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Interaction of Japanese Rice and Wheat Policy and Impact on Trade

by

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Abstract

The interaction of Japanese rice and wheat policies and their impact on trade is described and analyzed through estimation of an econometric model which includes the interrelationships between the two sectors and which reflects Japanese Government policies. The model is used to simulate the trade impacts of previously announced increases in wheat support prices and in diversion payments over a 5-year period. Results indicate that the price changes reduce wheat imports 4-5 percent (from 1973 base levels) and also the accumulation of excess rice stocks which have given rise to Japan's emergence as a rice exporter in recent years.

Keywords: Japan, international trade, wheat, rice, agricultural policy, trade policy, trade restrictions, nontariff barriers

Interaction of Japanese Rice and Wheat Policy and Impact On Trade

by Cathy L. Jabara*

An important objective of Japanese agricultural policy since the early 1960's has been to increase farm incomes by raising the farm price of rice, the country's principal agricultural crop (see Hayami for a review of Japan's rice policy). This objective was accomplished through a two-tiered pricing scheme administered by the Japanese Food Agency, the principal purchaser and seller of rice and its substitute, wheat, in which producer support prices were maintained at levels higher than the consumer equivalent. In recent years, however, the accumulation of excess rice stocks has forced Japan's policy-makers to implement major changes in rice policy to reduce persistent over-production. These policies include diversion payment programs which provide incentives to divert paddy land to production of priority crops such as wheat, barley, and soybeans, as well as surplus disposal programs which subsidize the disposal of accumulated rice stocks for export, industrial, and feed use. Other policy changes introduced include adjustment in the wholesale (resale) prices of rice and wheat to favor rice consumption and adjustments in producer support prices to promote production of competing crops. This study analyzes the impact of recent changes in Japanese rice and wheat policy on trade.

Japan's rice policy has impacts in the international rice and wheat markets because of the substitutability between the two commodities. Japan's exports of surplus rice compete with exports from the more traditional suppliers such as the United States.1/ At the same time, domestic pricing policies and programs that promote production of wheat and/or promote consumption of rice

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will affect Japanese demand for wheat imports. The impact of rice and wheat policies on Japan's wheat imports is of interest because Japan is a major importer of wheat from the United States.

Previous studies of Japanese agriculture have focused on the social costs of agricultural programs (Bale and Greenshields, Bale) or analyzed the impact of a change in the resale wheat price on Japanese wheat imports (Greenshields). The purpose of this study is to provide a more comprehensive framework for analysis of Japanese agricultural policies by considering explicitly the interaction of Japanese rice and wheat policies. An econometric model of the Japanese rice and wheat sectors which includes the interrelationships between the two sectors and which reflects Japanese government policies is estimated and used to quantify the trade impacts of Japan's current rice and wheat policies.

Rice and Wheat Policy in Japan

Pricing and marketing of rice and wheat are controlled by the Japanese Food Agency according to the Food Control Law of 1942. Domestic rice and wheat prices form a two-tiered price system with high prices for producers and lower prices for consumers. Losses on purchases and sales are absorbed by the government.

Rice is sold either directly to the government or to officially designated dealers (mainly local cooperatives) who constitute a "semi-controlled" market.[2/] Rice prices fixed by the government are applied only to government - controlled purchases, which have been limited since 1971. Because of the availability of "standard grade rice" at government prices, however, it is often difficult to sell rice from the "semi-controlled" market at competitive levels and the government provides some subsidies for this market (Ministry of Agriculture, Forestry and Fisheries, Food Agency).

Wheat imports are controlled by the Japanese Food Agency through quota arrangements with licensed traders.3/ Wheat producers are in principle free to sell their crops to any purchaser, but in practice almost all sales are made to ther government because of the high government purchase price.

Wheat is cultivated on upland fields as well as on paddy fields as a second crop after rice is harvested. Wheat production is small-scale. Second-crop farming on paddy fields is often limited by labor shortages during the winter because of the availability of temporary nonfarm jobs. Increases in wheat production on paddy fields are linked to the profitability of rice because the new varieties of rice do not leave sufficient time for wheat to mature without reducing the yield of the succeeding rice crop due to late sowing.

Government policies designed to reduce the accumulation of rice stocks affect wheat trade through the use of three policy tools: government-determined resale prices of rice and wheat, government-determined producer support prices, and diversion payments for rice producers which promote the production of wheat at the expense of rice. Rice diversion programs of one form or another have been in effect since 1969 (see Organisation for Economic Co-operation and Development, 1978, for a description of these programs).

The interaction of rice and wheat policy and their impact on wheat trade is shown in figure 1 where D and S represent Japanese domestic demand and and supply for wheat, respectively. Wheat imports are equal to the quantity $Q_0 - Q_1$ at the wheat resale price of PRW and the producer price of PPW. Increases in the resale and producer wheat prices to levels represented by PRW' and PPW 'result in a decrease in wheat imports to $Q_2 - Q_4$.4/ In addition, pay-

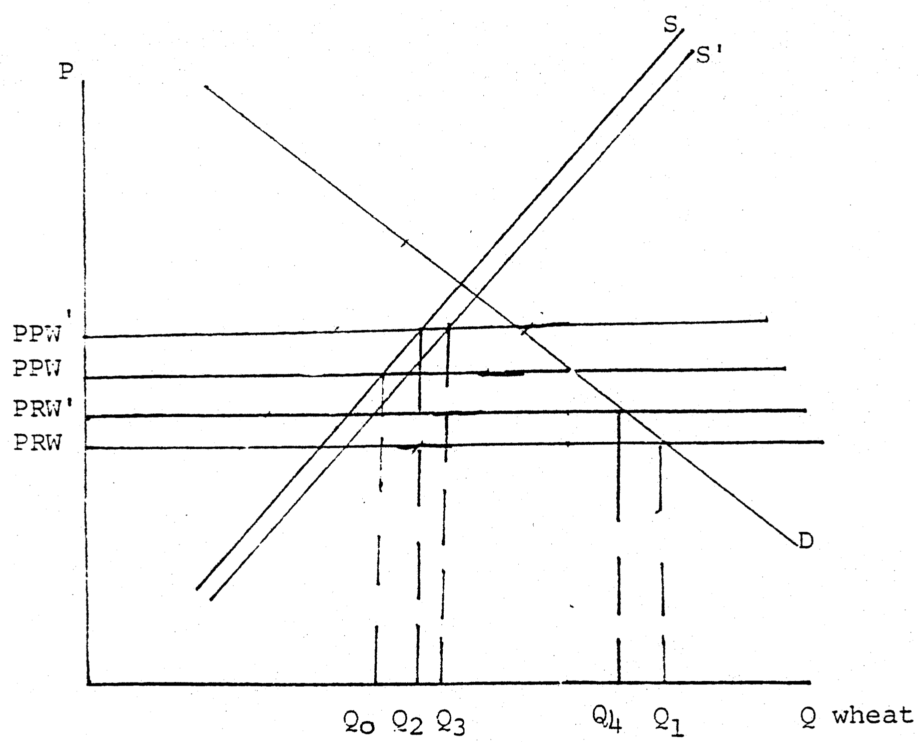

Figure 1. Impact of Japanese rice and wheat policies on wheat trade.

ments to divert paddy land from rice to wheat, resulting in a shift in the wheat supply schedule from S to S', further reduce wheat imports to $Q_3 - Q_4$.

To the extent that the above policies result in a reduction in the imbalance between rice production and consumption, rice supplies available for future surplus disposal decline. Japan is currently implementing a 5-year surplus disposal program, begun in 1979/80, to dispose of accumulated excess rice stocks through subsidized use as feed, as industrial use, and as exports.

Structural Econometric Model

The empirical model of the Japanese rice and wheat sectors is comprised of 11 equations of which 7 are behavioral and estimated with ordinary least squares (OLS). It was assumed that prices are not determined endogenously in the model so that OLS yields consistent and unbiased estimates of the parameters. Equations were specified to incorporate the policy instruments of the Japanese government in regulating the rice and wheat sectors. The period of analysis is from 1961/62 to 1977/78 except for the rice export equation which was estimated with data from the period 1969/70 to 1977/78.[5] Data used in fitting the model were obtained from the Japan Prime Minister's Office, Ministry of Agriculture, Forestry and Fisheries, and U.S. Department of Agriculture, Foreign Agricultural Service (FAS).

Acreage Equations

Rice and wheat acreage equations estimated are:

$$AR_t = \underset{(5.760)}{2833.700} + \underset{(2.120)}{.265}\, AR_{t-1} + \underset{(5.661)}{990.568}\,\frac{PPR_{t-1}}{PFI_{t-1}} - \underset{(-1.496)}{.005}\,\frac{PPW_{t-1}}{PPI_{t-1}}$$

$$- \underset{(-5.760)}{606.262}\,\frac{PPV_{t-1}}{PFI_{t-1}} - \underset{(-4.071)}{.337}\,\frac{DV_t}{PPI_{t-1}} + - \underset{(-2.245)}{6.784}\,\frac{MAN_t}{CPI_t} + \underset{(3.152)}{355.498}\, D1$$

$$\overline{R}^2 = .99 \quad h = -.87 \qquad n = 17 \qquad (1)$$

$$AW_t = 342.699 + .678\, AW_{t-1} + .002 \frac{PPW_{t-1}}{PPI_{t-1}} - .001 \frac{PPR_{t-1}}{PPI_{t-1}}$$
$$(1.372)\quad (3.452)\qquad (1.962)\qquad (-2.500)$$

$$- 3.691 \frac{MAN_t}{CPI_t} + .020 \frac{DV_t}{PPI_{t-1}}$$
$$(-1.787)\qquad (.417)$$

$$\overline{R}^2 = .99 \quad h = 2.220 \quad n = 17 \tag{2}$$

where the figures in parentheses are 't' statistics.6/ The variables used are defined in table 1. Equations 1 and 2 are specified to show the interrelationship of the rice and wheat sectors with producer support prices of rice and wheat as well as other substitute crops (vegetables).7/ The equations are expressed as functions of lagged producer prices because the government support prices are not announced until after the decision to plant the crops has been made. The negative coefficient of MAN in both equations indicates that opportunities for work in the nonfarm sector have been important factors in reducing both wheat and rice acreage in Japan over the estimation period.

The results of equation 1 also indicate that rice diversion payments (DV) have been an important factor in reducing rice acreage. The diversion program was changed somewhat in 1974 with the suspension of payments for land left fallow. DV is not significantly related to wheat acreage, however. This relationship is expected to change in the future with increases in diversion payments which make wheat more competitive with rice.8/

Wheat and Rice Production

Wheat production is represented by the identity

$$QWS_t = (AW_t)*(YDW_t) \tag{3}$$

A yield equation for wheat was not estimated because yields appear to have remained fairly stable over the estimation period.9/ Rice production equations are represented by

$$YDR_t = 5.275 - .0006\,AR_t + .889\,\frac{PPR_{t-1}}{PFI_{t-1}} - .414\,D2$$
$$(5.621)\quad(-2.622)\quad(2.641)\quad(-2.709)$$
$$\bar{R}^2 = .69 \quad DW = 1.20 \quad n=17 \qquad (4)$$

$$QRS_t = (AR_t)*(YDR_t) \qquad (5)$$

The results of equation 4 indicate practices of intensification of fields as producer prices for rice were increased over the estimation period.

Demand Equations

The rice and wheat demand equations estimated are of the form

$$QDW_t = .066 - .005\,\frac{Y_t}{CPI_t} - .0003\,\frac{PRW_t}{CPI_t} + .0002\,\frac{PRR_t}{CPI_t}$$
$$(9.665)\quad(-2.019)\quad(-4.160)\quad(2.079)$$

$$\bar{R}^2 = .84 \quad DW = 1.75 \quad n=17 \qquad (6)$$

$$QDR_t = .171 - .029\,\frac{Y_t}{CPI_t} - .0001\,\frac{PR_t}{PN_t} - .0002\,\frac{PF_t}{CPI_t}$$
$$(48.552)\quad(-4.868)\quad(-3.505)\quad(-2.114)$$

$$\bar{R}^2 = .98 \quad DW = 1.43 \quad n=17 \qquad (7)$$

Equations 6 and 7 are reduced form demand equations in that they are derived from a consumer demand function, a demand function for the intermediate marketing sector, and a market clearing identity.10/ Negative coefficients for Y_t for both rice and wheat indicate that per capita consumption has not increased with income. These results were also obtained by Greenshields and by Rojko et al. The price of fish, PF, is included in equation 7 on the assumption of its complementarity to rice.

Stock Equations

Wheat stocks are estimated by the following equation:

$$\Delta WS_t = 1790.330 - 1.071\,WS_{t-1} - 2.005\,EXR_t + 395.750\,D3$$
$$(4.509)\quad(-5.554)\quad(-2.474)\quad(4.357)$$

Table 1. DEFINITIONS OF VARIABLES

AR	Acreage planted in rice, 1000 hectares.
AW	Acreage planted in wheat, 1000 hectares.
CPI	Consumer price index, 1975/76 = 1000.
D1	Dummy variable representing change in diversion payment policy to provide payment only for production of other crops 1961/62 - 1973/74 = 0, = 1 otherwise.
D2	Dummy variable representing low rice yields not attributable to economic factors, = 1 1971/72 and 1976/77, = 0 all other years.
D3	Dummy variable representing policy of Japanese govenment to hold larger stocks, 1975/76 - 1977/78 = 1, 0 otherwise.
D4	Dummy variable representing surplus disposal program, 1970/71 - 1973/74 = 1, = 0 otherwise.
DV	Payments to producers for production of wheat and other crops on paddy land, 1000 yen per hectare.
EXR	U.S. $ - yen exchange rate, yen per dollar.
MAN	Index of wages received in the manufacturing sector, 1975/76 = 1000.
MW	Japanese wheat imports, 1000 mt.
PF	Retail price index for fish, 1975/76 = 1000.
PFI	Index of price paid for fertilizer, 1975/76 = 1000.
PIC	Japanese c.i.f. import price of corn, $ per ton.
PN	Retail price of dried wheat noodles, yen per kg.
POP	Japanese population, million persons.
PPI	Index of prices paid for inputs, 1975/76 = 1000.
PPR	Government support price for rice, yen per ton.
PPW	Government support price for wheat, yen per ton.
PR	Government resale price of rice, yen per ton.
PRR	Retail price of rice, yen per .10 kg.

PRW Government resale price of wheat, yen per kg.

PTR Thai rice export price, $ per ton.

QDR Japanese consumption of rice, per capita, brown basis, 1000 mt.

QDW Japanese consumption of wheat, per capita, 1000 mt.

QRS Total rice production, 1000 mt.

QWS Total wheat production, 1000 mt.

REX Net rice exports, 1000 mt.

RF Rice stocks diverted to feed, 1000 mt., 1970/71 - 1973/74.

RS Rice stocks, end of period, 1000 mt.

WS Wheat stocks, end of period, 1000 mt.

Y Japanese gross national product, per capita, million yen per person.

YDR Rice yield, mt./hectare.

YDW Wheat yield, mt./hectare.

$\overline{R}^2 = .68 \quad DW = 1.65 \quad n = 17$ (8)

The results of this equation, which relates government-held wheat stocks to economic and policy variables, indicate that the exchange rate and the level of the previous stocks are important in determining the behavior of government stock managers. The coefficient of WS_{t-1} indicates almost perfect adjustment. The significance of the exchange rate (EXR) in equation 8 indicates that foreign exchange availability is important for the Japanese government in its storage decisions. A decline in the US $ - yen exchange rate, representing a decrease in the cost of imported wheat to the Food Agency in terms of foreign exchange, results in an increase in wheat stocks.

Rice stocks are estimated by the following identity:

$$\Delta RS_t = - QDR_t * POP_t - REX_t - RF_t + QSR_t \quad (9)$$

No behavioral equation was estimated because it was assumed that rice stocks are accumulated after production, consumption, and export decisions have been made. The variable RF_t represents exogenous disposal of rice for feed under an earlier surplus disposal program (1970/71-1973/74). No behavioral equation for RF_t was estimated due to lack of sufficient observations. 11/

Trade Equations

Wheat imports are represented by the following identity:

$$MW_t = QDW_t * POP_t + \Delta WS_t - QSW_t \quad (10)$$

No behavioral equation was estimated because it was assumed that Japanese wheat imports are determined after consumption, production, and stock decisions have been made.

The rice export equation is estimated as:

$$REX_t = \underset{(-1.038)}{-102.94} + \underset{(4.678)}{.065}\, RS_{t-1} + \underset{(2.641)}{83.8994} \frac{(D4 * PTR_{t-1})}{PIC_{t-1}} - \underset{(-3.316)}{226.543}\, D3 \quad (11)$$

$\overline{R}2 = .95 \quad DW = 2.30 \quad n = 9$

The coefficient of PTR/PIC in equation 11 indicates that during the earlier surplus disposal program 1970/71-1973/74, the volume of rice exported was partly determined by relative prices of rice and imported corn. The level of the previous year's stocks, which indicates surplus rice availability, is positively related to rice exports. D3 is included in equation 11 as well as in equation 8 to represent the Japanese government's policy to hold large stocks of food and feed grains after 1975.

Validation

To validate the model, Newton's Method was used to simultaneously solve the eleven equations in the model over a nine year time period from 1969 to 1977. 12/ Actual and predicted values for the endogenous variables are shown in appendix 1. Predicted values closely followed the trends of actual values. Deviations between predicted and actual values averaged less than 10 percent for rice production, wheat imports, wheat and rice consumption, and wheat stocks. Deviations between predicted and actual values for wheat acreage averaged less than 27 percent with the largest deviations in 1974 (the first year of the wheat bonus program) and in 1977. Rice exports are overestimated in 1975-77, years in which Japanese rice exports were small. Estimated production and consumption elasticities are shown in table 2.

Simulation Results

Equations 1-11 were used to analyze the impact of exogeneous increases in the resale and producer support prices of rice and wheat on Japanese rice stocks, wheat imports, and rice exports. The model was first solved for a base period, year 1, using the observed values of all predetermined

Table 2--Estimate of Elasticities at Means

Elasticities	Wheat a/		Rice	
	Short run	Long run	Short run	Long run
.) Price elasticity of supply	.74	2.30	.31	.42
:) Cross price elasticity of supply	-.76	-2.36	-.18	-.25
l) Price elasticity of demand	-	-.33	-	-.08 b/
:) Cross price elasticity of demand	-	.11	-	-
i) Diversion payment elasticity	.02	.07	-.03	-.04

' The reader should be aware that estimated wheat production elasticities are computed
:om a smaller base than estimated rice production elasticities.

' Price variable is ratio of resale rice price to the retail price of noodles.

variables. The price changes were introduced into the model in the second year and the model was solved recursively for 5 years to estimate the time paths of adjustment to the specified changes (see Novakavic and Thompson for a description of this procedure). Price changes were assumed to be once and for all and were held at the levels established in year 2.

The base year chosen was 1973 because this is the last year for which data is available in which Japan was administering a surplus rice disposal as well as a diversion program. Since Japan is currently administering a 5-year surplus disposal program (1979/80 - 1984/85) and a 10 - year diversion program (1978/79 - 1988/89), it is believed that current conditions are similar to that earlier period.

The simulated impact of the price changes are summarized in table 3. Simulation I presents the impact of an 11.0 percent increase in the relative resale price of wheat to rice and a 2.4 percent increase in the producer price of wheat relative to rice from 1973 base values. 13/ Similar percentage increases in resale prices were effective in February 1980 and a similar percentage increase in the wheat producer price went into effect for the 1979/80 crop year. Simulation results indicate projected changes in the endogenous variables following these price changes (year 2 values) as well as the projected cumulative changes under the assumption the policies are maintained over a five year period.

The results of simulation I indicate an immediate decline in wheat imports of 3.6 percent and decline of 4.0 percent from the base value by year 5. This policy by itself, however, is not sufficient to bring about a large decrease in rice production. Rice stocks decline 7.7 percent from their base 1973 level by year 5 because of increased rice consumption and

Table 3. Comparison of Actual 1973 values with solution values for 1973 and simulation results.

Variable	Base value 1973	Base solution value 1973	Simulation I Projected values: Year 2 a/	Simulation I: Percentage change b/	Simulation I: Percentage change year 5 c/	Simulation II projected values: Year 2 d/	Simulation II: Percentage change b/	Simulation II: Percentage change year 5 c/
Wheat imports	5353	5400	5208	-3.6	-4.0	5195	-3.8	-5.2
Wheat production	202	155	170	9.6	25.5	182	17.4	64.5
Rice exports	392	418	418	0.	-4.2	418	0.	-26.5
Rice production	12149	12143	12103	-.3	-.4	11920	-1.8	-4.0
Rice stocks	4095	4260	4196	-1.5	-7.7	4012	-5.8	-48.9

a/ Increase in the relative wheat to rice resale price of 11 percent and an increase in the relative wheat to rice producer support price of 2.4 percent.
b/ Percent change of year 2 from the base solution value.
c/ Percent change of year 5 value from the base solution value.
d/ Increase in the rice diversion payment from 400,000 yen per hectare to 550,000 yen per hectare in addition to changes in simulation I.

decreased rice production. Rice exports decline 4.2 percent by year 5 due to the reduced availability of surplus stocks.

Simulation II presents the scenario of increasing the rice diversion payment 34 percent in addition to the changes introduced in simulation I. A similar percentage increase in the rice diversion payment took place in the 1978/79 crop year. 14/ The simulation results show that the increase in the in the diversion payment results in an increase in wheat production of 17 percent and a decrease in rice production of 2 percent in year 2.15/ Wheat imports decline 4 percent in year 2 and 5 percent in year 5. This decline in wheat imports is coupled with a larger percentage decline in rice exports of 26 percent by year 5. Thus these rice policies result in decreased wheat imports and a decreased supply of surplus rice which, in turn, reduces rice exports, all other things equal.

The diversion policy in combination with pricing policies results in a decline of 50 percent in rice stocks from the base value by year 5 or a decline of 1962 thousand metric tons (brown basis). This decline is short of the 70 percent decrease from the 1979/80 stock levels estimated by FAS desired by Japanese officials (Ministry of Agriculture, Forestry and Fisheries, Food Agency).

Conclusions

Japanese rice and wheat policies affect trade through their impact on Japan's wheat imports and rice exports.16/ The United States has an interest in the trade effects of these policies as Japan is a major importer of U.S. wheat (10 percent of the value of U.S. wheat exports in 1979). In addition, Japan's rice exports compete with U.S. rice exports in traditional Asian markets.

The results of this analysis indicate a decline in wheat imports of about 4 to 5 percent (from 1973 base values), all other things equal, from percentage changes in producer and consumer prices and in diversion payments introduced in recent years. The decrease in projected wheat imports in the analysis may be underestimated as the new diversion payment levels make wheat production more competitive with rice in contrast to the period of estimation. Further increases in both wheat producer and resale prices in following years may further work to decrease wheat imports all other things constant.

At the same time, the paddy field diversion program appears to be an effective policy in reducing surplus stocks. However, its success depends upon other factors such as weather and future demands for increases in rice support prices. Unusually favorable weather in Japan resulted in bumper rice crops in 1978 and 1979 and in increased rice stocks despite the diversion program effort.

A further note of caution to the interpretation of these results is that Japan agreed to limit rice exports to about 400,000 tons (milled) over a period of 4 years in a recent U.S. - Japan bilateral agreement. Because the rice export equation was estimated over a period in which such an agreement did not exist, the estimated relationship between rice stocks and rice exports may not hold. This limit on exports, while working to stabilize rice export markets, will place increased dependence upon feed disposal programs and/or diversion programs to reduce accumulated rice stocks. Increased reliance on rice diversion programs may work to further reduce wheat imports in the future.

FOOTNOTES

1. Japan agreed to restrict rice exports to about 400,000 tons (milled) over a period of four years U.S. - Japan consultations in April 1980. Additional trade impacts for feed grains could result from disposal of rice in livestock feed. The current surplus disposal program, which began in 1979/80, plans for feed disposal starting in 1981. Trade impacts of Japanese policies on feed use are not discussed in this paper.
2. This partially free market was established in 1969 in order to reduce the cost of rice control to the government and to improve the quality of rice marketed (Organisation for Economic Co-operation and Development 1974).
3. Wheat imports are physically managed by licensed traders who sell all imported wheat to the government at the port.
4. Wheat producers have been given increased incentive to produce wheat since 1974 when bonus payments were announced in addition to the support price. The bonus payment was incorporated into the wheat support price in 1976. Rice producers also receive additional incentive payments to double-crop rice and wheat. On the consumption side, announced increases in the resale wheat price were larger than increases in the rice resale price for 1980 and 1981.
5. The data are on a Japanese fiscal year basis, April-March except for wheat data which are on a July-June basis. The rice export equation was estimated from 1969-1977 because previous to this time period Japan was a large net importer of rice.

6. It is recognized that OLS may not be a consistent estimator when there is a lagged endogenous variable on the right hand side of the equation. For this reason, Durbin's h statistic (Johnston, pp. 312-313) is provided for equations 1 and 2. Strictly speaking, however, Durbin's h statistic is for large samples and its small sample properties are unknown.

7. The barley price was not included in equation 2 because of high correlation with the wheat price (.995).

8. Crops to which paddy land has been diverted over the period of the program include forage, vegetable crops, and fruits.

9. The coefficient of variation of wheat yields over the time period was .125.

10. Specifically, the three equations from which the wheat demand function is estimated are:

(a) QDN = f(PN, PRR, Z)
(b) QDW = f(PN,PRW)
(c) QDN = α QDW

Where QDN is consumption of wheat noodles and Z represents other exogenous factors. Eliminating PN in (b) and substituting into (a), and substituting (c) into (a) obtains the reduced form equation

(d) QDW = f(PRW, PRR, Z).

Alternatively, it could be assumed that retail margins are constant over time.

11. Diversion into industrial use is not included in equation 9. Diversion into industrial use has had almost no effect on stocks as it basically replaces new-crop rice with old-crop stocks and results in little or no net stock drawdown.

12. The version of Newton's Method used is contained in the TROLL Simulation Package. See MIT Center for Computational Research in Economics and Management Science for a description.

13. The increase in the retail wheat noodle price was limited to .4 of the increase in the wheat resale price. Wheat represents about 40 percent of the cost of the noodles.

14. This policy simulation represents an increase in the diversion payment received by rice producers form 400,000 yen per hectare to 550,000 yen per hectare. Rice farmers actually receive different incentives for retiring rice area depending on the crop they decide to cultivate.

15. The effect of the diversion payment on wheat acreage should be interpreted with a degree of caution because the diversion payment variable was not significant at acceptable levels in equation 2.

16. Future feed grain trade may be affected by these impacts, but is not discussed in this paper.

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Appendix I

The following tables provide the validation run for the Japanese rice and wheat sector model. Each table provides for the endogenous variables from 1969 to 1977 the actual value (actual), the predicted model value (model), the absolute and precentage differences between the two solutions (ER and PCER) and the root mean square (RMS).

SIMULATION OUTPUT BY VARIABLE

PER CAPITA RICE CONSUMPTION (QDR)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	0.11669	0.117053	0.000363	0.311023
1970	0.11415	0.114099	-5.120039E-05	-0.044854
1971	0.11178	0.111586	-0.000194	-0.173194
1972	0.11011	0.109257	-0.000853	-0.774465
1973	0.1107	0.108899	-0.001801	-1.62677
1974	0.10882	0.111051	0.002231	2.05012
1975	0.10688	0.106473	-0.000407	-0.381173
1976	0.10451	0.104384	-0.000126	-0.120224
1977	0.10059	0.10074	0.000151	0.149619

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	0.109359	0.109282	-7.634029E-05	-0.067769
RMS	0.109456	0.109383	0.001018	0.928542
STD.DEV	0.004896	0.004963	0.001077	0.982262

SIMULATION OUTPUT BY VARIABLE

PER CAPITA WHEAT CONSUMPTION (QDW)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	0.051348	0.051186	-0.000162	-0.314772
1970	0.04952	0.051333	0.001813	3.66198
1971	0.05006	0.05132	0.00126	2.51797
1972	0.05166	0.051628	-3.208220E-05	-0.062103
1973	0.051191	0.051161	-2.952293E-05	-0.057672
1974	0.050347	0.050625	0.000278	0.552367
1975	0.05162	0.051658	3.826618E-05	0.07413
1976	0.05073	0.050593	-0.000137	-0.269546
1977	0.05094	0.050454	-0.000486	-0.953327

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	0.050824	0.051107	0.000283	0.572114
RMS	0.050829	0.051108	0.000763	1.53292
STD.DEV	0.000731	0.000448	0.000752	1.50842

SIMULATION OUTPUT BY VARIABLE

RICE AREA (AR)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	3274.	3235.09	-38.9116	-1.1885
1970	2923.	2936.62	13.6199	0.465955
1971	2695.	2697.27	2.2688	0.084185
1972	2640.	2671.98	31.9849	1.21155
1973	2622.	2604.33	-17.6738	-0.674059
1974	2724.	2691.93	-32.0662	-1.17717
1975	2764.	2792.83	28.8337	1.04319
1976	2779.	2793.04	14.0413	0.505263
1977	2757.	2744.47	-12.5261	-0.454339

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	2797.56	2796.4	-1.1588	-0.020437
RMS	2803.85	2802.11	24.1611	0.849485
STD.DEV	199.193	189.717	25.5972	0.900754

SIMULATION OUTPUT BY VARIABLE

RICE EXPORTS (REX)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	392.	457.116	65.116	16.6112
1970	770.	815.247	45.2473	5.87627
1971	849.	749.927	-99.0725	-11.6693
1972	458.	542.329	84.3291	18.4125
1973	392.	512.447	120.447	30.7263
1974	208.	267.771	59.7708	28.7359
1975	-27.	37.4444	64.4444	-238.683
1976	-15.	74.6282	89.6282	-597.521
1977	29.	38.7571	9.75713	33.6452

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	339.555	388.407	48.8519	-79.3184
RMS	456.539	479.915	77.1547	215.429
STD.DEV	323.684	298.983	63.3414	212.446

SIMULATION OUTPUT BY VARIABLE

Wheat Imports (MW)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	4424	4535.84	111.84	2.528
1970	4834	4923.4	89.40	1.849
1971	4964	5034.98	70.98	1.430
1972	5468	5323.3	-144.70	-2.646
1973	5353	5417.05	64.05	1.197
1974	5404	5275.07	-128.93	-2.386
1975	5923	5885.66	-37.34	-.631
1976	5521	5512.07	-8.93	-.162
1977	5764	5662.32	-101.68	-1.764

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	5295	5285.52	-9.48	1.790
RMS	5314	5299.46	93.70	1.813
STD.DEV	473.20	407.464	152.11	2.900

SIMULATION OUTPUT BY VARIABLE

Rice Stocks (RS)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	10142.	10014.9	-127.109	-1.2533
1970	9861.	10246.8	385.844	3.91282
1971	6566.	7530.2	964.199	14.6847
1972	4896.	6327.51	1431.51	29.2383
1973	4095.	5623.65	1528.65	37.3297
1974	4146.	5566.21	1420.21	34.255
1975	5342.	6130.29	788.289	14.7564
1976	5310.	5586.12	276.125	5.20009
1977	6893.	6486.41	-406.594	-5.89865

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	6361.22	7056.9	695.68	14.6917
RMS	6711.41	7268.68	963.827	20.9069
STD.DEV	2269.39	1847.47	707.542	15.7769

SIMULATION OUTPUT BY VARIABLE

RICE YIELD (YDR)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	4.277	4.32079	0.043792	1.02389
1970	4.3411	4.50905	0.167946	3.86874
1971	4.0397	4.20641	0.16671	4.12679
1972	4.5034	4.62148	0.118078	2.62198
1973	4.6335	4.67288	0.039384	0.849981
1974	4.5125	4.63963	0.127127	2.81721
1975	4.763	4.4827	-0.280302	-5.88499
1976	4.2361	4.05837	-0.177732	-4.19564
1977	4.7497	4.53237	-0.21733	-4.57566

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	4.45066	4.44929	-0.00137	0.072478
RMS	4.4567	4.45373	0.16565	3.67806
STD.DEV	0.245993	0.210886	0.175693	3.90041

SIMULATION OUTPUT BY VARIABLE

WHEAT AREA (AW)

	ACTUAL	BASE	BASE_ER	BASE_PCER
1969	287.	270.339	-16.6611	-5.80527
1970	229.	221.718	-7.28223	-3.18001
1971	166.	175.181	9.18057	5.53046
1972	115.	123.612	8.61229	7.48894
1973	75.	63.5992	-11.4008	-15.2011
1974	83.	105.955	22.9553	27.6569
1975	90.	107.884	17.8839	19.871
1976	89.	84.4138	-4.58615	-5.15298
1977	86.	66.9444	-19.0556	-22.1577

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	BASE	BASE_ER	BASE_PCER
MEAN	135.556	135.516	-0.039324	1.00559
RMS	153.305	151.558	14.3372	15.0512
STD.DEV	75.9475	71.9772	15.2068	15.9285

SIMULATION OUTPUT BY VARIABLE

WHEAT STOCKS (WS)

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
1969	860.	1001.1	141.096	16.4065
1970	950.	1010.64	60.6443	6.3836
1971	1000.	1065.12	65.1177	6.51177
1972	1170.	1139.16	-30.8437	-2.63622
1973	1110.	1145.47	35.4731	3.19578
1974	1150.	1119.46	-30.5422	-2.65585
1975	1500.	1511.93	11.9329	0.795524
1976	1470.	1512.66	42.6616	2.90215
1977	1655.	1598.84	-56.1577	-3.39322

STATISTICS FOR SIMULATION OUTPUT BY VARIABLE

	ACTUAL	MODEL	MODEL_ER	MODEL_PCER
MEAN	1207.22	1233.82	26.598	3.05666
RMS	1234.48	1253.95	63.3199	6.64255
STD.DEV	273.646	237.333	60.9484	6.25522