Unit | Expected sign | Data source |
|---|---|---|---|---|---|
| Revenue considerations | Government debt (GD) | General government gross financial liabilities as a percentage of GDP | percent | + | OECD, 2009a |
| | Income tax (IT) | Taxes on income and profits as a percentage of GDP | Percent | - | OECD, 2009a |
| Optimal obfuscation | Higher education (ED) | Tertiary attainment for age group 25-64 as a percentage of the population of that age group | Percent | - | OECD, 2009a |
| | Newspaper subscription (NS) | Daily newspapers per 1,000 people | per mill | - | World Bank, 2010 |
| Lobby coordination | Voter turnout (VR) | Total vote as a percentage of registration in parliamentary elections | Percent | + | IDEA, 2009 |
| | Production concentration (PC) | Value of top commodity as a percentage of total value of agricultural production | Percent | - | FAO, 2009 |
| Control variables | Trade dependence (TR) | Trade in goods and services as a percentage of GDP | percent | - | OECD, 2009a |
| | UR Agreement dummy (D) | 1 for 1995-2000 and 0 otherwise | | - | |

**Table 2 Estimation results of regressions on tariff dependence**

| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| | Constant (a) | 135.33*** | 106.37*** | 133.91*** | 93.50*** |
| | | (5.37) | (5.86) | (2.78) | (9.32) |
| Revenue considerations | Government debt ($b_1$) | 0.19*** | 0.17*** | 0.39*** | 0.16*** |
| | | (2.85) | (2.81) | (3.09) | (2.63) |
| | Income tax ($b_2$) | -0.01 | | 1.61 | |
| | | (-0.02) | | (1.62) | |
| Optimal obfuscation | Higher education ($b_3$) | -1.46*** | -1.39*** | -1.72*** | -0.98*** |
| | | (-5.05) | (-6.44) | (-3.94) | (-4.17) |
| | Newspaper subscription ($b_4$) | | | 0.02 | |
| | | | | (0.59) | |
| Lobby coordination | Voter turnout ($b_5$) | -0.47** | -0.28 | -0.40 | |
| | | (-2.22) | (-1.38) | (-1.01) | |
| | Production concentration ($b_6$) | -0.06 | | -0.21 | |
| | | (-0.15) | | (-0.25) | |
| Control variables | Trade dependence ($b_7$) | -0.43 | | -1.54** | -0.62** |
| | | (-1.45) | | (-2.65) | (-2.11) |
| | UR Agreement dummy ($b_8$) | -1.09 | | | |
| | | (-0.58) | | | |
| Estimation periods | | 1991-2005 | 1991-2006 | 1997-2004 | 1991-2006 |
| Number of observations | | 150 | 160 | 80 | 160 |
| Adjusted $R^2$ | | 0.24 | 0.21 | 0.86 | 0.22 |
| Hausman Statistic | | 8.11 | 1.43 | 22.70 | 1.57 |
| | | [0.32] | [0.70] | [0.00] | [0.67] |
| Fixed or random effect | | Random | Random | Fixed | Random |

Note: Figures in round brackets are *t*-statistic and ***, ** and * denote the significance level of 1, 5 and 10 percent, respectively, while figures in square brackets are *p*-value of Hausman statistic.

**Table 3 Decomposition analysis of tariff dependence (1991-2006)**

| Country | Tariff dependence | Contribution to tariff dependence of: | | | |
|---|---|---|---|---|---|
| | | Government debt | Higher education | Trade dependence | Residual |
| Australia | -5.27 | -0.20 | -0.77 | -0.13 | -4.16 |
| Canada | -0.56 | -0.28 | -1.11 | -0.37 | 1.20 |
| Iceland | -1.26 | -0.22 | -1.18 | -0.33 | 0.46 |
| European Union | -1.84 | 0.14 | -0.60 | -0.54 | -0.84 |
| Japan | -0.18 | 1.28 | -1.32 | -0.22 | 0.09 |
| Korea | -0.33 | 0.23 | -1.19 | -0.68 | 1.30 |
| New Zealand | -0.58 | -0.38 | -1.03 | -0.08 | 0.90 |
| Norway | 0.06 | 0.22 | -0.51 | -0.04 | 0.39 |
| Switzerland | -1.96 | 0.19 | -0.62 | -0.59 | -0.94 |
| United States | -1.96 | -0.14 | -0.66 | -0.13 | -1.03 |

Note: Numbers are the change in percentage point per year.