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Agricultural Policy Adjustments in East Asia:
The Korean Rice Economy

by

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**AGRICULTURAL POLICY ADJUSTMENTS IN EAST ASIA:
THE KOREAN RICE ECONOMY**

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Yong Dae Kwon and Hiroshi Yamauchi¹

Abstract

The processes of agricultural policy decision-making in the East Asian economies of Japan, Taiwan, and Korea are characterized by the complex interactions of competing special interest groups in their respective political arenas. An analytical model is designed to investigate how adjustments in rice price policies are endogenously related to the political economic forces associated with macroeconomic changes. The model is tested against the case of Korean rice price policy, which has not been satisfactorily explained in earlier modeling efforts. A political preference function is used to estimate the relative political weights of producers, consumers, and government over a 25-year period (1961-1985) during which major macroeconomic changes occurred. A simultaneous 12-equation model is then constructed to explore the effects of the macroeconomic changes on the rice pricing decisions through the estimated political weights. Highly significant econometric results are obtained to explain the pattern of increasing political influence of producers relative to that of consumers and government. Simulation experiments show how the patterns in the rice economy are linked to macroeconomic change. The results obtained, thus far, open the way for methodological improvements to further our functional understanding of agricultural policy adjustments in Korea and other East Asian economies.

Key words: endogenous rice policy, political macroeconomy, political preference function, political weights, econometric simulation, East Asia, Korea

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AGRICULTURAL POLICY ADJUSTMENTS IN EAST ASIA: THE KOREAN RICE ECONOMY

1. INTRODUCTION

In the process of economic change over time, agriculture's declining share of total output is one of a number of variables indicating structural adjustments at the macroeconomic level. This phenomenon has been a starting point for many analytical studies that have explored the dynamic patterns and trends of sectoral changes in agriculture (Chenery and Syrquim, 1975; Hayami and Ruttan, 1985; Ercolani, 1986; Yamauchi, 1987; Anderson, 1987). It is generally appreciated that the nature of agricultural policy adjustments that accompany such structural changes are governed by complex political economic interrelations. From a historical perspective, it has become evident that the economic forces associated with macroeconomic changes are sources of primary influence that culminate in government actions in the agricultural sector (Rausser, 1988).

Accordingly, it can be inferred that political activities on behalf of farm interests are likely to escalate as structural macroeconomic changes result in unfavorable conditions for the operating level where the decisions on actual farm inputs and outputs are made. That is, political activities of agricultural interest groups to change farm policies are functionally related to their needs to adjust to new economic realities. Furthermore, the process of agricultural adjustments as reflected at the macro level usually involves government actions that are not exogenously given as in many economic models. Rather, such government actions are, in fact, endogenous variables in the real political economic systems where the evolution of interest groups and their policy-influencing powers are functionally related to the structural changes in the macroeconomy.

The recent efforts in *The Political Economy of Agricultural Protection* (Anderson and Hayami, 1986) have drawn attention to the need to better understand the growth of agricultural protection in the three East Asian economies of Japan, Korea, and Taiwan. These three economies have experienced rapid structural changes in recent decades,

necessitating substantial resource adjustments in their respective rice sectors. It has been observed that unique and complex systems of political economic relations have evolved in each of these countries to modify and implement their particular rice policy rules. However, the analytical modeling methods used to explain the agricultural policy adjustments have tended to treat the actions of governments as exogenous to the private market economy rather than endogenous to the macroeconomy as a whole. In this paper, we adopt an analytical institutional economics approach to advancing our basic understanding of the nature of agricultural policy adjustments in East Asia, and offer some test results for the case of Korea. These results have encouraged us to extend the modeling technique to Japan and Taiwan with the hope of contributing the kinds of information needed to further evaluate and interpret agricultural policy reforms in East Asia.

2. PERSPECTIVE ON AGRICULTURAL POLICY ADJUSTMENTS IN EAST ASIA

From an international perspective, East Asia is relatively poorly endowed with arable land. Japan, Korea, and Taiwan each have fewer than 60 hectares of arable land per 1000 people, compared with a global average of more than 300 hectares. The East Asian economies have recorded very high economic growth rates by international standards. During the two decades up to 1980, annual real per capita income growth averaged 6.3 percent for Japan, 6.6 percent for Taiwan, and 6.9 percent for Korea. These figures were almost twice the average for middle-income and industrial countries in the world (World Bank, 1983).

With the rapid growth of these economies, the typical signs of structural changes are clearly evident, as shown in Table 1. The relative contributions of the agricultural sectors to the growth of GNP have fallen dramatically. The declines in agricultural shares of GDP and employment, and in Engels coefficient for food are clear indicators reflecting such agricultural adjustments. During the same period, pronounced increases in the nominal rates of agricultural protection in these economies have also become grossly apparent, in particular to their major

trading partners. In 1960, the average nominal rate of protection in Japan was 41 percent, and by 1985 this had increased to 210 percent. Taiwan and Korea have followed somewhat similar paths beginning with negative protection rates in 1960 and escalating to 55 and 166 percent respectively by 1981. These high nominal protection rates have been attributed to increased agricultural support programs and tighter import controls, among other things.

Table 1. Indicators of Economic Structural Changes in East Asia

	1960	1965	1970	1975	1980	1985
Japan						
GDP per capita (1975 US \$)	1549	2376	3834	4456	5442	7817
Real growth in total GDP (%)		10.1	a	5.0	b	3.8 ^c
Manufacturing		11.0	a	6.4	b	7.8 ^c
Agriculture		4.0	a	1.0	b	1.6 ^c
Agricultural share of: (%)						
GDP	10	7	5	4	3	3
Labor force	27	21	16	11	9	8
Engels coefficient (%)	43	39	36	35	31	29
Nominal rate of ag protection (%)	41	69	74	76	85	210
Taiwan						
GDP per capita (1975 US \$)	372	500	686	952	1407	1750
Real growth in total GDP (%)		9.2	a	9.5	b	6.1 ^c
Manufacturing		17.3	a	13.0	b	6.6 ^c
Agriculture		3.2	a	1.6	b	1.2 ^c
Agricultural share of: (%)						
GDP	26	22	14	12	7	5
Labor force	50	46	37	30	19	17
Engels coefficient (%)	61	56	51	52	43	41 ^d
Nominal rate of ag protection (%)	-3	-1	2	20	52	55 ^e
Korea						
GDP per capita (1975 US \$)	233	278	415	593	792	1089
Real growth in total GDP (%)		8.6	a	9.5	b	7.9 ^c
Manufacturing		17.6	a	16.6	b	9 ^c
Agriculture		4.4	a	3.2	b	6.3 ^c
Agricultural share of: (%)						
GDP	36	34	24	22	15	14
Labor force	60	53	46	40	35	25
Engels coefficient (%)	58	62	56	56	52	37
Nominal rate of ag protection (%)	-15	-4	29	30	117	166 ^e

Source: Anderson and Hayami (1986), adapted from Tables 1.1, 2.5, 3.1, updated.

Notes:

a = 1961-70 average, b = 1971-80 average, c = 1980-85 average, d = 1983 data, e = 1981 data.

While policy prescriptions to reduce these growing protection rates have been offered based upon the attempts of economists to measure the social costs of government interventions, the traditional prescriptions calling on policymakers to get the prices right have not proved to be a sufficient basis for reform. It became evident that if there were to be any hope for improving the situation through corrective policy measures, there had to be a better understanding of the domestic conditions that give rise to these undesirable performances. If protectionist policies were rooted primarily in domestic conditions rather than in the international economy, the underlying protectionist forces needed to be identified and understood in the context of the changing domestic economies.

In spite of substantial agricultural adjustment efforts at the micro level, the relative productivity of the agricultural sector on a macro level continued to deteriorate vis-a-vis the rapidly expanding industrial and service sectors. Domestic agricultural policy attention, therefore, had to focus on the issues relating to the growing welfare imbalances between the rural and urban sectors. The political economic conditions for policy decisions reflected the increasing economic base of the non-agricultural sectors, which served to support the declining agricultural populations.

The implication was that the growth of the secondary industrial sector contributed to political economic conditions that were sensitive to the economic survival of the declining agricultural sector. Accordingly, it could be expected that the decision criteria of policymakers systematically adjusted to the special needs of the farm interests. In a broad sense, the political influences of these special interest groups derive from a diverse set of historical, cultural, and socioeconomic factors. But in a narrower context, it was the effectiveness of their lobbying and campaigning activities in changing the institutional "rules of the game" that gave evidence of their political power.

This brief historical perspective suggests a systematic evolutionary process of agricultural policy adjustments in East Asia. Institutional changes reflected in these policy

adjustments have been occurring within political economic systems concerned primarily with domestic policy issues. In these decision systems, the changing political influence of agricultural interest groups and their ability to effect changes in institutional rules are closely interrelated to macroeconomic changes. We need, at this point, an appropriate analytical framework that can utilize relevant political economic paradigms and empirical models for testing hypotheses on the endogenous behavior of interest groups, including government, in the process of adjusting agricultural policy.

3. POLITICAL ECONOMIC APPROACHES AND LIMITATIONS FOR EAST ASIA

To address questions on how and why economic policies evolve, we need to reach beyond the static paradigms of traditional welfare and trade economics that tend to treat government actions as exogenous. The notable attempts at formalizing political economic approaches to empirically test the endogenous policies of government in U.S. agriculture were reviewed by Rausser et al. (1982), and since then, new test results have been added to the literature. Conceptually, political economic approaches rely on such paradigms as liberal-pluralism, Marxist theory of the state, the theory of economic regulation, the theory of rent-seeking, and the theory of efficient government redistribution. The literature is vast and is widely applicable to many fields of economics with varying degrees of success depending upon such factors as the scope and focus of decision-making and the particular conditions that govern political economic decisions and institutional change in each case.

For East Asia, the works in Anderson and Hayami (1986) rely primarily on the liberal-pluralism behavior of politicians whose actions are designed to maximize votes and keep them in office. In Chapter 4 of their book, the results of an econometric analysis of the determinants of agricultural protection levels are reported by Honma and Hayami (also, 1986). They conclude that the rapid rise in agricultural protection rates (in nominal terms) from 1955 to 1980 was due largely to three factors: (i) the rapid decline in the comparative

advantage in agriculture, (ii) the systematic fall of agriculture's share in the total economy (in terms of both output and labor), and (iii) the shifts in the international terms of trade.

However, 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, particularly for the case of Korea. Aside from measurement and specification errors that are always likely to be present in such econometric studies, the simple rationale of maximizing votes within "political economic markets" for agricultural policies leaves too many questions concerning the structure, functioning, and performance of agricultural policy adjustments unanswered. The underlying ethics of liberal-pluralistic societies may differ fundamentally, and these differences are likely to be manifested in the institutions that govern decision-making at all levels. The fallacy of treating institutions as factors that could be brought into demand-supply equilibrium in a political marketplace was clearly exposed two decades ago by Ciriacy-Wantrup (1969).

It is well known that industrializing countries implement agricultural policies to shift the burden of adjustment to the non-agricultural sectors. But that in itself does not necessarily lead to high protection rates and distortionary trade policies. There are always offsetting factors operating in a changing economy. Honma and Hayami allow for this by including the comparative advantage and international terms of trade variables that imply different natural resource endowments. As long as the agricultural sectors of resource-rich economies can maintain a strong international comparative advantage in trade over their resource-poor trading partners, their domestic agricultural support policies need not necessarily result in high protection rates. Thus, the land resource-abundant economies of the Pacific such as the United States, Canada, Australia, and New Zealand have continued to maintain relatively low agricultural protection rates in spite of the fact that they have also experienced similar structural shifts. But in the case of Korea, agricultural protection rates were already high by international standards even at the early stage of economic

development when its agricultural share in the economy was still relatively high. 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.

4. AN ALTERNATIVE POLITICAL MACROECONOMIC APPROACH

An alternative approach that provides for the explicit treatment of government actions as endogenous factors in empirical models is the efficient government redistribution approach. This approach dates back to the works of Rausser and Freebairn (1974) and Zusman (1976), and focuses on the political economic functioning of a system where the values of economic variables and policy instruments are endogenously determined. The critical role of special interest groups in the formulation of farm policy are recognized and taken into account in a political preference function that reflects the welfare measures (or economic objectives) of each interest group. More recently, the potential applicability of this approach to analyzing changes in agricultural policy has been demonstrated by Sarris and Freebairn (1983) and by Paarlberg and Abbott (1986), in both cases for the international wheat economy.

The political preference function is designed to detect and measure the relative political powers (weights) of different interest groups in changing the institutional rules of agricultural policies to their benefit. Conceptually, the resulting weights can be interpreted in terms of an equilibrium solution to a political economic bargaining game. If the weights are differentiated according to the effectiveness of each interest group's pursuit of its welfare measures, the implication is that the priority rankings of policymakers have, indeed, been responsive to the group's interests. Thus, these weights can be potentially useful aids in policy analyses. They can be used to detect whether differences exist among interest groups and, if so, what directions these differences are taking. Also, since these

differences can be related to policy changes over time, the weights have direct implications for the direction and degree of changes in policies for the future.

Further, since macroeconomic changes are major sources of influence on the performance of the agricultural sector, the relationships between selected macroeconomic variables and the political weights can be empirically tested. The establishment of such empirical relationships would then provide better insight into the effects of macroeconomic changes on the political influence of interest groups in agricultural policymaking. Such an analytical approach offers the possibility of overcoming some of the previously discussed limitations of earlier studies and developing more relevant criteria and information on the functional economic nature of agricultural policy adjustments over time.

5. MODEL FOR EMPIRICAL APPLICATION IN EAST ASIA

The structural components of the political macroeconomic systems of East Asian rice economies can be described by three sets of equations grouped as follows: (i) economic structural equations, (ii) endogenous policy decision equations, and (iii) political macroeconomic system equations. The model focuses on measuring how policymakers accommodate the competing efforts of interest groups to influence rice price policy for their own benefit, in relation to changing macroeconomic environments.

5.1. Structure of the Domestic Rice Economy

The structure of the domestic rice economy in an East Asian society 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. Time subscripts are omitted. Domestic production is a function of the ratio of domestic producer prices divided by the producer cost index.

$$DP = F1(PDP/PAI) \quad (1)$$

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

$$DC = F2(CDP/CPI, PGNP) \quad (2)$$

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,
 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.

$$DP = DC + (ST - ST1) - NIM \quad (3)$$

where:

ST and ST1 are the rice stocks in the current and previous years respectively,
 NIM is net imports of rice.

5.2. Endogenous Policy Decisions

5.2.1. Political Preference Function for Policy Decisions

Endogenous policy decisions are reflected in the political preference function model. In the context of the rice economies of East Asia, the political preference function attempts to capture the influence of the producers, consumers, and government agencies in setting the levels of domestic prices for rice to producers (PDP) and to consumers (CDP).

The model is specified in simple weighted additive terms as follows.

$$W = WP*UP + WC*UC + WG*UG \quad (4)$$

where:

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

It is assumed that there exists a rice policymaker who arbitrates the conflicting objectives of interest groups seeking their own benefits from the rice policy. If so, the

political weights (WP, WC, and WG) attempt to capture the marginal values accruing to the welfare measures of respective interest groups as a result of political bargaining among themselves. These weights also reflect the political willingness of the policymaker to redistribute income through adjusting the rice policy based on the assumption that the rice policymaker selects policy instruments to maximize 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 implementing the rice management program after accounting for all receipts from consumers and outlays to producers, importers, and for storage costs.

$$UP = P(PDP) \quad (5)$$

$$UC = - E(CDP, Ucons) \quad (6)$$

$$UG = CDP*DC - PDP*DP - BPR*NIM + (PDP - CDP)*(ST - ST1) \quad (7)$$

where:

P(.) is the profit function of rice producers,

E(.) is the rice expenditure function of consumers for given utility level Ucons,

BPR is the border price for rice.

The first term on the RHS 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 both outlays (negative) and receipts (positive) from adding to or drawing down on the rice stock. Thus, the government's interest (as viewed from the vantage of policymakers) accounts for the distribution of social revenues and costs of agricultural rice policy incident upon consumers, producers, exporters, and taxpayers.

5.2.2. 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 two main policy instruments, the producers' domestic price (PDP) and the consumers' domestic price (CDP). The underlying assumption for pluralistic societies is that the actual price levels approximate the political 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.

$$WG = 300/(X+Y+1) \quad (8)$$

$$WP = 300 - WG - WG*Y \quad (9)$$

$$WC = 300 - WG - WP \quad (10)$$

where:

$$X = \{DP+(PDP-BPR)*[\partial DP/\partial(PDP/PAI)]+ST-(ST1)\}/DP,$$

$$Y = \{DC+(CDP-BPR)*[\partial DC/\partial(CDP/CPI)]+ST-(ST1)\}/DC,$$

$\partial DP/\partial(PDP/PAI)$ is the price coefficient of domestic production,

$\partial DC/\partial(CDP/CPI)$ is the price coefficient of domestic consumption.

If there are different political attitudes toward the interest groups in the policymaking process, political weights will be differentiated since the weights are designed to represent the political willingness of policymakers to favor one interest group over another. When the weights are tested to be 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 circumstances. For this purpose, we assume that the policymakers are aware of the underlying domestic behavioral relationships that are stable over time.

5.2.3. Determination of Endogenous Rice Price Policy

Once the political weights are quantified, we can derive the formulas for the endogenous domestic prices. By simply rearranging equations (11), (12), and (13) we have the following relationships that reflect political and economic influences.

$$PDP = BPR + (DP*WP/WG - DP-ST+ST1)/(\partial DP/\partial(PDP/PAI)) \quad (11)$$

$$CDP = BPR + (DC*WC/WG - DC-ST+ST1)/(\partial DC/\partial(CDP/CPI)) \quad (12)$$

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.

Further, if we move the border price variable (BPR) to the LHS of equations (11) and (12), we can see how the political economic factors influence the differences between the domestic and international prices in equations (13) and (14).

$$PDP - BPR = (DP*WP/WG - DP-ST+ST1)/(\partial DP/\partial(PDP/PAI)) \quad (13)$$

$$CDP - BPR = (DC*WC/WG - DC-ST+ST1)/(\partial DC/\partial(CDP/CPI)) \quad (14)$$

These equations suggest the potential utility of the political weights in evaluating the historical changes in nominal protection rates of the Korean rice economy. Equation (13) suggests that it was again the surging political power of rice producers that largely contributed to the widening price differentials between domestic producer prices and the international prices at the border.

On the other hand, the difference between producer and consumer prices is determined without regard to international border prices, which cancel out in equation (15). Here, the differences are influenced purely by domestic demand and supply factors that also are reflected in the political weights of consumers and producers relative to that of government.

$$CDP - PDP = (DC*WC/WG - DC-ST+ST1)/(\partial DC/\partial(CDP/CPI)) - (DP*WP/WG - DP-ST+ST1)/(\partial DP/\partial(PDP/PAI)) \quad (15)$$

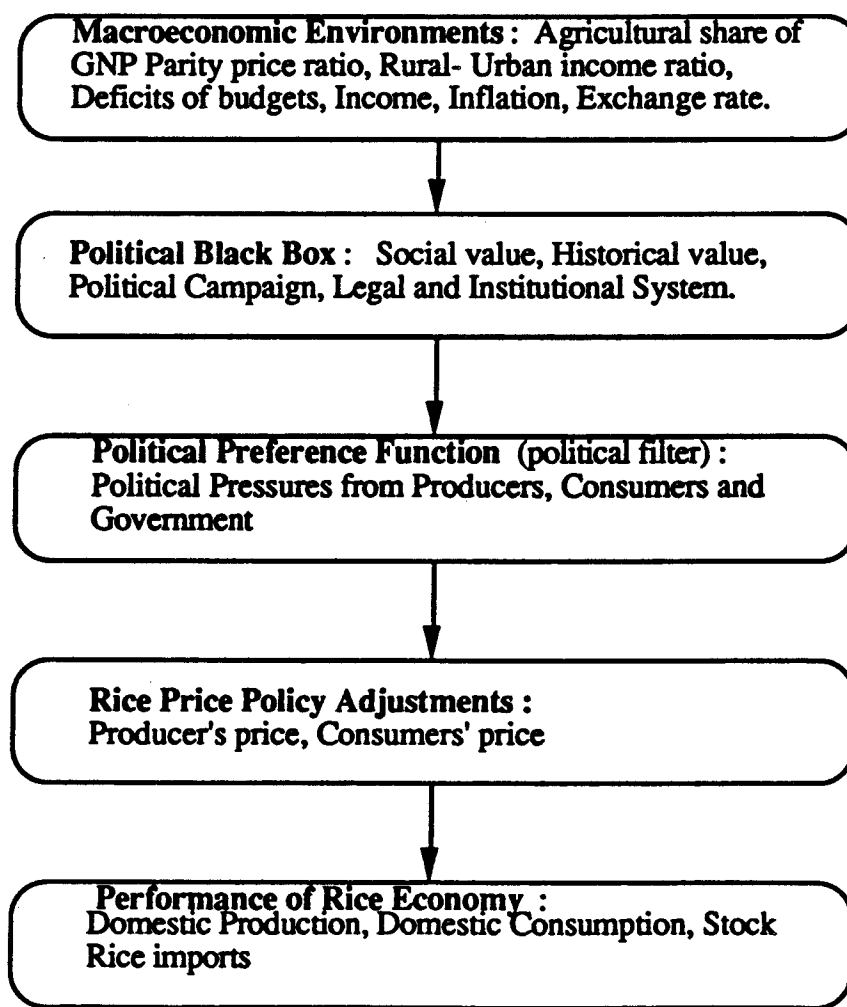
5.3. Channels of Macroeconomic Influences on the Domestic Rice Economy

Once the political weights of interest groups are shown to have significant influence on rice policy decisions, our next step is to test for macroeconomic factors that may be functionally related to changes in the political weights. Macroeconomic changes and their

links to the agricultural sector have been shown to have significant causal relationships to policy developments in the United States, leading to government intervention in agriculture (Andrews and Rausser, 1986).

The conceptual framework in which the macroeconomic forces are translated into rice policymaking is presented sequentially in Figure 1. Changing macroeconomic factors enter a “political black box” where conflicting interests lobby to adjust the institutional framework and rules that govern operating decisions at the farm level and the ultimate performance of the rice economy.

Figure 1. Conceptual Framework of Political Macroeconomy of Rice Economy



The political mechanisms through which macroeconomic forces are translated into political pressure for policy adjustments are part of the "political black box." Attention is focused on how macroeconomic forces are transmitted to rice policy adjustments that are brought about through the policy-influencing efforts of interest groups. The actual transmission processes can be quite complicated and include both forward and backward linkages between the rice economy and the macroeconomy. The selection of macrovariables depends upon the particular political economic conditions of an economy.

6. EMPIRICAL TEST OF THE KOREAN RICE ECONOMY

The role of the Korean government in the domestic rice economy has been a major factor in the political macroeconomy 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.

It can be inferred that the changing macroeconomic conditions over the past 25 years 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 macroeconomic modeling framework for expanding our knowledge of the agriculture policy adjustment process.

6.1. Empirical Model for the Korean Rice Economy

We construct an econometric model, consisting of 10 behavioral equations and two identities. Since our focus is on testing the effects of macroeconomic changes on domestic rice policies, our initial selection of macrovariables is based on previously identified factors. The political economic system of the Korean rice economy linked to the performance of the macroeconomy is summarized as follows:

1) Structural Equations of the Rice Economy

$$(1) DP = f_1(\text{LAG}(\text{PDP}/\text{PAI}), \text{FWI}/\text{SAI}, \text{LAG}(\text{DP}), \text{DUM1})$$

$$(2) DC = f_2(\text{CDP}/\text{CPI}, \text{GNP}/\text{POP}, \text{LAG}(\text{DC}))$$

$$(3) \text{NIM} = \text{DC} - \text{DP} + \text{ST} - \text{LAG}(\text{ST})$$

2) Endogenous Policy Decisions

$$(4) \text{PDP} = f_3(\text{USBPR} * \text{EX}, \text{PAI}, \text{LAG}(\text{DP}) * \text{WP}/\text{WG}, \text{LAG}(\text{FWI}))$$

$$(5) \text{CDP} = f_4(\text{USBPR} * \text{EX}, \text{CPI}, \text{DC} * \text{WC}/\text{WG}, \text{LAG}(\text{CDP}))$$

3) Political Macroeconomy of Rice

$$(6) \text{WG} = f_5(\text{GMFD}, \text{GVD}, \text{LAG}(\text{WG}), \text{DUM2})$$

$$(7) \text{WP} = f_6(\text{SAI}/\text{PAI}, \text{DP}/\text{DC}, \text{RRUI}, \text{GNPA}/\text{GNP}, \text{DUM2})$$

$$(8) \text{WC} = f_7(\text{GNP}/\text{POP}, \text{CDP}/\text{CPI}, \text{LAG}(\text{WC}))$$

$$(9) \text{CON} = f_8(\text{GNP}, \text{LAG}(\text{CON}))$$

$$(10) \text{MS} = f_9(\text{LAG}(\text{MS}), \text{GMFD}, \text{GVD}, \text{GNP})$$

$$(11) \text{CPI} = f_{10}(\text{LAG}(\text{MS}), \text{GNP}, \text{SAI}, \text{LAG}(\text{CPI}))$$

$$(12) \text{GNP} = \text{CON} + \text{INV} + \text{GVC} + \text{GX} - \text{GM}$$

where:

SAI/PAI is the parity price index (ratio of prices received [SAI] to the prices paid [PAI] by farmers),

DP/DC is the self-sufficiency rate,

RRUI is the ratio of rural household income to urban household income,

GNPA is the aggregated value of agricultural products,

GNP is the gross national product,

GNP/POP is the per capita GNP,

CDP/CPI is the real consumer price for rice,

GMFD is the deficits of the Grain Management Fund (GMF),

GVD is the total government budget deficits,

CON is the aggregate consumption,

USBPR*EX is the border price of rice in terms of Korean *won*,

DUM1 and **DUM2** are dummy variables,

MS is the money supply,

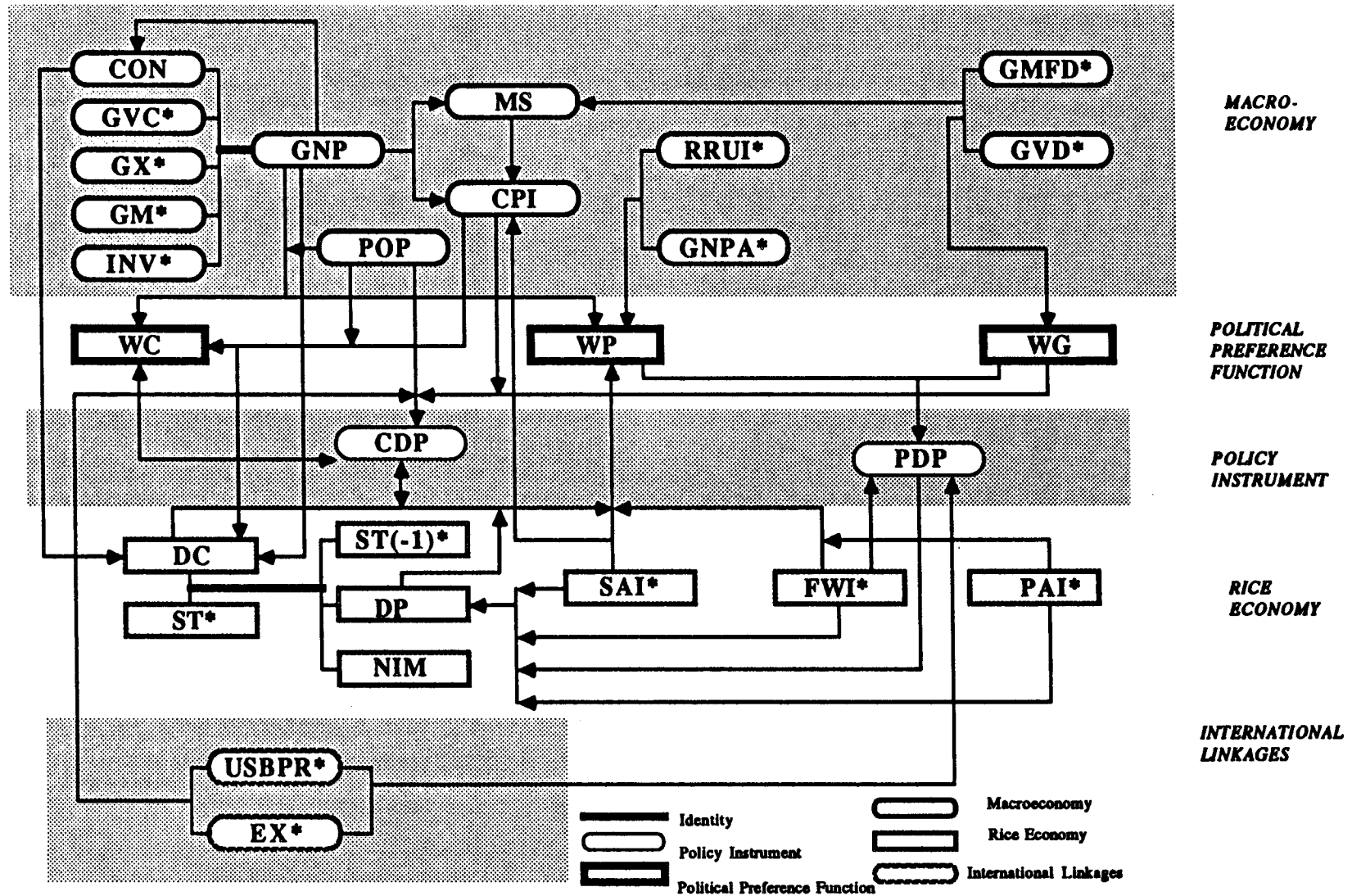
INV is the gross investment,

GVC is the government expenditure,

GX is the gross exports,

GM is the gross imports.

Figure 2. Schematic Diagram of Model



Notes: * marked variables are exogenous

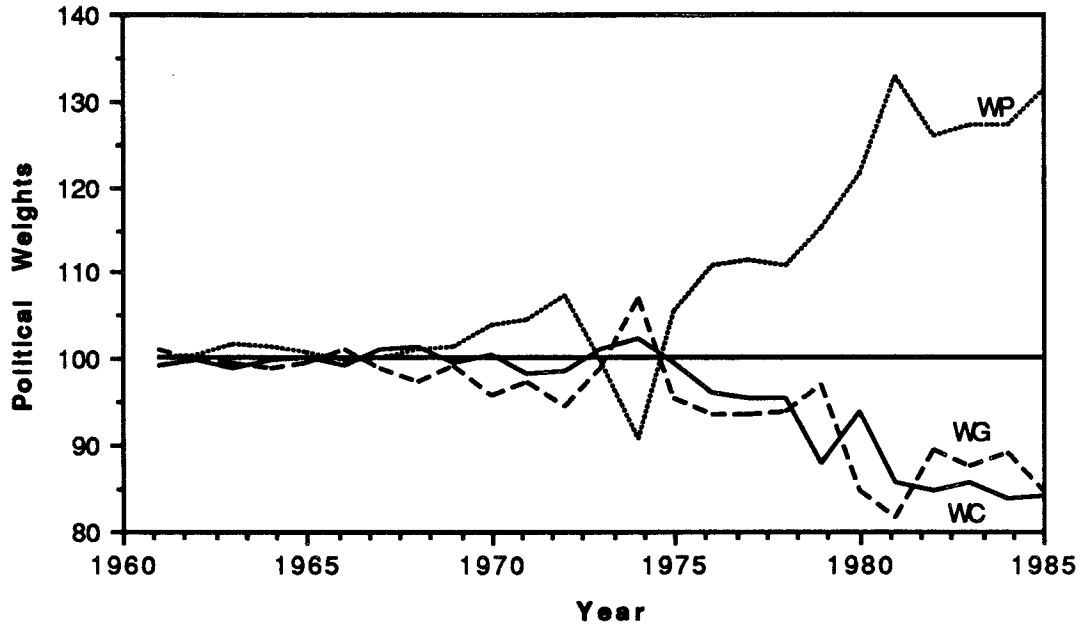
Figure 2 illustrates the major linkages among the relevant variables. Basically, macroeconomic factors play major roles in bringing about functional linkages among the variables. Based on the empirical findings presented in the following sections, we discuss the political macroeconomic system of the Korean rice industry.

6.2. Quantification of Political Weights for Korean Rice Economy

Figure 3 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 percent level. The changing political weights clearly indicate that Korean rice policymakers 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 both fell by about -15 percentage points over the period.

In other words, the welfare of rice farmers (indicated by their income status) gained in the preference ranking of policymakers relative to that of consumers (expenditures) and the government (net revenues). This is consistent with the historical perspective of rice policy in Korea. The present government 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 is 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.

Figure 3. Political Weights for the Korean Rice Economy



6.3. Discussion of the Estimated Simultaneous Equations

The estimated results of 10 behavioral equations representing the political macroeconomic system are discussed in this section. Since the mathematical structure of the model is nonlinear, the nonlinear three-stage least square method (N3SLS) was used to insure high efficiency in estimating the parameters. The numbers in parentheses below the estimated coefficients are t-values.

6.3.1. Domestic Rice Production Function

$$\begin{aligned}
 DP = & - 1296.13 + 5.0344 \cdot \text{LAG}(PDP/PAI) + 0.3829 \cdot \text{LAG}(DP) \\
 & \quad (3.11) \qquad \qquad \qquad (3.37) \\
 & + 2136.17 \cdot (\text{FWI}/\text{SAI}) - 2183.5 \cdot \text{DUM1} \\
 & \quad (4.48) \qquad \qquad \qquad (-7.60) \\
 R^2 = & 0.8577
 \end{aligned}$$

The price faced by rice producers in the previous year was found to have significant positive impact on domestic rice production at the 1 percent level. This indicates that farmers responded strongly to the high price support for rice. The significance of the lagged (DP) variable is consistent with the time it takes farmers to expand their paddy lands for rice production in response to the price signal.

The index of real farm wage rate was involved as a proxy for the input prices because farm wages took a major portion of agricultural management expenditures. Farm wages deflated by the price received index were found to be highly significant (at the 1percent level) but with an unexpected positive coefficient. This means that although farmers suffered from increasing labor costs due to rural manpower shortages, the high rice price supports were sufficient to provide them with incentives to increase their rice production. The highly significant dummy variable coefficient isolates the severe negative impact of bad weather on rice production in 1981.

6.3.2. Domestic Rice Consumption Function

$$DC = 1657.5 + 0.11805*(CDP/CPI) + 1.2584*(GNP/POP) + 0.44008*LG(DC)$$

(0.16) (3.02) (3.18)

$$R^2 = 0.8984$$

The consumer price for rice expressed in real terms (CDP/CPI) was found to be insignificant as its low t value, 0.16, indicates. This is simply explained by the fact that changes in consumption prices over time reflect the interactions of both supply and demand forces, and in this case, the rise in prices had no discernible effect on aggregate rice consumption.

On the other hand, changes in per capita real income were found to be highly significant in their strong positive effect on aggregate rice consumption. This was also true for the lagged DC coefficient. Together, these effects can be interpreted as follows. As incomes rose and the price of rice changed relative to that of other food products, gradual

shifts in diets may have occurred, but the impacts on aggregate rice consumption continued to be positive with a geometric lag.

6.3.3. Functional Effects on Government's Weight

$$\begin{aligned} \text{WG} = & 79.504 - 0.0053591 \cdot \text{GVD} - 0.0031151 \cdot \text{GMFD} + 0.19181 \cdot \text{LAG}(\text{WG}) \\ & \quad \quad \quad (-4.21) \quad \quad \quad (-6.67) \quad \quad \quad (2.30) \\ & + 13.541 \cdot \text{DUM2} \\ & \quad \quad \quad (7.16) \\ R^2 = & 0.8531 \end{aligned}$$

High farm price support programs in Korea have led to accumulating deficits in the government's food agency budget. As the size of these deficits continued to mount and the competition for scarce public resources increased, the political bargaining attitude of policymakers and government agencies toward increasing farm price support programs tended to tighten up.

Increasing deficits in the overall government budget (GVD) and in the Grain Management Fund (GMFD) were both found to be inversely related to the declining political weight of government at highly significant levels. The political influence of government in the decision criteria for rice policy appeared to weaken with the increased spending and accumulation of debts throughout the public sector. Here again the influence of the downward trend in the relative political weight of government was reflected in the significant coefficient for the LAG(WG) variable.

In 1974, the price of rice soared in the international market as a result of the first oil shock. The dummy variable captured the highly significant effect of the unstable global price conditions on the political weight of government. This was due mainly to the narrowing difference between the border price and the domestic price for rice.

Rising per capita income (GNP/POP) was found to be significantly related to the declining political weight of consumers. This inverse relationship is consistent with the expectation that rising consumer income helps to offset the rising cost of rice, and also contributes to shifting demands toward higher quality staple foods. The combined effect is to reduce the impact of rising rice prices on the relative cost of rice in household expenditures, thereby lessening the political sensitivity to rice price policy as evidenced by the insignificant ($t = 0.63$) coefficient for consumers' real price (CDP/CPI). Also, a reinforcing influence of the downward trend in the consumers' political weight is reflected in the significant coefficient for the LAG(WC) variable.

6.3.6. *Estimated Results of Aggregate Consumption Function*

$$\text{CON} = 1157.1 + 0.17245 \cdot \text{GNP} + 0.71657 \cdot \text{LAG}(\text{CON})$$

(3.88) (8.66)

$$R^2 = 0.9977$$

As expected, the coefficient of GNP was found to be positive and highly significant. This is only being consistent with the theory that the level of income determines the level of consumption. As in some of the earlier equations, a significant lagged effect was present. In this case, consumption in the previous year is positively related to consumption in the current year.

6.3.7. *Estimated Results of Money Supply Function*

$$\text{MS} = -324.92 + 1.1164 \cdot \text{LAG}(\text{MS}) + 0.10290 \cdot \text{GMFD} + 1.2791 \cdot \text{GVD}$$

(50.24) (0.85) (6.25)

$$+ 0.02320 \cdot \text{GNP}$$

(1.96)

$$R^2 = 0.9983$$

It has been suggested that the size of government deficits financed by printing money may raise the level of general prices. While increasing deficits in the overall government budget (GVD) were found to be highly significant in their positive relationship to the increasing supply of money, the deficits of the grain management fund (GMFD)

were found to be statistically insignificant ($t = 0.85$). The implication is that Korean rice policymakers may not have been overly concerned with the potential inflation effects of increasing deficits in the grain management fund resulting from high price supports.

6.3.8. Estimated Results of Consumer Price Index Function

$$\text{CPI} = 0.02086 - 0.00000167 \cdot \text{LAG}(\text{MS}) + 0.00000205 \cdot \text{GNP} + 0.00612 \cdot \text{SAI}$$

(-0.76)
(2.58)
(12.7)

$$+ 0.32862 \cdot \text{LAG}(\text{CPI})$$

(3.86)

$$R^2 = 0.9980$$

To detect any backward effects of changes in the rice economy on the general economy, the consumer price index was used as the dependent variable because of its broad representation of price conditions in the general economy. The highly significant positive coefficient for the level of prices received by farmers (SAI) supports the hypothesis of backward linkage from the rice economy to the general economy.

6.3.9 Functional Effects on Producers' Price Policy

$$\text{PDP} = -46.991 + 0.10994 \cdot (\text{USBPR} \cdot \text{EX}/10) + 388.69 \cdot \text{PAI}$$

(0.76)
(2.58)

$$+ 0.01499 \cdot (\text{LAG}(\text{DP}) \cdot \text{WP}/\text{WG}) + 1.00286 \cdot \text{LAG}(\text{FWD})$$

(2.98)
(2.07)

$$R^2 = 0.9945$$

If we want to predict and evaluate the government's rice policy in the political economic context, we need to explore the functional relationships between the producers' domestic price for rice and selected political economic variables. Prices paid by farmers (PAI) are significantly related to producers' price and support the hypothesis that increasing cost to farmers is a contributing factor in the decision to raise the purchasing price of rice. Also, the statistical significance of the positive coefficient to the politically weighted lagged domestic production variable $[\text{LAG}(\text{DP}) \cdot \text{WP}/\text{WG}]$ means that political reevaluations of rice

production rather than market valuations contribute to the persistent upward tendency of producers' prices.

However, changes in border prices (USBPR*EX/10) were found to have an insignificant impact on the producers' price. This result implies separation of domestic rice policy decisions concerning producer prices from the international rice market prices.

6.3.10. Functional Effects on Consumers' Price Policy

$$\begin{aligned}
 \text{CDP} = & 59.783 + 0.3927*(\text{USBPR}*\text{EX}/10) + 668.38*\text{CPI} - 3085*(\text{DC}*\text{WC}/\text{WG}) \\
 & \quad (4.25) \qquad \qquad \qquad (7.53) \qquad \qquad \qquad (-3.01) \\
 & - 0.03379*\text{LAG}(\text{CDP}) \\
 & \quad (-0.29) \\
 R^2 = & 0.9938
 \end{aligned}$$

Although not significant with respect to producer prices, border prices were found to have a highly significant positive impact on the determination of consumer prices. Apparently, Korean policymakers link border prices to their decisions on setting domestic consumer prices for rice. With respect to the consumer price index (CPI), the result suggests that decisions on consumer rice prices had significant effects on the general price level. The negative coefficient of the politically weighted domestic rice consumption (DC*WC/WG) variable suggests that, for any given amount of rice consumption, the higher the political weight of consumers relative to that of government, the lower the consumer price of rice is likely to be set. However, the one-year lagged consumer price for rice was found to have an insignificant effect on the decision to set current price levels for rice.

6.4. Simulation Analysis of Macroeconomic Impacts

6.4.1. Test of Model Validation

Based on the estimated equations, we experimented with dynamic simulation analysis to explore the question of how external macroeconomic changes affect endogenous rice prices and the Korean rice economy. To test the validity of the model for this purpose, a historical simulation covering the period from 1962 to 1985 was carried out to compute

the root mean square errors (RMSE) and root mean square percentage errors (RMSPE) of the simulated levels for the endogenous variables. Reasonable results were obtained, as shown in Table 2.

Table 2. Validation Test Results, RMSE and RMSPE of Historical Simulation (1962-1985)

Variable	RMSE	RMPSE
DP	766.62	19.93
DC	319.58	7.01
PDP	23.89	17.34
CDP	33.66	17.20
CPI	0.02	8.88
WG	2.21	2.41
WP	4.07	3.75
WC	2.65	2.64
GNP	960.29	5.22
CON	960.29	6.93
MS	1667.74	36.26

Except for the money supply variable (MS) with a RMSPE of 36.3 percent, all the other variables have less than 20 percent RMSPE with the best precision in the political weights (less than 4 percent). The direct and indirect uncertainty effects of macro-level changes on the rice economy are reflected in the higher RMSPEs for domestic prices, production, and consumption.

6.4.2. Results of Macroeconomic Impacts Simulation

Two simple scenarios of macroeconomic changes were simulated for the period of 1969-1985 to test the general effects of expansionary versus contractionary macroeconomic policies. In the expansionary macroeconomic policy, gross government expenditure, budget deficits, and exchange rates are increased by 20 percent per year. In the contractionary macroeconomic policy, the same three same macrovariables are decreased by 20 percent per year. The results are summarized in Table 3.

Table 3. Dynamic Impact of Macroeconomic Changes on the Endogenous Variables (1969-1985)

	<u>Expansionary policy¹</u>		<u>Contractionary policy²</u>	
	Total Net Changes		Total Net Change	
	Amount	Percent	Amount	Percent
DP (thous. m/t)	2, 791	78.9	-2,025	-26.6
DC (thous. m/t)	-1,281	-23.7	-4,039	-77.1
PDP (10 thous. won/t)	87	66.9	-211	-44.8
CDP (10 thous. won/t)	282	112.1	-237	-26.9
CPI (index)	-0.11	-30.8	-0.18	-45.3
WG (index)	2.56	4.1	8.17	10.3
WO (index)	26.5	26.4	-63.75	-55.2
WC (index)	-10.27	-8.7	11.54	15.4
NIM (thous. m/t)	-4,071	-1831.1	-2,013	-2,956.1
GNP (bil. real won)	7,696	17.8	-38,996	-123.2
CON (bil. real won)	-4,498	-29.5	-26,802	-127.0
MS (100 mil. current won)	33,714	499.9	-2,139	-71.6

Notes :

1. Expansionary macroeconomic policy is represented by 20% per annum increases in aggregate demand variables to expand output.
2. Contractionary macroeconomic policy is represented by 20% per annum reductions in aggregate demand variables to contract output.

In the case of expansionary policy, the total net increase of producers' price is 870 thousand Korean won per ton and the net rice production increases by 2,791 thousand tons for the period. On the other hand, simulation of contractionary policy results in a net decrease of producers' price by 2,110 thousand won and production drops by 2,025 thousand tons over the same period.

We can derive the following implications from the simulated results. First, macroeconomic expansion is an important source of strengthening the political efforts of rice producers to increase rice prices and production levels. Second, the political influencing power of consumers with respect to rice prices gets weaker as the expansion of

the economy continues. As a result, consumer rice prices move upward, in spite of a steady decline in the consumption of rice. Third, the required amount of rice imports is less in the expansionary phase than in the contractionary phase. This may be due to the fact that economic expansion leads to an increasing rate of rice production as the rate of consumption declines.

7. SUMMARY CONCLUSIONS AND IMPLICATIONS

Understanding the endogenous behavior of government actions in agriculture has become an important prerequisite for designing alternative policy strategies to change the tide of growing agricultural protectionism in East Asia. This is especially so since previous efforts at measuring the social costs of protection have not proved to be sufficient for agricultural reform. Therefore, 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 (i) measuring the political weights of special interest groups including producers, consumers, and government in the formulation of agricultural policies, and (ii) measuring the macroeconomic determinants of changes in the political weights over time. An analytical model has been designed for East Asia with three major component parts including (i) structural equations representing the supply, demand, and market clearing functions for rice in the domestic economy, (ii) a political preference function to estimate the relative weights of the interest groups in establishing domestic rice procurement and price policies, and (iii) a set of 12 simultaneous equations to estimate the functional relationships between changes in the macroeconomy 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 effects on consumers' political weight are found in the changing aggregate per capita income and real price of rice. Government's political weight is significantly related to its fiscal balances in the general budget and the more specific grain management fund. The reasonable validity of the model allows us to conduct simulation experiments for alternative macroeconomic expansion and contraction conditions. During periods of prolonged economic expansion, political preference tends to favor higher producer prices and, therefore, increased production. This, unfortunately, coincides with declining rice consumption, thereby lessening the need to import. The opposite tends to prevail during contractionary times.

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 into the agricultural policy reform processes of East Asia.

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