연세경제연구 제 Ⅷ 권 제 2 호
Yonsei Economic Studies, Vol. Ⅷ, No. 2 (September 2001)

A Test of Tariff Endogeneity in Japan

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Tariff endogeneity assumes that tariff and non-tariff barriers are created in the political system in response to the economic factors which are the proxies of protectionist pressures. In this paper, the rationale of tariff formation in Japan is analyzed using time series technique, and the role of foreign country's pressure is investigated for the long run and short run.

The results indicate that there is strong evidence of tariff endogeneity in Japan. In the long run, real GDP, unemployment, CPI and the U.S. trade balance affect on Japan's tariff protection. However, in the short run, the variables of import penetration which express Japan's international competitiveness play an important role in the tariff formation in Japan. These asymmetric findings imply that Japan's protection is highly related to both domestic economy and the U.S. pressure in the long run, whereas in the short run, only international competitive position plays an important role on tariff policy.

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I. Introduction

There has been increased interests in recent years in positive political economy of the determination of international trade policy. Most of the empirical studies focused on the endogeneity of the level of protection. They suggest that the tariffs or other forms of protection are created by protectionist pressures which are determined in the political system among various interests groups.

Test of these interest group theory has been studied by several lines. One is cross section analysis, which examined the cases of specific protectionist legislation or the protectionist history of selected industries. For instance, McArthur and Marks [27] examined interest group's role by analyzing congressional voting behavior, and Ray [31] and Metcalfe and Goodwin [28][1] investigated the determinants of relative degree of protection across industries.

Another group of studies is time series analysis. It concerns the influence of fluctuations in a country's macro economy and international economic position. They believe that domestic economic condition and international trade position contribute to the protectionist pressure. Economic hardship increases both the demand for protection by particular groups and the likelihood that such efforts will be successful. However, there has been considerable disagreements among informed observers about the relative importance of the determinants of protectionist pressure. Takacs [33] and Feigenbaum, Ortiz and Willett [13] showed that state of the domestic economy such as domestic unemployment, capacity utilization and the international factors such as the trade balance and

1) In the previous studies, the number of escape clause is used as a proxy of non-tariff barrier. Metcalfe and Goodwin [28] used the ratio of international price to domestic price as the degree of trade policy protection.

import penetration are both important, whereas Feigenbaum and Willett [12] and Salvatore [32] argued that domestic variables are more important than international factors.

Recently there has been many trade conflicts between the U.S. and Japan. The U.S. believes that Japan maintains extensive trade barriers of its own. Therefore, the protection in Japan is very interesting issue.[2] However, most of these empirical studies have been tested for the U.S. and Canada cases, and less studies for the Japan.

This paper examines the determinants of the tariff policy in Japan by time series analysis. By investigating the relations among tariff protection and various macroeconomic variables such as unemployment rate and import penetration etc., the protectionist pressures in Japan are examined. Most of previous empirical studies assume that domestic protectionist pressure affects on the tariff protection, and did not examine the protection pressure of foreign countries. Recently, however, as foreign countries' pressures are increased, the role of foreign country's interest group has become important. Especially the U.S. pressure on tariff or non-tariff protection in Japan is very interesting issue. Therefore, U.S. import penetration is included in the variables of this model and the role of U.S. interest group is tested.

Furthermore, in this study, the long-run and short-run properties in endogeneity of tariff policy in Japan are investigated. For this purpose, a multivariate cointegration technique to test the long-run relation and an error correction model to analyze the short-run dynamic property are used.

2) Bureau of Tariff [6].

Ⅱ. The Political Economy of Protection : Testable Hypothesis

The traditional public choice approach views that industries are smaller, more homogeneous, with fewer proprietors, and processing a higher geographic concentration have a great chance of successfully forming a political pressure group by reducing free rider problem. Pincus [30] and Caves [8] evaluated the protection in the U.S. and Canadian manufacturing industries and found that industry's characteristics are highly related with each country's protection. Recently, Metcalfe and Goodwin [28] also confirmed these previous results.

Alternative approach concerns that the protection rests upon the presumption that the political effectiveness of interest group in the creation of trade policy will vary and the macro-economic variables like unemployment, inflation and trade balance are modeled as the determinants of protection policy. Takacs [33] made an important contribution to this issue by offering the first systematic empirical studies and found that domestic and international variables could explain the U.S. protection which was measured by the number of escape clauses to the International Trade Commission. Magee and Young [26] also tested this model by using macroeconomic variables as proxies for political pressure. Bohara and Kaempfer [4] examined aggregate time series data for the U.S. from 1890 to 1970 through the VAR methodology.[3)]

In the time series analysis, domestic variables used are real GDP, unemployment, inflation, and international variables are trade balance and import penetration. Higher unemployment, for instance, will tend to lead affected industries to intensify their efforts for protection. Inflation or the level of CPI

3) Bohara and Kaempfer [4] found strong evidence of U.S. tariff endogeneity stemming from domestic variables like real GDP, unemployment and inflation.

will have two alternative impacts on the levels of protection. Higher inflation will lead to more imports and thus to pressure for more protection, while higher price will lead to consumers as voters demanding less protection in order to lessen inflation.

Higher real GDP leads to more lobby for fewer restriction because growth leading export industries worry about the retaliatory trade policies abroad. The deficit of trade balance increases the protectionist pressure, whereas its surplus may increase the political effectiveness of anti-protectionist group since fear of retaliation is diminished.

Besides these domestic pressures, the U.S. trade deficit or U.S. import penetration as proxies of the U.S. pressure also could affect on the protection of Japan. Higher U.S. trade deficit or import penetration will increase political pressure on the part of anti-protectionist group.

In the standard theory of international trade, protection affects on these macro economic variables because they concerns on the effect of protection on the national economy. Thus, it is more appropriate that the relation among these variables should be analyzed in the time-series framework. In order to investigate the long-run relation, Johansen's cointegration technique is employed and error correction model is used for the short-run relation.

Ⅲ. Econometric Methodology : Johansen's Cointegration Test

Following Johansen and Juselius [21], we consider the following VAR model.

$$X_t = \sum_{i=1}^{k} \Pi_i X_{t-i} + e_t \qquad (1)$$

where $X_t = [s_t, p_t, p_t^*]$ and e_t is an independently and identically distributed vector of innovation with zero mean and covariance matrix Λ.

Letting $\Delta = 1 - L$, where L is the lag operator, we can rewrite equation (1) as

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \alpha\beta' X_{t-k} + e_t, \qquad (t = 1, 2, \cdots, T) \tag{2}$$

In (2), matrix Π is restricted as $\Pi = \alpha\beta'$, but the parameter can be eliminated by regressing ΔX_t and X_{t-k} on lagged differences $\Delta X_{t-1}, \cdots, \Delta X_{t-k+1}$. This gives residuals R_{0t}, R_{kt} and residual moment matrices.

$$S_{ij} = T^{-1} \sum_{t=1}^{T} R_{it} R_{jt}', \qquad (i, j = 0, K) \tag{3}$$

The cointegration relations are estimated as the eigenvectors corresponding to the r largest eigen values (λ) of equation (3).

$$|\lambda S_{kk} - S_{k0} S_{00}^{-1} S_{ok}| = 0 \tag{4}$$

Johansen suggested two test statistics. One is a maximum eigenvalue test. That is, the null hypothesis, $r=0$, is tested against the alternative $r=1$, $r=1$ against the alternative $r=2$, etc.. The form of the maximum eigenvalue statistics is

$$\lambda_{\max} = -T \ln(\hat{\lambda}_{r+1}) \tag{5}$$

Another test is a trace test. In the trace test, the null hypothesis that there are at most r cointegrating vectors is tested against a general alternative. The trace statistics is computed as

$$Trace = -T \sum_{i=r+1}^{p} \ln(1-\hat{\lambda}_i) \tag{6}$$

when analyzing the VAR model, it is sometimes the case that only a subset of the variables in the X_t-vector are needed in the cointegration space. When the full system is partitioned into two groups y and z such that $X_t = (y_{1t}, y_{2t}, z_t)'$, we show this in the system with $p=3$, $k=2$, $p=2$.[4]

$$\begin{bmatrix} \Delta y_{1t} \\ \Delta y_{2t} \\ \Delta z_t \end{bmatrix} = \Gamma_1 \begin{bmatrix} \Delta y_{1t-1} \\ \Delta y_{2t-1} \\ \Delta z_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{21} & \beta_{31} \\ \beta_{12} & \beta_{22} & \beta_{32} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} \tag{7}$$

If we assume that z_{t-1} in (7) is not needed to get stationary long run relations, then $\beta_{31} = \beta_{22} = 0$. Long run exclusion can be expressed as the following hypothesis.[5]

$$H = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \tag{8}$$

The short run dynamics consistent with the long-run equilibrium are modeled as an error correction mechanism (ECM).

$$\Delta X_t = \alpha U_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta X_{t-i} + \sum_{i=0}^{s} \varepsilon_i \Delta W_{t-i} + \varepsilon_t \tag{9}$$

Here U_{t-1} is error correction term, and W_t is other short run variables.

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4) Hansen and Juselius [18].

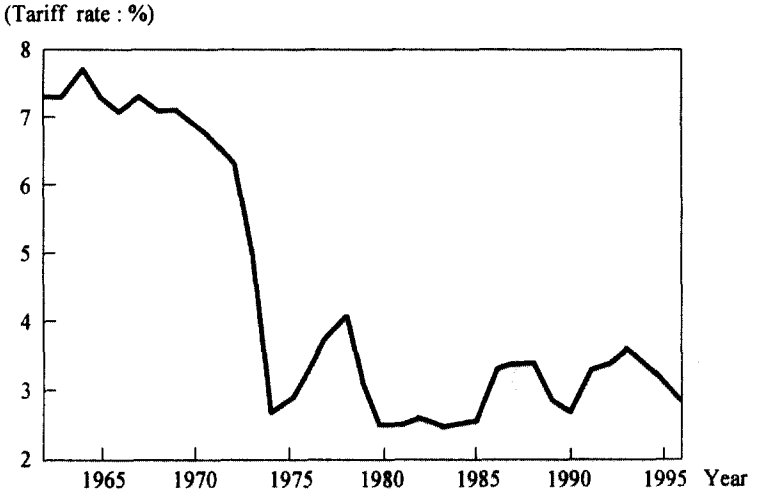
5) $\beta = H\psi$, where H is $(p \times s)$; ψ is $(s \times r)$, $r \leq s \leq p$.

Ⅳ. Empirical Results

To analyze the relation between tariff and the Japan's economy, a six-variable VAR model is employed because the VAR model does not require any stringent 'a priori' assumptions regarding exogeneity and endogeneity. Variables considered in this paper are tariff rate, real GDP, unemployment rate, CPI, import penetration, and U.S. import penetration. The data used are annual data from 1960 through 1997,[6] and a dummy variable is also created to capture a sudden change of tariff during the Kenedy Round (1 for 1973～1997, 0 for 1960～1972). Tariff rate is measured by tariff revenue/import value.

〈Figure 1〉 shows the trend of Japan's tariff protection. In 〈Figure 1〉, tariff rate

〈Figure 1〉 Trend of Tariff in Japan



Source : Japan Custom and Tariff Bureau.

6) Data of (Tariff revenue/ Import value) is from Japan Customs and Tariff Bureau and the other data are from IFS of IMF.

〈Table 1〉 Unit Root Test Results

	Dickey-Fuller		Phillips-Perron	
	Level	Differenced	Level	Differenced
Tariff	-1.246(5)	-4.454*(1)	-1.063	-4.447*
Real GDP	-1.800(1)	-4.209*(1)	-1.814	-5.573*
Unemployment	-0.349(1)	-3.397*(1)	-0.002	-3.604*
CPI	-0.653(1)	-3.067*(1)	0.063	-3.080
Import Penetration	-2.473(1)	-4.783*(1)	-2.071	-4.789*
U.S. Import Penetration	-0.615(1)	-3.988*(1)	-0.655	-6.640*

Notes : Numbers in parenthesis indicate lag length used, and in P-P test 3 lags are used.

〈Table 2〉 KPSS Test

	η_μ	η_τ
Tariff	0.6427*	0.1540*
Real GDP	0.8259*	0.2087*
Unemployment	0.7435*	0.0780
CPI	0.8015*	0.1966*
Import Penetration	0.2188	0.1567*
U.S Import Penetration	0.7698*	0.1801*

Note : * Indicates 5% significance level and lag length used is 4. η_μ is test statistics allowing for constant mean and η_τ is a test statistics allowing for trend for mean.

* KPSS test refers to Kwiatkowski, Phillips, Schmidt and Shin, "Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root," *Journal of Econometrics*, 54, 1992.

was 7.7% in 1964, however, it is lowered by Kennedy Round and Tokyo Round since 1973. In 1973, average tariff rate was 5.0%.

In order to implement the Johansen's procedure, each six variables' stationarity are checked through ADF, Phillips and Parron(P-P) and KPSS test[7] methodologies. In 〈Table 1〉 and 〈Table 2〉, time series properties justify using

7) Kwiatkowski, Phillips, Schmidt and Shin [24].

〈Table 3〉 Johansen's Cointegration Test Results

Number of Cointegration Vector	Test Statistics		Critical Value(5%)	
	λMAX	Trace	λMAX	Trace
$r \leq 6$	1.33	1.33	9.24	9.24
$r \leq 5$	11.00	12.33	15.67	19.96
$r \leq 4$	21.78	34.11	22.00	34.91
$r \leq 3$	43.70*	77.81*	28.14	53.01
$r \leq 2$	49.47*	127.28*	34.40	76.07
$r \leq 1$	63.39*	190.66*	40.30	102.14
$r = 0$	88.24*	278.91*	40.45	131.70

Note : * Indicate the significance under the 95% confidence interval.

all six variables because there are strong evidences that these variables are non-stationary.

In order to test cointegration relations, a lag length must be chosen for the VAR. The optimal lag lengths are chosen as 4, and the residuals from the VAR were checked for whiteness. The results of the cointegration tests are shown in 〈Table 3〉. The trace statistics and the eigenvalue statistics indicate the existence of three cointegrating vectors.

〈Table 4〉 Exclusion Test

Variables	Exclusion test
Real GDP	50.20*
Unemployment	48.18*
CPI	51.50*
Import Penetration	33.44*
U.S. Import Penetration	36.91*

Note : Number in parenthesis indicate the 5% significance level, and all tests have χ^2 distribution.

The results of the exclusion test are given in 〈Table 4〉. The exclusion restrictions are all rejected, at least at the 5 percent significance level, lending support to the hypothesis that the tariff protection and the vector of the proxies of protectionist pressures are of the same order of integration. More important, these results imply that the real GDP, unemployment, inflation, Japan's import penetration and the U.S. import penetration affect tariff in the long run.

Given the theoretical background, all the proxies are modeled as exogenous, and the cointegration relation is estimated. The results imply that the tariff is determined as follows :

$$\begin{aligned} TARIFF = & -1.664RGDP + 0.293JAPUNEM + 2.616JCPI \\ & -0.714JAPPEN - 0.887USPEN - 1.386D \end{aligned} \qquad (10)$$

where TARIFF is defined as tariff (revenue/import value), RGDP is real GDP, JAPUNEM is unemployment rate, JCPI is CPI, JAPPEN is import penetration (import value/GDP), USPEN is the U.S. import penetration, and D is dummy variable.

In (10), most of the coefficients are of the expected sign : In the long run, tariff protection in Japan decreases if real GDP increases, and it increases as unemployment rises, or price level increases. Besides these domestic variables, tariff protection will decrease when U.S. import penetration increases. However, in the case of import penetration of Japan, it does not have the expected sign. The results imply that the domestic variable is important in the tariff protection of Japan, and foreign variable which is the proxy of the U.S. pressure is also very important determinant of the tariff policy in Japan.

The short run adjustment mechanism is modeled as an ECM. The implied error correction vector, z_{t-i}, from the Johansen procedure is used in the ECM, together with past differenced macroeconomic variables that affect the tariff

protection in the short run. Following the now familiar general-to-specific modeling strategy, some variables that are not significant are excluded. The final parsimonious specification is as follows :

$$\Delta TARIFF_t = \underset{(2.9822)}{2.9583}^{*} + \underset{(0.4056)}{0.2966}\Delta RGDP_{t-2} + \underset{(0.5664)}{0.0913}\Delta JAPUNEM_{t-3}$$
$$+ \underset{(1.9130)}{0.3298}^{*}\Delta JAPPEN_{t-3} - \underset{(-2.9788)}{0.2030}^{*}ECM_{t-1} \qquad (11)$$

In (11),[8] the coefficients of domestic variables are insignificant. However, import penetration differential is significant with the expected sign : a higher import penetration in Japan leads to an increase of tariff protection in the short run. This implies that the short run determinants of the tariff protection in Japan may be different from the long run determinants : In the short run, only international competitiveness like import penetration affects on the tariff protection, whereas both domestic variables like real GDP and unemployment and foreign variable affect on tariff protection in the long run.

V. Conclusion

Political economy approach to the trade policy provides a positive theory of tariffs endogeneity. Tariff endogeneity assumes that tariff or non-tariff barrier is created in the political system in response to the economic factors which are the proxies of protectionist pressures. In this paper, I examined the rationale of

8) The figure in parenthesis are t-statistics. * indicates significance at 5 percent level. Also for the regression, $R^2 = 0.53$, and $D\text{-}W$ is 1.8923. Serial corelation and heteroskedacity is rejected at 5 percent significant level and it passed the normality test.

tariff formation in Japan using time series technique like cointegration test and error correction mechanism. Furthermore, the role of foreign country's pressure has been investigated for the long run and short run.

The results imply that there is strong evidence of tariff endogeneity in Japan. The endogeneity stems from real GDP, unemployment, CPI and U.S. trade balance in the long run. However, in the short run, the variable of import penetration which expresses Japan's international competitiveness plays an important role in the tariff formation in Japan.

This finding is different from those of the previous empirical studies which examined the cases of the U.S. and Canada. In the previous studies, they argued that state of domestic economy has greater importance than international trade position. However, in the case of Japan, tariff protection is highly related to both domestic economy and the U.S. external balance in the long run, whereas in the short run, only international competitive position plays an important role on the tariff policy.

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