Agricultural policy adjustments
in the Korean rice economy

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ABSTRACT

A political preference function is used to endogenize government actions in a simultaneous equation model for South Korean rice policy. The effects of economic changes on rice pricing decisions through estimated political weights are tested to improve our understanding of policy adjustments in that country and open the way for further research in East Asia.

INTRODUCTION

Recent studies in the political economy of agricultural protection have drawn attention to the need to better understand the growth of agricultural protection in the East Asian economies of Japan, Korea, and Taiwan (Anderson and Hayami, 1986). These economies have experienced rapid structural changes in recent decades necessitating substantial resource adjustments in their respective rice sectors. Complex systems of political economic relations have evolved in each of these countries to modify and implement their particular rice policy rules. However, the design of analytical models used to estimate the welfare impacts of agricultural policies on producers, consumers, and taxpayers have tended to ignore the endoge-

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nous role of government by treating its actions as exogenous to the private market economy. As a result, policy implications derived from such models have met with limited success in furthering our understanding of the reform process. More recent modeling efforts based on the theory of efficient government redistribution attempt to endogenize government policy variables that affect operating decisions on actual inputs and outputs (Rausser and Freebairn, 1974; Zusman, 1976; Sarris and Freebairn, 1983; Paarlberg and Abbott, 1986; Rausser and Foster, 1990; Oehmke and Yao, 1990) [1].

The model presented in this paper adopts this new political economic modeling approach to test the hypothesis that political activities of competing interests in producer, consumer, and government sectors are functionally related to economic changes. A political preference function is used to measure the relative political weights of competing interests in the institutional decision-making process. The economic factors that influence changes in the political weights are then tested econometrically. Government policy choices are endogenized in the model and not given solely as explanatory variables for production and consumption decisions. Instead, the choice levels are also explained in the model by factors motivating the decision process. The model was designed for the East Asian rice economies and has, thus far, been applied to the case of Korea (Kwon, 1990; Kwon and Yamauchi, 1990).

STRUCTURE OF THE MODEL

The main components of the political economic system of the East Asian rice economy can be described by three sets of equations: (a) economic structural equations, (b) endogenous policy decision equations, and (c) political economic system equations [2]. The model focuses on measuring how policy-makers accommodate the competing interests of private and

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[1] A recent review of the literature can be found in Young, Marchant and McCalla (1991).
[2] Macroeconomic equations representing only the rudimentary changes in GNP, consumer price index, consumption, and money supply can be added to this third set of political economic system equations, but they are not essential to the model. The marriage of political economic frameworks that have been advanced in the literature with macroeconomic linkage models is not an easy task since each of these two frameworks has its own analytical bases and was advanced to answer different questions. The combination of these two approaches must be based on some formal foundation and should be motivated by a new conceptual framework (Andrews and Rausser, 1986).

public groups to influence rice price policy in the context of changing economic conditions.

Domestic rice economy

The structure of the domestic rice economy in East Asia is reflected in its supply of and demand for rice. In the model, supply and demand are specified in terms of domestic production and domestic consumption that clears the market. The following implicit functions may be specified in simple linear terms with the time subscripts omitted.

Domestic production is a function of the ratio of nominal domestic producer prices divided by the producer cost index. To the extent that profitability is a factor in the adoption of new technology over time, the effects of such technological change on productivity and total output are implicitly reflected in this price ratio:

$$DP = F_1(PDP/PAI) \tag{1}$$

Domestic consumption is a function of the ratio of domestic consumer prices divided by the consumer price index and per-capita income:

$$DC = F_2(CDP/CPI, PGNP) \tag{2}$$

where DP and DC are the quantities supplied and demanded; PDP and CDP are the current prices faced by domestic producers and consumers; PGNP is per-capita income; PAI is the index of prices paid by producers; and CPI is consumer price index.

The market-clearing constraint accounts for changes in storage and net imports. Thus, domestic production is equal to domestic consumption plus net changes in stock minus net imports:

$$DP = DC + (ST - ST_1) - NIM \tag{3}$$

where ST and ST_1 are the rice stocks in the current and previous years, respectively; and NIM is net imports of rice.

Political preference function for endogenous policy decisions

Endogenous policy decisions are reflected in a political preference function that is designed to capture the relative influences of producers, consumers, and government agencies in setting the levels of domestic rice prices to producers (PDP) and consumers (CDP). The function is specified in simple weighted additive terms as follows:

$$W = WP*UP + WC*UC + WG*UG \tag{4}$$

where WP, WC, and WG are the political weights attached to the rice producers, consumers, and government, respectively; and UP, UC, and UG the welfare measures of the rice producers, consumers, and government, respectively.

Policy-makers arbitrate the conflicting objectives of interest groups seeking their own benefits from the rice policy. The political weights (WP, WC, and WU) capture the marginal values accruing to the welfare measures of the respective interest groups as a result of political bargaining. These weights also reflect the political willingness of the policy-makers to redistribute income through adjusting the rice policy based on the assumption that optimum actions are taken to maximize the value of the political preference function. The weights are associated with each interest group's welfare measure as follows. The producers' welfare (UP) is measured by a profit function that depends upon the price of rice received by the producers. The consumers' welfare (UC) is measured by an expenditure function that depends upon the price paid by the rice consumers at a given utility level. And finally, the government's welfare is measured by the net fiscal balance in the grain management fund after accounting for all receipts from consumers and outlays to producers, importers, and for storage costs:

$$UP = P(PDP) \tag{5}$$

$$UC = -E(CDP, U_{cons}) \tag{6}$$

$$UG = CDP * DC - PDP * DP - BPR * NIM + (PDP - CDP) * (ST - ST_1) \tag{7}$$

where $P(\cdot)$ is the profit function of rice producers; $E(\cdot)$ is the rice expenditure function of consumers for given utility level U_{cons}; and BPR is the border price for rice.

The first term on the right-hand side of equation (7) is the revenue from selling rice to consumers, and the second and third terms are costs of purchasing domestic production and importing, respectively. The fourth term represents changes in storage costs resulting from both outlays (negative) and receipts (positive) due to the addition of or drawdown on the rice stock. Thus, the government's interest (as viewed from the vantage point of policy-makers) accounts for the distribution of social revenues and costs of agricultural rice policy incident upon consumers, producers, exporters, and taxpayers.

Approach to quantifying the political weights. A set of computational formulas for the political weights was derived by maximizing the political preference function W given in equation (4), subject to the market-clearing

constraint of equation (3) with respect to the three main policy instruments, the producers' domestic price (PDP), the consumers' domestic price (CDP), and the net imports (NIM). The underlying assumption for pluralistic societies is that the actual price levels approximate the politically feasible optimal policy [i.e., the revealed preference assumption in Rausser and Freebairn (1974) and in Gardner (1987)]. From the first order conditions, the following formulas were derived with the sum of the political weights normalized to equal 300:

$$WG = 300/(X + Y + 1) \tag{8}$$

$$WP = 300 - WG - WG * Y \tag{9}$$

$$WC = 300 - WG - WP \tag{10}$$

where

$$X = \{DP + (PDP - BPR) * [\partial DP/\partial(PDP/PAI)] + ST - (ST_1)\}/DP$$

$$Y = \{DC + (CDP - BPR) * [\partial DC/\partial(CDP/CPI)] + ST - (ST_1)\}/DC$$

and $\partial DP/\partial(PDP/PAI)$ is the price coefficient of domestic production, and $\partial DC/\partial(CDP/CPI)$ the price coefficient of domestic consumption.

If there are different political attitudes toward the interest groups in the policy-making process, political weights will be differentiated since the weights are designed to represent the political willingness of policy-makers to favor one interest group over another. When the weights are tested to be significant and different among interest groups, we can reject the null hypothesis that there is no political willingness to adjust the rice policy in favor of a particular group. In that case, political weights may vary with changing political economic circumstances. For this purpose, we assume that the policy-makers are aware of the underlying domestic behavioral relationships that are stable over time.

Determination of endogenous rice price policy. Once the political weights are quantified, we can derive the formulas for the endogenous domestic price policy. By simply rearranging equations (8), (9), and (10) we have the following relationships that reflect political and economic influences on the producer and consumer prices:

$$PDP = BPR + (DP * WP/WG - DP - ST + ST_1)/(\partial DP/\partial(PDP/PAI))$$
$$\tag{11}$$

$$CDP = BPR + (DC * WC/WG - DC - ST + ST_1)/(\partial DC/\partial(CDP/CPI))$$
$$\tag{12}$$

From these equations, it is possible to evaluate how the various political economic factors contribute to the establishment of the endogenous price

levels. From equation (11), for example, the increasing political weight of producers relative to that of consumers and government clearly shows how this contributed to the rising producer prices.

EMPIRICAL TEST OF THE KOREAN RICE ECONOMY

Honma and Hayami (1986) in their efforts to establish baseline measurements on the determinants of agricultural protection in East Asia conclude that the rapid rise of agricultural protection (in nominal terms) from 1955 to 1980 was due largely to three factors: (a) the rapid decline in the comparative advantage in agriculture; (b) the systematic fall in agriculture's share in the total economy (in terms of output and labor); and (c) the shifts in the international terms of trade. However, for the case of Korea, the key empirical estimates that attempt to explain the growth of protection rates with declining agricultural shares and weakening comparative advantages in agricultural trade both domestically and internationally are not entirely satisfactory. Apparently, the key variables through which the declining agricultural shares, comparative disadvantage, and international terms of trade operate to explain high protection rates have not yet been adequately specified and empirically tested. There is ample room for improvement.

The role of the Korean government in the domestic rice economy has been a major factor in the political economy of agricultural policy adjustments since direct government procurements of rice from the farmers began in 1961. Ever since then, there has been much political conflict over determining the government procurement price, which impacts directly on the income and welfare of rural farmers and urban consumers.

The changing economic conditions over the past 25 years have created political pressures to adjust rice prices in accordance with the special interests involved. The Korean rice economy offers an opportunity to specify and empirically test a political economic modeling framework for expanding our knowledge of the agricultural policy adjustment process.

Korean rice economy model

Based on previously identified factors and relationships, the following econometric model consisting of seven behavioral equations (f1–f7) and one accounting identity (I1) was constructed to test the effects of economic changes on domestic rice policies. We began by estimating the domestic production and consumption functions to derive the necessary price coefficients for computing the political weights according to equations (8), (9), and (10). These computed weights were then fed into the remaining functional equations to test the influence of additional economic factors on the endogenous policy decisions and on the political weights themselves.

(1) Structural equations of the rice economy

> f1 $DP = f1(LAG(PDP/PAI), FWI/SAI, LAG(DP), DUM_1)$
>
> f2 $DC = f2(CDP/CPI, GNP/POP, LAG(DC))$
>
> I1 $NI = DC - DP + ST - LAG(ST)$

(2) Endogenous policy decisions

> f3 $PDP = f3(USBPR * EX, PAI, LAG(DP) * WP/WG, LAG(FWI))$
>
> f4 $CDP = f4(USBPR * EX, CPI, DC * WC/WG, LAG(CDP))$

(3) Political preference weights

> f5 $WG = f5(GMFD, GVD, LAG(WG), DUM_2)$
>
> f6 $WP = f6(SAI/PM, DP/DC, RRUI, GNPA/GNP, DUM_2)$
>
> f7 $WC = f7(GNP/POP, CDP/CPI, LAG(WC))$

> where CDP/CPI is the real consumer price for rice; DP/DC is the
> self-sufficiency rate; GMFD is the deficit of the Grain Management
> Fund (GMF); GNPA/GNP is agriculture's share of gross national
> product; GNP/POP is the per-capita GNP; GVD is the total govern-
> ment budget deficit, FWI is the index of wages in the farm sector
> (1980 = 100); SAI/PAI is the parity price index (ratio of prices re-
> ceived [SAI] to the prices paid [PAI] by farmers); RRUI is the ratio of
> rural household income to urban household income; USBPR * EX is
> the border price of rice in terms of Korean won; DUM_1 and DUM_2 are
> dummy variables for 1981 extraordinarily poor harvest and 1974 oil
> shock, respectively.

Quantification of the political weights

Figure 1 shows the results of applying equations (8), (9), and (10) with
data from official Korean sources covering the 25-year period 1961–1985.
The estimated patterns and trends are significantly different from the 100
baseline and pairwise among the three interest groups at the 5% level. The
changing political weights clearly show how Korean rice policy-makers
favored producers by raising prices for their outputs.

This implies an increased political willingness to redistribute income in
favor of rural farmers. Their political weights increased by about 30
percentage points, while those of consumers and government fell by about
15 percentage points each over the period. In other words, the welfare of
rice farmers (indicated by their relative income status) gained in the
preference ranking of policy-makers relative to that of consumers (expendi-
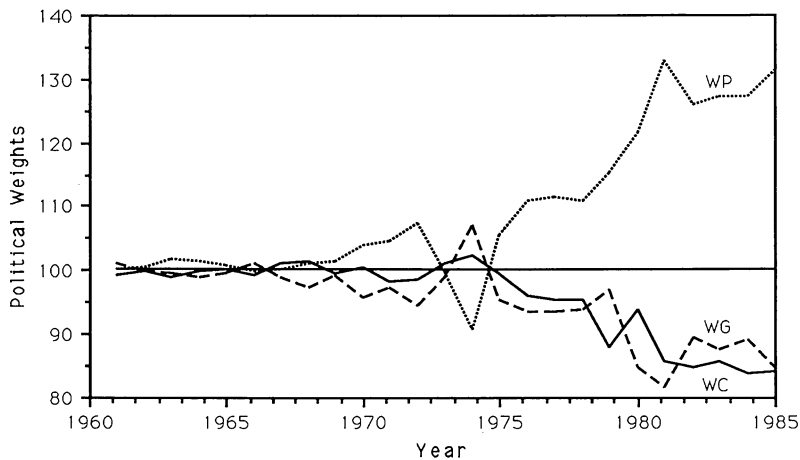
Fig. 1. Political weights for the Korean rice economy.

tures) and the government (net revenues). This is consistent with the historical perspective of rice policy in Korea. The present policy of direct rice purchases from farmers began in 1961. But it wasn't until about 1968 that the food agency began increasing the purchase prices. The effects of the first oil crisis in 1973–1974 are clearly seen in the opposite swings in the political weights as the border price of rice shot sharply upwards. This temporary situation corrected itself in a couple of years as the government's domestic purchase prices continued to escalate in favor of the rice producers and border prices stabilized at a lower level. The second oil shock in the late 1970's had little effect on the border prices as the official domestic purchase prices continued to increase. A poor harvest in 1980 led to further sharp increases in producer and consumer prices, which then tended to correct themselves with better harvests in the following years.

Econometric results

The estimated results of the seven behavioral equations representing the political economic system are summarized in Table 1 and interpreted as follows:

Function 1. Domestic production (DP) responded positively, as expected, to changes in real prices (PDP/PAI) reflecting the close coupling of government price policy with the input and output decisions of farmers. On the other hand, the positive coefficient for the index of real farm wages (FWI/SAI) as a proxy of input costs was unexpected. This may be rationalized in terms of the countermeasures to increasing real farm wages that

resulted from the severe shortages of farm labor with the mass exodus of farm population to urban areas.

Function 2. Domestic consumption (DC) is not significantly affected by its deflated prices (CDP/CPI) as indicated by the low *t*-value of 0.16. This is not surprising considering the high government subsidies for consumption as well as for production. Total rice consumption increased in Korea during this period of rising per-capita income even as household food expenditure patterns shifted.

Function 3. Producers' domestic price (PDP) is positively related to the index of prices paid by farmers (PAI). This reflects the government's efforts to use rice price policy as an offset against the regressive income effects of rising costs of purchasing necessities from the urban sector. The degree to which taxpayers are made to bear the fiscal burden of redistributing income in favor of producers is also reflected in the positive coefficient for LAG(DP)*(WP/WG). The increasing relative political weights in favor of farmers are applied to the volume of production in the previous year since output in the current year is not known when the price is set. Since Korean rice producers are isolated from the international markets, border price (USBPR*EX/10) is not significant.

Function 4. Consumers' domestic price (CDP), on the other hand, is positively related to the border price. Whereas the relatively high producers' prices are shielded from the international market, the potential rise in consumer prices is repressed by cheaper imports during emergency periods of domestic shortfalls. The significant coefficient for consumer price index (CPI) simply means that it figures directly in the setting of CDP. The negative coefficient for DC*(WC/WG) implies that the consumers' domestic price is held down by the relative political weight of consumers vis-a-vis government (WC/WG) applied to the volume of domestic consumption. This reflects the degree to which taxpayers are made to bear the burden of fiscal deficits in redistributing income in favor of consumers.

Function 5. Government's political weight (WG) is negatively related to its fiscal deficits in the grain management fund (GMFD) and the overall government budget (GVD). These negative coefficients reflect the degree to which the government political power is constrained by these deficits that taxpayers bear.

Function 6. Producers' political weight (WP) is positively influenced by the farm parity price (SAI/PAI) and the ratio of rural–urban income (RRUI). Both of these variables reflect the government's effort to reduce

TABLE 1

Empirical estimates

f1	$DP = -1296.13 + 5.0344 * LAG(PDP/PAI) + 0.3829 * LAG(DP) + 2136.17 * (FWI/SAI) - 2183.5 * DUM_1$ $(3.11) \qquad\qquad (3.37) \qquad\qquad (4.48) \qquad\qquad (-7.60) \quad R^2 = 0.8577$
f2	$DC = 1657.52 + 0.11805 * (CDP/CPI) + 1.2584 * (GNP/POP) + 0.44008 * LAG(DC)$ $(0.16) \qquad\qquad (3.02) \qquad\qquad (3.18) \qquad\qquad R^2 = 0.8984$
f3	$PDP = 46.99 + 0.10994 * (USBPR * EX/10) + 388.69 * PAI + 0.01499 * (LAG(DP)) * WP/WG)$ $(0.76) \qquad\qquad (2.58) \qquad (2.98)$ $+ 1.00286 * LAG(FWI) \qquad\qquad\qquad\qquad\qquad\qquad R^2 = 0.9945$ (2.07)
f4	$CDP = 59.783 + 0.3927 * (USBPR * EX/10) + 668.38 * CPI - 3085 * (DC * WC/WG) - 0.03379 * LAG(CDP)$ $(4.25) \qquad\qquad (7.53) \qquad (-3.01) \qquad\qquad (-0.29) \quad R^2 = 0.9938$
f5	$WG = 79.504 - 0.0053591 * GVD - 0.0031151 * GMFD + 0.19181 * LAG(WG) + 13.541 * DUM_2$ $(-4.21) \qquad\qquad (-6.67) \qquad\qquad (-2.30) \qquad\qquad (7.16) \qquad R^2 = 0.8531$
f6	$WP = 76.575 - 0.95619 * (GNPA/GNP) + 0.004522 * (SAI/PAI) + 0.3466 * RRUI - 19.124 * (DP/DC)$ $(-10.64) \qquad\qquad (3.05) \qquad\qquad (6.18) \qquad\qquad (-2.12)$ $- 21.1182 * DUM_2 \qquad\qquad\qquad\qquad\qquad\qquad\qquad R^2 = 0.8975$ (-5.52)
f7	$WC = 65.942 - 0.01408 * (GNP/POP) + 0.004786 * (CDP/CPI) + 0.388 * LAG(WC)$ $(-3.46) \qquad\qquad (0.63) \qquad\qquad (2.78) \qquad\qquad R^2 = 0.8386$

Note: Nonlinear three-stage least square method was used to ensure high efficiency in estimating the parameters. Numbers in parentheses are t-values.

the income gaps between rural and urban households through rice price policy. The negative influence of agriculture's declining share of gross domestic product (GNPA/GNP) reflects the increased intensity of farm lobbying to counter the net regressive income effects of economic growth on the farm sector.

Function 7. Consumers' political weight (WC) is negatively related to changes in per capita income (GNP/POP), and consumers rice price in real terms (CDP/CPI) is not a significant factor. These results are generally consistent with the declining Engel's coefficient for household food expenditures and changing consumer behavior.

SUMMARY CONCLUSIONS AND IMPLICATIONS

The thrust of our efforts in this study has been to analyze the endogenous behavior of government in adjusting agricultural policy. We have focused on the conceptual and methodological approaches to (a) measuring the political weights of interest groups including producers, consumers, and government in the formulation of agricultural policies; and (b) measuring the economic determinants of changes in the political weights over time. An analytical model has been designed for East Asia with three major component parts including (a) a structural equations representing the supply, demand, and market clearing functions for rice in the domestic economy; (b) a political preference function to estimate the relative weights of the interest groups in establishing domestic rice procurement and price policies; and (c) a set of simultaneous equations to estimate the functional relations between changes in the economy and the political economic system of the rice industry.

The model has been successfully tested for the case of Korea with data covering 25 years (1961–1985) of adjustments in government rice procurement and pricing policies. The dramatic increase in agricultural protectionism in Korea during this period can be explained principally by changes in the domestic rice economy that contributed to the rapid rise in the political weight of producers and the gradual decline in political weights of both government and consumers.

The effects of changing rural–urban terms of trade on producers' political weight are clearly measurable through selected price and income parity ratios and the long-term structural decline in agriculture's share of GDP. The measurable effect on consumers' political weight is found in the changing aggregate per capita income and not the real price of rice which is insignificant. Government's political weight is significantly related to its fiscal balances in the general budget and the more specific grain management fund.

The design and testing of our analytical model, thus far, has been limited to capturing the endogenous nature of agricultural policy adjustments on an incremental basis. Nevertheless, the way has been opened for further improvements in the specification of policies, the criterion function, and the transmission of domestic and international macroeconomic forces in the agricultural policy reform processes of East Asia.

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REFERENCES

Anderson, K. and Hayami, Y., 1986. The Political Economy of Agricultural Protection: East Asia in an International Perspective. Allen and Unwin, Sydney.

Andrews, M.S. and Rausser, G.C., 1986. Some political economy aspects of macroeconomic linkages with agriculture. Am. J. Agric. Econ., 68: 413–417.

Gardner, B.L., 1987. The Economics of Agricultural Policies. Macmillan, New York.

Honma, M. and Hayami, Y., 1986. Structure of agricultural protection in industrial countries. J. Int. Econ., 20: 115–129.

Kwon, Y.D., 1990. Political macroeconomy of agricultural policy: rice policy adjustments in Korea. Ph.D. dissertation in Agricultural and Resource Economics, University of Hawaii, Honolulu.

Kwon, Y.D. and Yamauchi, H., 1990. Political macroeconomy of agricultural policy adjustments in East Asia, Chapter 5 in: A.N. Rae and D.D. Chadee (Editors), Policies for Agricultural Trade Liberalization and Adjustment in the Pacific Rim, Agric Policy Proc. 14, Center for Agricultural Policy Studies, Massey University, New Zealand/Korea Rural Economics Institute, Seoul, Korea, 260 pp.

Oehmke, J.F. and Yao, X., 1990. A policy preference function for government intervention in the U.S. wheat market. Am. J. Agric. Econ., 72: 631–640.

Paarlberg, P.L. and Abbott, P.C., 1986. Oligopolistic behavior by public agencies in international trade: the world wheat markets. Am. J. Agric. Econ., 68: 8–19.

Rausser, G.C. and Foster, W.E., 1990. Political preference functions and public policy reform, Am. J. Agric. Econ., 72: 641–652.

Rausser, G.C. and Freebairn, J.W., 1974. Estimation of policy preference functions: an application to U.S. beef import quotas. Rev. Econ. Stat., 56: 437–449.

Sarris, A.H. and Freebairn, J., 1983. Endogenous price policies and international wheat prices. Am. J. Agric. Econ., 65: 214–224.

Young, L., Marchant, M. and McCalla, A., 1991. The political economy of agricultural trade: a review of the literature on domestic policy behavior and international price formation. Agriculture and Trade Analysis Division, USDA Economic Research Service, Washington, DC.

Zusman, P., 1976. The incorporation and measurement of social power in economic models. Int. Econ. Rev., 127: 447–462.