



HOKKAIDO UNIVERSITY

Title	The Economic Effect of Public Expenditures in Agriculture
Author(s)	KUROYANAGI, Toshio
Citation	北海道大学農経論叢, 45, 209-255
Issue Date	1989-03
Doc URL	https://hdl.handle.net/2115/11034
Type	departmental bulletin paper
File Information	45_p209-255.pdf



The Economic Effect of Public Expenditures in Japanese Agriculture

Toshio Kuroyanagi *

Table of Contents

1. Introduction-Problem and Background-	209
2. Outline of Agricultural Fiscal Expenditures in Japan	211
3. Estimation of Models and Structural Equations	215
1) Framework of the Models	215
2) Estimation of Structural Equations	219
4. Measurement of Economic Effect shown by the Simulations	240
1) Tests for Goodness of Fit	240
2) Understanding the Economic Effect shown by the Simulations	242
5. Conclusions '	251
References	254

1. Introduction-Problem and Background-

The fiscal policies of the Japanese Government have been asked the difficult response for the reconstruction of the government finance in the continuing depression under the increasing exchange rate of yen. Government services and intervention have increased in order to adjust the "Market Failure" during the high economic growth period. However, at present there are demands for a reestablishment of "cheap government", because Japanese central government has to get rid of high pressure of increasing national debt and has to restore more competitive private firm activities under more expanding

* Professor, Dept. of Agricultural Economics, Hokkaido University. This paper was presented at the XX International Conference of Agricultural Economists, Buenos Aires, Argentina, August 27, 1988. Before this conference, the summary of this paper was presented at the Seminar for the faculty members in the Dept. of Rural Economy April 11, 1988, when I was invited by the University of Alberta in Canada.

trade friction between Japan and other countries. This makes budget cuts in various administrative fields necessary. Recently there has been an especially strong argument for agricultural budget cuts raised by the Extraordinary Adjustment Council and Administrative Reform Council. Foremost among these arguments is that agricultural fiscal expenditures have less economic impact and work less efficiently both on the agricultural and non-agricultural sectors. At the same time, there have been a lot of strong arguments internationally and domestically that big subsidies for agriculture have made it as an industry weaken and made domestic agricultural commodity prices higher than those of world prices. However, policy solutions must be acceptable for producers, consumers, and taxpayers. Simple reductions in expenditures, without considering the economic impact on agriculture & non-agriculture are not reasonable.

Here we examine the impact of agricultural fiscal expenditures on agricultural production, income, producer & consumer prices and on consumer's price index, wage rates, gross national product, and government tax revenue and its impact on the non-agricultural sector and national income in the period after the legislation of the Fundamental Agricultural Act. To perform this, we will adopt macro econometric models for an objective analysis of Japanese agriculture and the overall national economy. Further to measure, quantitatively, the overall economic impact on investment & production and consumption & finance in agriculture ; and the investment & production and final consumption structure in the non-agricultural sector. The time period for this analysis is confined to the eighteen years 1962 (the year after the start of the Fundamental Agricultural Act) through 1979.

An understanding of the economic impact of agricultural fiscal expenditures on agriculture, non-agriculture, and national income can offer a new point of view for a discussion of agricultural policies in Japan. This paper, to considerable extent, is based on a joint research between Dr. Hideaki Abe* and I.

* Dr. Hideaki Abe is the Associate professor of Hokkaigakuen-Kitami Univ.

2. Outline of Agricultural Fiscal Expenditures in Japan

Prior to the main part of this report, brief explanations will be given on :

- 1) the relative situation of the agricultural fiscal expenditures in the national and local government.
- 2) agricultural fiscal expenditures and agricultural income.
- 3) structure of agricultural fiscal expenditures by items and countries.
- 4) structure of the agricultural expenditures in national general account.
- 5) agricultural fixed capital formation by the structural items.
- 6) agricultural fixed capital formation by government subsidies and government loans.
- 7) sources of the funds of land improvement works.

On the item 1), agricultural expenditure in national general account was 11.4% in 1970 but was 5.9% in 1983. The amount of agricultural expenditure in local government level corresponds to 57.6% of that of national general account in 1983 (Table 1).

Table 1 . Relative Situation of the Agricultural Fiscal Expenditures in Japan

Expenditures in Japan						
	1960	1965	1970	1975	1980	1983
% of Agriculture in National General Account	7.8	9.3	11.4	9.5	7.3	5.9
% of Agricultural Expenditures in Local Govt. for that of National General Account	55.9	52.3	43.9	46.6	52.1	57.6
% of Agricultural Expenditures in National and Local Govt. for Total Net Govt. Expenditures (National and Local)	7.4	8.4	9.4	7.7	6.7	5.5

Source : M. Honma, The Structure of the Agricultural Fiscal Expenditures in Japan, Journal of Rural Economics (Japan), 1987, Vol .58, No. 4, P. 192.

On the item 2), the percentage of national agricultural fiscal expenditures for agricultural income in Japan before 1970 was relatively lower than that of the U. S. A. and that of Japan in 1983 was 46.1% which was higher than that of the U. S. A. (Table 2).

Table 2. Percentage Distribution of Agricultural Fiscal Expenditures for Agricultural Income by Countries

	1960	'65	'70	'75	'80	'83
Japan	9.3%	15.2	28.8	33.1	52.1	46.1
EC				30.7	35.7	
U. S. A	12.9	17.8	19.2	6.1	12.5	35.0

- 1) Agricultural fiscal expenditures include only that of national general account.
- 2) Agricultural fiscal expenditures includes that of common part among EC countries with that of each country.
- 3) Agricultural fiscal expenditures means that of federal budget. These were measured by Dr. M. Honma.
- 4) Source : Y. Hayami and M. Homa, The Review for Japanese Agricultural Policy . 1987 (Seisaku Kohsoh Forum) P. 24.

On the items 3), the percentage of the expenditures for the production policy in the national agricultural budget general account was 48.6% in 1984 and was remarkably higher than those of other countries, while that for the price and income policy is less than those of other countries (Table 3).

On the item 4), the national agricultural budget general account in Japan consists mainly of transfer payment and capital formation (Table 4).

On the items 5), about 50% of the agricultural fixed capital formation is devoted to the land improvement and less than 30% to the agricultural machine (Table 5).

On the item 6), the sum of government subsidies and loans has reached a level as high as 55% of the agricultural fixed capital formation (Table 6).

On the item 7), approximately 85% of the land improvement expenditures

The Economic Effect of Public Expenditure in Agriculture

comes from government expenditures (Table 7).

Table 3. The Structure of Agricultural Expenditures -1984-

	Japan	France	West Germany	U. K.	U. S. A.	EC
1. Agriculture	100.0	100.0	100.0	100.0	100.0	190.0
1) Production Policy	48.6	4.9	13.9	13.9	7.6	0.8
2) Structural Policy	2.8	8.2	8.7	0.6	—	0.6
3) Agricultural Finance	5.5	—	0.9	0.0	14.4	—
4) Price, Income Policy	23.6	24.5	59.0	66.7	20.7	93.3
5) Marketing, Processing	0.7	1.2	included in 1)	1.3	0.3	0.6
6) Demand Increase and Processing	0.7	1.1	0.1	0.5	55.1	—
7) Agricultural Damage Insurance	7.8	0.5	included in 9)	—	1.9	—
8) Regional Development	1.4	5.0	included in 2)	6.6	0.1	1.8
9) Welfare	3.0	48.8	26.0	0.0	—	—
10) Foreign Assistance	0.3	—	0.4	0.8	3.3	2.9
11) Others	5.6	1.1	0.4	9.7	△ 3.5	—
2. Agr., Forestry & Fishery	Billion Yen 3,460	Million F 101,595	Million M 13,943	Million P 2,108	Million D 34,973	Million ECU 17,445
3. Total National Account	50,627	950,089	257,750	95,557	853,760	—
4. 2)/3) (%)	6.8	10.7	5.4	2.2	4.1	—

Source:

1) 1983.

Noseichosa-iinkai, Report on the Analysis of Agricultural Policies in the Main
Advanced Countries -1984-, 1985, March, P. 12.

Table 4. Structure of the Agricultural Expenditures in National General Account

	1960	1965	1970	1975	1980	1984
% of Ordinary Expenditures	15%	10	8	9	9	9
% of Capital Formation	46	37	27	28	38	39
% of Transfer Payment	39	53	65	63	53	52

Source: M. Honma, *ibid*, P. 193.

Table 5. Agricultural Fixed Capital Formation by Structural Items

	1960	1970	1980	1984
Agricultural Fixed Capital Formation (1)	100.0	100.0	100.0	100.0
Land Improvement / (1)	51.4	42.4	48.6	47.1
Agricultural Building / (1)	11.0	19.8	16.3	18.2
Agricultural Machine / (1)	20.8	26.7	28.8	28.1
Plant / (1)	7.4	4.7	2.1	2.2
Animal / (1)	9.4	6.4	4.2	4.3

Source: *ibid*, P. 98.

The Economic Effect of Public Expendure in Agriculture

Table 6. Agriculture Investment and the Source of Fund

	1970	1975	1980	1984
(1) Agricultural Fixed Capital Formation	Billion Yen 944.1	2,486.5	3,630.1	3,498.6
(2) Government Subsidies /(1)	(%) 22.8	25.4	38.5	37.8
(3) Government Loans /(1)	(%) 21.8	21.0	19.7	16.8

Source: The Ministry of Agriculture, Forestry and Fishery, Social Accounting of Agriculture and Farm Household Economy in Japan, 1986.

Table 7. Land Improvement Investment and Government

	Expenditures					
	1960	1965	1970	1975	1980	1984
Land Improvement Investment (1)	100.0	100.0	100.0	100.0	100.0	100.0
Government % Expenditures/(1)	73.3	77.1	74.0	79.9	83.8	85.8
Borrowing /(1)	19.6	16.3	17.2	17.7	14.9	12.9
Farmers' Payment /(1)	7.1	6.6	8.8	2.4	1.3	1.3

Source: The Ministry of Agriculture, Forestry and Fishery, "Social Accounting of Agriculture and Farm Household Economy", 1986. Pp. 71~72.

3. Estimation of Models and Structural Equations

1) Framework of Models

The model for this analysis consists of a simultaneous-equation framework of 41 structural equations and 25 definitive equations, with some of these equations being determined successively.

This model is non-linear, and the structural equations are estimated by the direct OLS method.

The model includes a total of 85 variables, 66 endogenous variables and 19 exogenous variables. The simulation of the impact of agriculture & non-agriculture on each endogenous variable in this model, will enable an understanding of the economic impact of agricultural expenditures like the rice price support, the subsidy per ha for conversion from paddy to other use, expenditures for rearrangement of paddy field use (the allotted area for production adjustment) as agricultural policy variables, the expenditures, for land improvement, agricultural price supports, extension services and institutional loans, *input goods prices* as *agricultural fiscal expenditures*.

The economic impacts of the above policy variables will be shown by the difference between the theoretical value of each endogenous variables and the theoretical value in the final tests of this model. The theoretical values can be obtained from simulation assuming a functional failure of the policy variables. The policy variables estimated for the national economy (endogenous variables) were systematically formulated as structural equations.

The overall framework of the model is largely divided into the following four areas : (a) "Agricultural Production Block" for dealing with agricultural production, (b) "Farm Household Economy Block" for dealing with farm income, consumption, and investment, (c) "Consumer Price Block" for dealing with food demand, food & consumer prices, and (d) "National Income Block" for dealing with gross domestic product and final demands. The following mutual linkages were attempted : the agricultural production block and farm household economy block through the two endogenous variables of agricultural product and agricultural intermediate inputs ; a linkage of the agricultural production block and consumers block through the variables of agricultural product and agricultural product prices ; and a linkage of the consumer price block and the national income block through gross product and consumer prices of food.

The agricultural production block is divided into the two sectors : paddy and others, such as crops & livestock. Production factors, planted areas, and intermediate inputs, are also allotted to two sectors corresponding to the above division. The fixed capital stock for agriculture (buildings and machin-

ery) is considered an agricultural variable as it is difficult to divide for each crop.

Furthermore, expenditures for agricultural extension services are included as a policy variable which affects products in the sectors from the policy side. We have assumed that the expenditure for agricultural extension services (spending for human capital in research, education, and guidance) raises production by improving breeding practices, progress in fertilizer management, and in mechanization research.

The producer response to rice prices is formulated to affect the formation of agricultural income through the subsidy for crop conversion, and with a deflator for subsidies spending per ha when determining areas for conversion from paddy to other crops.

In the farm household economy block, agricultural income is determined by subtracting the agricultural production costs amount defined by the intermediate inputs, wages, fixed capital depreciation, and cost of input goods from the agricultural product. The agricultural intermediate input as a production factor is determined by adding together the fixed capital stock from the previous period and the current investment flow. In this case, the investments (for the formation of agricultural fixed capital) is determined by the expenses for capital investments : institutional loans (policy variable) and loans from cooperative organizations, expenditures for land improvement as a policy variable, and agricultural product price indexes. Overall this is a simultaneous determinant framework.

In the consumer price block, the domestic supply of agricultural product is determined by the agricultural product specified in the agricultural production block. Next, the amounts of imported food & agricultural products, the domestic food supply, and wholesale food prices. Consumer prices of food and food expenditures are determined in the consumption stage. The general consumer price is simultaneously determined by both personal consumption expenditure (demand) such as expenditure for food and the domestic net product (supply) from the national income block as described later.

In the national income block, the overall system is simultaneously determined by the demand structure of the final demand and supply structure which is made up of the production capacity.

Expenditures for consumption by households as a final demand category is assumed to be simultaneously determined by both the expenditure for food specified through the consumer price of foods in the consumer price block, and the consumption expenditure for other items excluding food & drink.

Investment for private housing and corporate equipment is determined by the *personal income and corporate income* of the previous time period, and is successively determined in a linkage to the total formation of domestic fixed capital. The total formation of domestic fixed capital determines the product in secondary industry. Total domestic expenditures, such as personal consumption, final consumption by government and total formation of domestic total fixed capital are simultaneously determined in a linkage to the production in tertiary industry. The domestic production is determined in a mechanism which adds the production from forestry and fishery as a variable for the agricultural production specified in the agricultural production block.

With the limited data available, this model examines how endogenous variables in each block support the impact in this framework, divided into four blocks of simultaneous equations. A determination of consistency with economic theories is also attempted.

From the statistical point of view, possible simplification is attempted to avoid multicollinearity in the multi-variables metrical equations.

-
- 1) Expenditures for extension are assumed to Accumulate over a several year long time period, we use this expenditure for expenditure for extention services as an accumulated amount up to a t-6 time period, which has a high correlation with the strongest contribution to production as an accumulated amount of the expenditures within the time period from t-1 through t-10, we aim at giving one time period lag to an accumulated amount up to the t-6 time period.
 - 2) With respect to projects for agricultural structural reform, or other similar projects, loans from cooperative organizations are also demanded for supplementing the institutional loans of subsidies.

2) Estimation of Structural Equations

The outlines and results of the structural equations in each block are described below.

Parameter estimation is performed by the direct OLS method. The numbers in parentheses are parameter t-values : \bar{R}^2 shows determinant coefficients, LOG is the natural logarithm, and DW is Durbin-Watson statistics.

(1) Consumer Price Block

① Relative Market Price of Food

Market price of food are assumed to be prescribed by supply & demand. However, as with rice, the market prices of most agricultural products are determined by price support policies. Therefore, the supply & demand factor is formulated with both a expenditure demand factor for personal consumption and supply factor of the domestic food supply, including a price factor for agricultural product prices.

$$\text{PMRE} = 0.9113 + 0.001102 (\text{PAG}) - 0.429102 (\text{GSPF/ RPCE})$$

$$(12.2307) \quad (3.04369) \quad (2.00346)$$

$$\text{PMRE} : \text{Relative Market Price of Food} \quad \bar{R}^2 = 0.8532$$

$$\text{PAG} : \text{Agricultural Product Price} \quad \text{DW} = 1.637$$

GSPF : Domestic Food Supply

RPCE : Personal Consumption

② Imported Agricultural Products for Food Consumption

A growing amount of imported agricultural products for food consumption has caused forth the an expansion in livestock consumption and an increase in feed demand, due to an increasingly diversified and improved diet. This is due to stable imported product prices and improvements in the foreign reserve situation supported by high economic growth. The equation is formulated with personal consumption as a variable that shows strong purchasing power under high economic growth, and terms of trade as a variable showing the relative price between market price of food and imported agricultural product price.

$$RIMPA = 190.875 - 486.7501(PIMP/PMF) + 0.409126(RPCE)$$

$$(0.6162) (0.4816) \quad (6.9197)$$

$$RIMPA : Imported Agricultural Products \quad \overline{R^2} = 0.8712$$

$$PIMP : Imported Agricultural Product Prices \quad DW = 1.478$$

PMF : Market Price of Foods

RPCE : Expenditures for Personal Consumption

③ Consumer Price of Food

The consumer price of food is formulated by the market price as a market factor and the rice price index for rice as a variable representing the policy side factor. This consumer price of food is used as the price factor (price variable) of expenditures for food described later.

$$PCF = -17.6572 + 0.93829(PMF) + 0.256104(PR)$$

$$(4.5418) (4.2366) \quad (1.3628)$$

$$PCF : Consumer Price of Food \quad \overline{R^2} = 0.9958$$

$$PMF : Market Price of Food \quad DW = 1.647$$

PR : Rice Price Index

④ Agricultural Product Price

The agricultural product price formulated by the average production cost which is a factor in the farming and the consumer price of food of the previous time period which is a market factor, and includes policy expenditures for agricultural product prices as a variable, in view of that, many agricultural products are objective items for price support policies.

$$PAG = -1.60111 + 0.012734(PAJT) + 0.824723(PCFt - 1)$$

$$(0.8788) (4.19953) \quad (3.6299)$$

$$+ 10.27832(COT 1 / GYYT)$$

$$(2.79918)$$

$$PAG : Agricultural Product Price \quad \overline{R^2} = 0.9953$$

$$PAJT : Expenditure for Agricultural \quad DW = 1.108$$

Price Supports

PCF : Consumer Price of Food

COTI/GYYT : Average Agricultural Production Cost

⑤ General Consumer Price

General consumer price is formulated by the supply & demand factor represented by the personal consumption (demand) to net domestic product (supply) ratio, and by the labor wage rate of the previous time period as a dummy variable setting the trend in commodity prices.

$$PCT = -100.9589 + 93.09182(RPCE/RGNP) + 1.44385(WRt - 1)$$

$$(1.2743) \quad (1.6294) \quad (6.1263)$$

PCT : General Consumer Price $\bar{R}^2 = 0.9023$

RPCE : Personal Consumption Expenditure DW = 1.003

RGNP : Net Domestic Product

WR : Labor Wage Rate

⑥ Personal Consumption Expenditure

A consumption function of a Keynesian model which is determined by the disposable income factor.

$$RPCE = 11682.011 + 0.68201(RDINC)$$

$$(6.6061) \quad (33.4008)$$

RPCE : Personal Consumption Expenditure $\bar{R}^2 = 0.9859$

RDINC : Personal Disposable Income DW = 1.398

⑦ Food Expenditure

The food expenditure is the consumer price of food as a price variable and personal consumption expenditure as an income factor, as mentioned in the formulation of the consumer price of food.

$$(RFBT/POPU) = 0.092407 - 0.042373(PCRE) + 0.27642(RPCE/POPU)$$

$$(0.8414) \quad (0.32186) \quad (12.6499)$$

RFBT : Food Expenditure $\bar{R}^2 = 0.9828$

PCRE : Relative Consumer Price of Food DW = 1.320

RPCE : Personal Consumption Expenditure

POPU : Full-time Resident Population

⑧ Domestic Food Supply, ⑨ Market Price of Food, and ⑩ Relative Market Price of Food, are formulated in the forms of definitive equations :

$$GSPF = PGYYT + GSFF + RIMPA + REXPA$$

GSPF : Domestic Food Supply

RGYYT : Domestic Agricultural Product Supply

GSFF : Fisheries Supply for Food

RIMPA : Imported Agricultural Product

REXPA : Exported Agricultural Product

⑨

$$PMF = PMPRE \times PMT$$

PMF : Market Price of Food

PMPRE : Relative Market Price of Food

PMT : Wholesale Price Index

⑩

$$PCRE = PCF/PCT$$

PCRE : Relative Consumer Price of Food

PCF : Consumer Price of Food

PCT : General Consumer Price

⑪ Domestic Supply of Agricultural Product

The amount of agricultural products and the domestic supply of agricultural products should be essentially equal. The former is obtained by estimating all agricultural products with the "Agricultural Prices for Commodities Statistics", the latter is obtained by estimating all production volumes in the "Food Supply & Demand Tables" with market prices. Hence, it is formulated as an adjustment function to avoid inconsistencies between the two variables.

$$RGYYT = 3466.8702 + 0.5683(GYYT) \\ (10.3406) \quad (14.6654)$$

GYYT : Agricultural Products	$\bar{R}^2 = 0.9307$
Domestic Supply	DW = 2.366

GYYT : Agricultural Product

⑫ Labor Wage Rate

An increase of labor wage rates is assumed to reflect actions such as labor contracts or collective bargaining, through the increase of household

costs such as expenditures for food consumption. Here, the labor wage rate is formulated with explanatory variables of both the labor wage rate in the previous period, the labor wage and consumer food price.

$$WR = 10.36902 + 0.12584(PCF) + 0.78973(WR_t - 1)$$

(3.5831) (2.34854) (11.97031)

WR : Labor Wage Rate $\bar{R}^2 = 0.9739$

PCF : Consumer Price of Food DW = 1.496

(2) National Income Block

(A) Formulation of Production Structure

① Net Product in Tertiary Industry

The net product in tertiary industry is formulated by an explanatory variable for the total domestic expenditures, representing the amount of domestic sales. Tertiary industry will be divided into three sectors : commerce, private service, and public service. The net product of this industry can also be formulated by the aggregate of explanatory variables of expenditures such as private final consumption and government final consumption. In this model, this amount is estimated by the value of total domestic expenditure, a value composed of all these expenditures.

$$LOG(RTHS) = -0.02933 + 0.94183 LOG(RGNE)$$

(0.07731) (28.8509)

RTHS : Net Product in $\bar{R}^2 = 0.9811$

Tertiary Industry DW = 1.319

RGNE : Total Domestic Expenditure

② Net Product in Secondary Industry

The net product in secondary industry, like for tertiary industry, is formulated by the total amount of domestic fixed capital formation instead of estimating each sector (such as mining, manufacturing, and civil engineering). This sums up the production input factors (such as corporate equipment investments, private housing investments and formation of public fixed capital).

$$RSCS = -7829.5602 + 1.22522(RCAPT)$$

(3.5282) (22.5518)

$$\begin{aligned} \text{RSCS : Net Product in} & \quad \overline{R^2} = 0.9695 \\ \text{Secondary Industry} & \quad \text{DW} = 1.514 \end{aligned}$$

RCAPT : Domestic Total Formation
of Fixed Capital

③ Net Product in Primary Industry

The net product in primary industry is prescribed by a definitive equation obtained by aggregating the net agricultural product and net forestry & fishery product.

$$\text{RAGR} = \text{AYYT} + \text{RFIA}$$

RAGR : Net Product in Primary Industry

AYYT : Net Product in Agriculture

RFIA : Net Product in Forestry & Fishery

④ Net Domestic Product

The net domestic product is obtained by aggregating the net product of these three industries. To protect against inconsistencies from difference among deflators for each industry, a functional adjustment is attempted to maintain consistency in the amounts obtained.

④- 1

$$\begin{aligned} \text{RGNP} &= 352.1253 + 0.94844(\text{RTS}) \\ & \quad (0.78189) \quad (142.4750) \end{aligned}$$

RGNP : Net Domestic Product $\overline{R^2} = 0.9992$

RTS : Adjustment Variable for $\text{DW} = 1.264$
Net Domestic Product

④- 2

$$\text{RTS} = \text{RAGR} + \text{RSCS} + \text{RTHS}$$

RTS : Aggregate Net Production in
Primary, Secondary, and Tertiary Industry
(Adjustment Term)

RAGR : Net Production in Primary Industry

RSCS : Net Production in Secondary Industry

RTHS : Net Production in Tertiary Industry

(B) Formulation of Income Structure (Distribution)

⑤ Personal Income and Corporate Income

In formulation of distributed incomes such as personal & corporate income, we adopt the allocation estimation method determined by the net domestic product of each.

⑤- 1

$$\text{RPINC} = -14137.7002 + 1.1729(\text{RGNP})$$

$$(4.53061) \quad (39.2571)$$

$$\text{PRINC : Personal Income} \quad \bar{R}^2 = 0.9897$$

$$\text{RGNP : Net Domestic Product} \quad \text{DW} = 1.383$$

⑤- 2

$$\text{RCORP} = 2886.7501 + 0.05944(\text{RGNP})$$

$$(3.33313) \quad (7.54851)$$

$$\text{RCORP : Corporate Income} \quad \bar{R}^2 = 0.7808$$

$$\text{RGNP : Net Domestic Product} \quad \text{DW} = 0.776$$

⑥ Personal Disposable Income and Personal Burden

The personal disposable income is obtained by subtracting the personal burden, which consists of direct taxes and other expenses excluding taxes, from the personal income. The formulation for personal burden is explained by personal income since personal burden is done under form of progressive taxation.

⑥- 1

$$\text{RDINC} = \text{RPINC} - \text{RDTAX}$$

RDINC : Personal Disposable Income

RPINC : Personal Income

RDTAX : Personal Burden

⑥- 2

$$\text{RDTAX} = -9405.111 + 0.28873(\text{RPINC})$$

$$(11.1484) \quad (37.4897)$$

$$\text{RDTAX : Personal Burden} \quad \bar{R}^2 = 0.9887$$

$$\text{RPINC : Personal Income} \quad \text{DW} = 0.759$$

(C) Formulation of Expenditure Structure

⑦ Household Consumption Expenditure and Government Final Consumption Expenditure

First, the household consumption expenditure is divided into expenditures for foodstuffs and others. The expenditure for food is formulated by price and income. The explanatory variable for price is the relative consumer price of food, and for income it is personal consumption (shown in Equation 7 in the Consumer Block).

⑦- 1

$$\text{REPC} = \text{RFBT} + \text{PEPCE}$$

REPC : Household Consumption Expenditure

RFBT : Expenditure for Food

REPCE : Household Consumption

for Things Other than Food

Household consumption other than food is formulated by an explanatory variable of personal expenditure for consumption as an income factor. For the final household consumption by non-profit private organizations, and personal consumption, definitive equations are established. These equations are obtained by subtracting household consumption from personal consumption.

⑦- 2

$$\text{REPCE} = -6098.3402 + 0.72144(\text{RPCE})$$

(10.3755) (86.0493)

PEPCE : Household Consumption $\bar{R}^2 = 0.9978$

Other than Food $\text{DW} = 1.325$

RPCE : Personal Consumption

⑦- 3

$$\text{ROETC} = \text{RPCE} - \text{REPC}$$

ROETC : Miscellaneous Personal Consumption

RPCE : Personal Consumption

REPC : Household Consumption

The government final consumption is specified by an explanatory variable

of the net domestic product. This considers that the expenditure depends on the size of the economy.

⑦- 4

$$RGCE = 4596.9804 + 0.07793(RGNP)$$

$$(12.0054) \quad (21.2524)$$

RGCE : Government Final Consumption $\bar{R}^2 = 0.9658$

DW = 0.522

⑧ Total Domestic Expenditure

The total domestic expenditure is obtained by aggregating the private final consumption, government final consumption, overseas surplus, and total fixed capital formation. In this model, consistency for a definitive equation is not fulfilled because the inventory and overseas business surplus are not explicitly included. The bias is removed with an adjustment function.

⑧- 1

$$RGNE = -2428.1201 + 1.02853(RGNEM)$$

$$(1.98047) \quad (103.519)$$

RGNE : Total Domestic Expenditure $\bar{R}^2 = 0.9985$

RGNEM : Adjustment Variable for $DW = 0.846$

Total Domestic Expenditure

⑧- 2

$$RGNEM = RCAPT + RPCE + RGCE$$

RGNEM : Adjustment Variable for

Total Domestic Expenditure

RCAPT : Total Domestic Fixed

Capital Formation

RPCE : Personal Consumption

RGCE : Government Final Consumption

(D) Formulation of Investment Structure

⑨ Private Housing Investment

Private housing investment is formulated by personal income as the income factor, over consideration of a time lag for decision making. General-

ly, an interest rate factor is considered desirable for this formulation, but this is not taken into account due to the characteristics of the model.

$$\text{RIPD} = 10.25043 + 0.074975(\text{RPINC}_t - 1) \\ (1.7335) \quad (12.9363)$$

$$\text{RIPD} : \text{Private Housing Investment} \quad \overline{R^2} = 0.9127$$

$$\text{RPINC} : \text{Personal Income} \quad \text{DW} = 0.759$$

⑩ Corporate Equipment Investment

Corporate equipment investment, similar to the above housing investment, is formulated by corporate income as the income factor over consideration of a time lag for decision making. The estimate is performed by adding the public formation of fixed capital as an explanatory variable, which seems to be a push from the policy side.

$$\text{RIOD} = -940.6254 + 0.67581(\text{RCORP}_t - 1) + 1.288342(\text{RIGD}) \\ (0.6598) \quad (3.71752) \quad (9.9958)$$

$$\text{RIOD} : \text{Corporate Equipment Investment} \quad \overline{R^2} = 0.9474$$

$$\text{RCORP} : \text{Corporate Income} \quad \text{DW} = 1.357$$

RIGD : Public Formation of Fixed Capital

⑪ Domestic Total Formation of Fixed Capital

For total domestic fixed capital formation, a definitive equation is obtained by aggregating the private housing investment, corporate equipment investment, and the public fixed capital formation.

$$\text{RCAPT} = \text{RIPD} + \text{RIOD} + \text{RIGD}$$

RCAPT : Total Domestic Fixed Capital Formation

RIPD : Private Housing Investment

RIOD : Corporate Equipment Investment

RIGD : Public Formation of Fixed Capital

⑫ Government Revenue (Tax Revenue)

The tax revenue received by the government is obtained by adding direct taxes, indirect taxes, and other government revenues. However, as it is difficult to model factors which prescribe other government revenues, this tax revenue is estimated by explanatory variables for direct & indirect taxes.

The direct tax is an aggregate of personal and corporate taxes. The indirect tax is explained by total domestic expenditure because it depends on expenditure size.

⑫- 1

$$\text{RGCR} = -6360.0612 + 1.69834(\text{RTAX} + \text{RIDTAX})$$

$$(3.8689) \quad (22.7819)$$

$$\text{RGCR : Government Revenue} \quad \bar{R}^2 = 0.9701$$

$$(\text{Tax Revenue}) \quad \text{DW} = 1.531$$

RTAX : Direct Taxes

RIDTAX : Indirect Taxes

⑫- 2

$$\text{RIDTAX} = 5902.8702 + 0.03264(\text{RGNE})$$

$$(13.0026) \quad (8.93833)$$

$$\text{RIDTAX : Indirect Taxes} \quad \bar{R}^2 = 0.8332$$

$$\text{RGNE : Total Domestic Expenditure} \quad \text{DW} = 0.678$$

(3) Agricultural Production Block

① Total Planted Area

As mentioned above, agricultural production is divided into paddy and other crops, such as seed-plant crops & livestock, and for the planted area and intermediate inputs, a similar division is necessary. In the model, the total planted area is expressed by the capacity of the planted area, and by the price, (the terms of trade) the ratio between agricultural product price and input goods price. The formulation is achieved by distributing the cultivated area and relative price to the two sectors, paddy and other crop. The planted area is connected by planted area of rice before crop conversion and planted area with seed-plants excluding paddy.

①- 1

$$\text{LAAG} = -5656.0002 + 1.8765(\text{LAND}) + 1219.2501(\text{PAG/PPPT})$$

$$(1.06221) \quad (1.65986) \quad (1.69734)$$

$$\text{LAAG : Total Planted Area} \quad \bar{R}^2 = 0.9555$$

$$\text{LAND : Cultivated Area} \quad \text{DW} = 0.545$$

PAG : Agricultural Product Price

PPPT : General Index of Input Goods Price

①- 2

$$\text{LAR.IF} = 2339.3902 + 0.115943(\text{LAAGt} - 1) \\ (19.5402) \quad (6.48832)$$

LAR.IF : Area Planted with Rice Crops $\bar{R}^2 = 0.7246$
before Crop Conversion $DW = 0.545$

LAAG : Total Planted Area

①- 3

$$\text{LOAT} = \text{LAAG} - \text{LAR}$$

LOAT : Area Planted with Seed-Plants Excluding Paddy

LAAG : Total Planted Area

LAR : Area Planted with Paddy

The area planted with paddy is obtained by subtracting the area allotted for production adjustments and the area for rice crop conversion, obtained by equation ①- 2. Here, the area for rice crop conversion is determined from the subsidy payment per ha deflated with the rice price index, and the countermeasures for readjustment of paddy field use.

①- 4

$$\text{LAR} = \text{LAR.IF} - \text{LAR.SA}$$

LAR : Area Planted with Paddy

LAR.IF : Area Planted with Rice

Before Crop Conversion

LAR.SA : Area for Rice Crop Conversion

①- 5

$$\text{LAR.SA} = -88,37211 + 0.75031(\text{SAG}) + 404.9451(\text{SASUZ/PR}) \\ (1.20932) \quad (5.09311) \quad (2.08954)$$

LAR.SA : Area for Rice Crop Conversion $\bar{R}^2 = 0.9275$

SAG : Area Alloted for Production $DW = 2.138$

Readjustment (ha)

SASUZ : Subsidy Payment per ha

PR : Rice Price Index

② Cultivated Area

The cultivated area is specified by both the areas converted into agricultural use and the cultivated area in the previous period. The area converted to agricultural use is determined by the relative income, the terms of trade for the agricultural sector and non-agricultural sector. The area cultivated in the previous time period is determined by assuming a Koyck lag, where the current value depends on the previous values of more than one time period.

②- 1

$$\text{LAND} = 195.3754 + 0.96811(\text{LAND}_t - 1) - 1.34252(\text{ACONV})$$

(1.26741) (38.8032) (2.23316)

LAND : Cultivated Area $\bar{R}^2 = 0.9918$

ACONV : Area Converted to DW = 2.971

Agricultural Use

②- 2

$$\text{ACONV} = -1.30961 + 11.1235(\text{RYYT}_t - 1)$$

(0.2811) (7.91185)

ACONV : Area Converted to $\bar{R}^2 = 0.7964$

Agricultural Use DW = 0.832

RYYT : Relative Income for Agricultural

and Non-Agricultural Sectors

③ Intermediate Agricultural Inputs

In formulating intermediate agricultural inputs, the total amount of intermediate agricultural inputs is explained by the agricultural fixed capital equipment. Similar to the planting area in the previous clause, the agricultural production is divided into two sectors after detailing the intermediate inputs for paddy production, others by definition determined with the subtraction from the whole.

③- 1

$$\text{AGIN} = -127.6254 + 0.51021(\text{SKKT}) \\ (0.4774) \quad (11.9227)$$

AGIN : Intermediate Agricultural Inputs $\bar{R}^2 = 0.8988$

SKKT : Agricultural Fixed Capital Equipment DW = 0.865

③ - 2

$$\text{RIN} = -1271.5004 + 0.28216(\text{LAR}) + 0.34161(\text{AGIN}) \\ (3.7173) \quad (3.7706) \quad (7.6678)$$

RIN : Intermediate Inputs $\bar{R}^2 = 0.8851$
for Paddy Production DW = 1.015

LAR : Area : Area for Rice Production

AGIN : Agricultural Intermediate Inputs

③ - 3

$$\text{REIN} = \text{AGIN} - \text{RIN}$$

REIN : Agricultural Intermediate Inputs for
other Crops

AGIN : Intermediate Agricultural Inputs

RIN : Intermediate Agricultural Inputs
for Paddy Production

④ Agricultural Product

The agricultural product is formulated by the total product of paddy and other crops. The agricultural product for each sector, as shown below, is specified by both planted area and intermediate inputs. An attempt is made to specify the paddy product by the following two variables. One is a dummy variable taking weather conditions into account, the other is for expenditure for agricultural extension services (human capital for research, education and guidance, etc.) which affects production.

Note :

With respect to this dummy variable, the crop yield index is classified into three categories : (- 1) for less than 95, (0) for more than 96 and less than 104, (1) for more than 105. Using this categorization, crop yield indexes become (- 1) for 1965FY, 1971FY,

and 1976FY ; (1) for 1967FY, 1968FY, 1973FY, 1975FY, 1977FY, and 1978FY ; and (0) for other fiscal years.

④ - 1

$$GYYY = R + GRIE$$

GYYT : Agricultural Production

R : Rice Production

GRIE : Other Crops

④ - 2

$$\begin{aligned} (GRIE/LOAT) = & 0.09273 + 1.6044(REIN/LOAT) \\ & (0.7727) (4.28192) \\ & + 4.36051(TED1/LOAT) \\ & (1.54001) \end{aligned}$$

GRIE : Other Crop Production than Rice $\bar{R}^2 = 0.9391$

REIN : Intermediate Inputs for $DW = 0.897$

Other Crops

LOAT : Area Planted with
Seed-Plant Crops

TED1 : Expenditures for Extention Services

④ - 3

$$\begin{aligned} (R/LAR) = & 0.94931 + 0.87982(RIN/LAR) + 0.37694(TED1/LAR) \\ & (52.9938)(3.98296) \quad (1.9076) \\ & + 0.06233(DY) \\ & (8.3735) \end{aligned}$$

R : Rice Production $\bar{R}^2 = 0.8851$

LAR : Area Planted with Rice $DW = 1.015$

TED1 : Expenditures for
Extension Services

DY : Dummy for Weather

⑤ Agricultural Income

Agricultural income is determined by subtracting agricultural production cost from the agricultural product. In this research, the model for agricultural

production cost is established on the basis of an agricultural income theory, which excludes the estimated amount of family labor from the total.

$$A\text{Y}\text{Y}\text{T} : G\text{Y}\text{Y}\text{T} - C\text{O}\text{T}\text{1}$$

AYYT : Agricultural Income

GYT : Agricultural Product

COT1 : Agricultural Production Cost

(4) Farm Household Economy Block

① Number of Farmers

The number of farmers is specified by the two explanatory variables of agricultural fixed capital equipment and relative income. The former variable explains the process of substitution capital for labor during the high economic growth period. The latter variable explains shifts to industry due to profit difference between agriculture and non-agriculture.

The substitutive relationship between capital and labor must be taken into account in Japanese agriculture.

$$ANNT = 2242.1121 - 0.21693(SKKT) - 38.78612(RYYT_t - 1)$$

$$(16.5659) \quad (9.0353) \quad (1.06533)$$

ANNT : Number of Farmers $\bar{R}^2 = 0.8935$

SKKT : Agricultural Fixed DW = 0.721

Capital Equipment

RYYT : Relative Income of Agriculture (to Non-Agriculture Income)

② Farmer Tax Burden

The amount of the tax burden is determined by the current income.

$$TAXT = -1938.0209 + 0.280192(TYYT)$$

$$(9.7318) \quad (25.7384)$$

TAXT : Farmer Tax Burden $\bar{R}^2 = 0.9762$

TYYT : Farmer Income DW = 0.521

③ Farmer Income and Farmer Disposable Income

The farmer disposable income is obtained by subtracting the farmer tax burden from the farmer income. Here, the farmer income is determined by summing up agricultural income, non-agricultural income, and subsidies for

crop conversion.

③- 1

$$SUZ = LAR.SA SASUZ$$

SUZ : Subsidy for Rice Crop Conversion

LAR.SA : Area for Rice Crop Conversion

SASUZ : Subsidy per ha

③- 2

$$YYT1 = TYYT - TAXT$$

YYT1 : Farmer Disposable Income

TYYT : Farmer Income

TAXT : Farmer Tax Burden

③- 3

$$TYYT = AYYT + EYYT + SUZ$$

TYYT : Farmer Income

AYYT : Farmer Agricultural Income

EYYT : Non-Agricultural Income

SUZ : Subsidy for Rice Crop Conversion

④ Consumption by Farmers

An ordinary Keynesian consumption function determined by the income factor of the disposable income.

$$CTT1 = 15.18751 + 0.892911(YYT1)$$

$$(0.0319) \quad (28.2091)$$

CTT1 : Total Consumption by Farmers $\bar{R}^2 = 0.9811$

YYT1 : Farmer Disposable Income $DW = 0.636$

⑤ Increase in Farmer Deposits & Savings and Farmer Deposit Balances at the End of F. Y.

The increase in deposits & savings is specified by the disposable income of the current period. The deposit balance at the end of a fiscal year is determined by adding the deposit balance from the previous period and the increase in deposits & savings in the current period.

⑤- 1

$$\text{DST1} = 306.23801 + 0.153727(\text{YYT1})$$

(0.8181) (6.17781)

DST1 : Increase in Farmer Deposits & Savings

$\bar{R}^2 = 0.7051$
DW = 1.349

YYT1 : Farmer Disposable Income

⑤- 2

$$\text{LST1} = \text{DST1} + \text{LST1t} - 1$$

LST1 : Balance of Farmer Deposits
at the End of F. Y.

DST1 : Increase in Farmer
Deposits & Savings

⑥ Loans Payable from Cooperatives & Other Organizations and Investment in Agricultural Fixed Capital

For loans payable from cooperatives & other organizations, it is assumed that the balance of the farmer deposits (as a security) enables loans for investment money. As an explanatory variable., the policy expenditure for agricultural price supports is added to the formulation, under the assumption that the establishment of price supports and rise in prices induces investments from the production side. The investment for agricultural fixed capital is determined by the sum of loans payable from cooperatives & other organizations and institutional loans. With respect to this institutional loans, the capacity & requisited for financing is by prescribed policies.

⑥- 1

$$\text{LPMT} = 250.29501 + 0.022118(\text{LST1t} - 1) + 0.266959(\text{PAJT})$$

(2.5669) (5.05443) (3.20445)

LPMT : Loans Payable from Cooperatives & Other Organizations

$\bar{R}^2 = 0.8822$
DW = 0.982

LST1 : Balance of Farmer Deposits
at the End of F. Y.

PAJT : Agricultural Price Support Expenditure

⑥- 2

$$\text{IMMT} = \text{LPMT} + \text{GMMT}$$

IMMT : Borrowing for Agricultural Fixed Capital
Investment

LPMT : Loans Payable from Cooperatives
& Other Organizations

GMMT : Institutional Loans

⑦ Agricultural Fixed Capital Investment

Agricultural fixed capital investment is formulated by three explanatory variables : (a) fund capital, agricultural fixed capital investment, (b) factors inducing investment in land improvement, and (c) a factor for agricultural product prices. Fixed capital assumed is investment to occur under improved operating conditions, such as government prescribed land improvement policies (accompanied by expenditures for land and cultivation improvements).

$$\begin{aligned} \text{ITT1} = & 228.30511 + 0.61127(\text{IMMT}) + 0.04937(\text{EVA1T} - 1) \\ & (2.0102) \quad (4.32953) \quad (2.71785) \\ & + 6.65039(\text{PAG}) \\ & (2.3094) \end{aligned}$$

ITT1 : Agricultural Total Fixed Capital Investment $\bar{R}^2 = 0.9633$
DW = 1.281

IMMT : Borrowing for Agricultural Fixed
Capital Investment

EVA1 : Land Improvement Investment

PAG : Agricultural Product Price

⑧ Agricultural Fixed Capital Stock

Agricultural fixed capital equipment is determined by adding the agricultural fixed capital investment in the current period to that in the previous period. However, here it is an adjustment function to correct data inconsistencies from fixed capital equipment from the end of the year to the beginning of the following year.

$$\text{⑧} - 1$$

$$\text{KIT1} = \text{ITT1} + \text{KTT1}_{t-1}$$

KIT1 : Agricultural Fixed Capital Stock

at the Beginning of Year

ITT1 : Agricultural Total Fixed Capital Investment

KTT1 : Agricultural Fixed Capital Stock

at the End of Year

⑧— 2

$$\text{SKKT} = 1558.8301 + 0.65208(\text{KIT1}) \\ (6.0716) \quad (18.3659)$$

SKKT : Agricultural Fixed Capital Stock $\bar{R}^2 = 0.9557$

Adjusted at the Beginning of Year

KIT1 : Agricultural Fixed Capital Stock $\text{DW} = 1.087$

at the Beginning of Year

⑨ Agricultural Fixed Capital Depreciation Cost and Agricultural Fixed Capital Stock at the End of Year

The agricultural fixed capital depreciation cost (allowance for depreciation) is essentially determined on the basis of the following factors ; the acquisition price of the fixed capital, its period of operation & probable like, and the current write off policies. It was impossible to get a clear picture of the changes in statutes during the sample period. It was simplified by explaining it as a total of the newly acquired capital and the capital stock in the previous period, and this is defined as the agricultural fixed capital stock.

Agricultural fixed capital stock at the end of a year is obtained by subtracting the agricultural fixed capital depreciation cost from the agricultural fixed capital stock specified above.

⑨— 1

$$\text{DKT1} = -61.73832 + 0.13494(\text{SKKT}) \\ (0.9867) \quad (13.4742)$$

DKT1 : Agricultural Fixed Capital $\bar{R}^2 = 0.9193$

Depreciation Cost

SKKT : Agricultural Fixed Capital Stock $\text{DW} = 1.550$

Adjusted at the Beginning of Year

⑨ - 2

$$KTT1 = SKKT - DKT1$$

KTT1 : Agricultural Fixed Capital Stock
at Year End

SKKT : Agricultural Fixed Capital Stock
Adjusted at the Beginning of Year

DKT1 : Agricultural Fixed Capital
Depreciation Cost

⑩ Agricultural Production Cost

The agricultural production cost is the total of fixed capital depreciation, cost, agricultural intermediate inputs, and employment wages, and to take into account the price of input goods is added to account for price factors.

$$\begin{aligned} \text{COT1} = & 382.00812 + 12.9065(\text{PPPT}) + 3.21391(\text{WTW1}) \\ & (2.5189) \quad (8.81063) \quad (2.7471) \\ & + 1.13592(\text{DKT1}) + 0.58162(\text{AGIN}) \\ & (3.3921) \quad (5.5165) \end{aligned}$$

COT1 : Agricultural Production Cost $\bar{R}^2 = 0.9932$

PPPT : Input Goods Price DW = 1.550

WTW1 : Total Agricultural Wages

DKT1 : Agricultural Fixed Capital
Depreciation Cost

AGIN : Total Agricultural Intermediate

⑪ Agricultural Wages

In the formulation for agricultural wages, the wage rate the non-agricultural sector is assumed as a dummy variable for the agricultural wage rate. This assumes that the wage rate in agriculture moves parallel to that non-agriculture.

$$\begin{aligned} \text{LOG(WTW1)} = & 3.72095 + 0.41608 \text{ LOG (WR)} \\ & (10.3276)(4.9796) \end{aligned}$$

WTW1 : Agricultural Wages $\bar{R}^2 = 0.7078$

WR : Wage Rates DW = 0.675

⑫ Relative Income (to Non-Agriculture)

The relative income shows the comparative profitability. It is obtained through the proportion of net labor productivity in agriculture to that in secondary industry. The former productivity is obtained by dividing agricultural income by the number of farmers, and the latter productivity is calculated by dividing the net product in secondary industry by the number of workers in this industry.

⑫- 1

$$RYYT = SCSTY/PYGT$$

RYYT : Relative Agricultural Income (to Non-Agriculture)

SCSTY : Net Productivity in Secondary Industry

PYGT : Net Agricultural Productivity

⑫- 2

$$PYGT = AYYT/ANNT$$

PYGT : Net Labor Productivity in Agriculture

AYYT : Agricultural Income

ANNT : Number of Farmers

⑫- 3

$$SCSTY = RSCS/SCLAB$$

SCSTY : Net Productivity in Secondary Industry

RSCS : Net Product in Secondary Industry

SCLAB : Number of Workers in Secondary Industry

Some of these determinant coefficients and Durbin-Watson statistics are not relevant, however all signs (plus & minus) are.

The solution to the model is obtained with the Gauss-Sidel method. The convergence standard is set at 0.01%. For the initial values of endogenous variables, we have adopted the observed values.

4. Measurement of Economic Effect shown by the Simulations

1) Tests for Goodness of Fit

The test for goodness of fit for theoretical models is used to examine how the structure estimated by the model fits actual conditions. Here, a total test and a final test have been done.

The total test tests the predictive power in a time period. Actual values are put into the predetermined variables (exogenous & predetermined-endogenous variables) of the model, and the estimated endogenous variables and actual values are compared.

The final test tests predictive power over multiple time periods. Here the actual values for exogenous variables and the initial values of predetermined variables are set, and these variables circulate in the model. Then, a comparison between the actual and forecast values is performed. This is the strictest test for examining the validity of models. The initial values used here for the predetermined variables are those of 1960.

The results show that some variables do not compare well with the actual values. However, with the necessity of simplifying this model further, the result of goodness of fit generally seems to fall within acceptable ranges.

Theil's inequality coefficient was used to evaluate the goodness of fit of each variable. Due to space limitations, only inequality coefficients for 52 representative variables are shown in Table 9 (on the left under Theil-u). There are three above 0.05, and the highest is 0.086.

Table 8 . Combination of Policy Variables

	EVAI	GMMT	PAJT	TEDI	PR	SAG	PIMP	PPPT
Value of Final Test	100%	100%	100%	100%	100%	100%	100%	100%
Case-1	0	100	100	100	100	100	100	100
Case-2	100	0	100	100	100	100	100	100
Case-3	100	100	0	100	100	100	100	100
Case-4	100	100	100	0	100	100	100	100
Case-5	100	100	100	100	0	100	100	100
Case-6	100	100	100	100	100	0	100	100
Case-7	100	100	100	100	100	100	0	100
Case-8	100	100	100	100	100	100	100	10

2) Understanding the Economic Effect shown by the Simulations

Multiplier analyses were performed on the basis of the econometric model established in the previous chapter, and the economic effect in response to each policy variable is shown. The procedure is (1) strategic variables for agricultural administration, were the exogenous variables : the input goods prices (PPPT) ; price of imported agricultural products (PIMP) ; and various policy expenditures such as, the rice price (PR), subsidy per ha (SASUZ), and allotments for production adjustment (SAG). The subsidies in broad sense were expenditures for land improvement (EVA1), for agricultural extension services (TED1), expenditures for agricultural price supports (PAJT), and institutional loans (GMMT), etc.. (2) The simulations were performed to investigate the values of other variables when one variable is excluded from the policy variables, under the assumption that "the variable does not contribute at all or only at 10% under conditions of the actual functioning by all others." The combinations of policy variables are shown in Table 8.

There are two types of economic effect : one is the monetary expression in current 1979 values (the final year for these analyses), which has been obtained by subtracting the theoretical values from the values in the final test. The other is an expression in (the form of contribution)³⁾ rates of the actual values of 1975. The economic effect of each variable is shown in Table 9 and 10.

① Effect of Rice Price

1. The producer responses to rice prices brought forth great increases of

3) When an economic index shows a plus impact, the economic impact increases only at this rate in 1979, where there was the investment expenditure. When it shows a minus, the situation was reserved.

The Economic Effect of Public Expendure in Agriculture

Table 9

Factor	Theft-U	PAJT		CMMT		EVAI		TEDI	
		Exp. for Agricultural Price Supports		Institutional Loans		Land Improvement Investment		Exp. for Extension Services	
		Value	Percent	Value	Percent	Value	Percent	Value	Percent
CSPF Domestic Food Supply Volume	0.0077	257.9410	1.7438	307.8130	2.0809	354.5800	2.3971	830.8860	5.6170
RPCE Personal Consumption	0.0054	389.0000	0.3945	605.0940	0.6136	739.5310	0.7499	1436.8000	1.4570
RIMPA Imported Agricultural Products	0.0051	-1.2349	-0.0304	32.5747	0.8029	9.5933	0.0146	-9.8748	-0.2434
PMF Market Price of Foods	0.0003	0.8628	0.7333	-0.0252	-0.0215	-0.1258	-0.1069	-0.4625	-0.3930
PCF Consumer Price of Food	0.0003	0.8055	0.6632	-0.0237	-0.0194	-0.1180	-0.0967	-0.4339	-0.3555
PAC Agricultural Product Prices	0.0001	8.4900	7.5039	-0.0770	-0.0680	-0.1636	-0.1446	-1.4262	-1.2605
PCT General Consumer Price	0.0119	0.6905	0.6288	0.0526	0.0479	0.0375	0.0342	-0.3985	-0.3628
RGNP Net Domestic Product	0.0036	572.2810	0.3738	768.0310	0.5017	946.0630	0.6180	2667.8000	1.7426
WR Labor Wage Rate	0.0062	0.4727	0.4369	-0.0111	-0.0103	-0.0379	-0.0350	-0.1772	-0.1538
RDING Personal Disposable Income	0.0061	570.3830	0.4475	887.2340	0.6960	1084.3600	0.8507	2106.7600	1.6528
RFBT Food Expenditure	0.0059	145.8200	0.4483	134.7170	0.4142	210.7710	0.6480	387.1000	1.1902
GGYTT Domestic Agricultural Product Supply	0.0102	259.1760	2.8342	275.2380	3.0098	353.9860	3.8709	840.7600	9.1939
GGYTT Agricultural Product	0.0164	456.2950	4.5647	484.5740	4.8476	623.2160	6.2345	1480.2100	14.8077
RCORP Corporate Income	0.0049	40.8094	0.3605	63.1699	0.5609	77.8051	0.8655	149.9990	1.3318
RPINC Personal Income	0.0066	801.8910	0.4831	1247.3400	0.7515	1524.4800	0.9185	2961.8400	1.7845
RDITAX Personal Burden	0.0082	231.5080	0.6011	360.1090	0.9350	440.1210	1.1428	855.0860	2.2202
RIPD Privata Housing Investment	0.0063	59.6621	0.4640	92.8047	0.7217	113.4250	0.8821	220.3670	1.7138
RIOD Corporata Equipment Investment	0.0010	22.6348	0.0750	35.2109	0.1167	43.0332	0.1426	83.6074	0.2771
RIDTAX Indirect Tax	0.0021	17.5879	0.1499	27.3574	0.2311	33.4636	0.2849	64.9619	0.5536
RSCS Net Productivity in Secondary Industry	0.0021	100.8280	0.1504	156.8440	0.2339	191.6950	0.2859	372.4300	0.5554
RTHS Net Product in Tertiary Industry	0.0041	261.6640	0.2991	407.0160	0.4653	497.4530	0.5686	966.4960	1.1048
RCNEM Total Domestic Expenditure	0.0041	524.5620	0.2975	815.9530	0.4628	997.2500	0.5657	1937.5000	1.0990
RATX Indirect Taxes	0.0046	54.5664	0.3341	84.8779	0.5196	103.7360	0.6351	201.5440	1.2339
RACR Net Production in Primary Industry	0.0134	240.9060	3.6969	245.9490	3.7743	308.3770	4.7323	1474.0400	22.6204
RCGR Government Revenue	0.0041	122.5430	0.2966	190.6170	0.4614	232.9690	0.5639	452.6210	1.0956
LAAC Total Planted Area	0.0102	311.3860	5.7852	214.8810	3.9922	182.3880	3.3885	293.8010	5.4585
LAND Cultivated Area	0.0050	124.3450	2.2856	110.9990	2.0043	97.4653	1.7915	163.4299	3.0040
ACONV Area Converted to Agricultural Use	0.0806	-9.6684	-25.7959	-10.0924	-26.9271	-11.9107	-31.7785	-15.0519	-40.1592
RIN Intermediate Agricultural Inputs for Paddy Production	0.0489	98.4744	13.3188	105.0340	14.2059	135.5440	18.3325	11.4138	1.5437
LAR Area Planted with Paddy	0.0095	34.8982	1.3751	22.5518	0.8886	18.1221	0.7141	30.5435	1.2035
ACIN Intermediate Agricultural Inputs	0.0235	259.4640	6.8433	288.8590	7.6186	381.8310	10.0707	8.1982	0.2162
SKKT Agricultural Fixed Capital Equipment	0.0227	508.5540	6.6205	566.1690	7.3705	748.5990	9.7428	16.0688	0.2092
R Paddy	0.0173	122.0310	3.8154	117.6280	3.6777	142.4170	4.4527	67.0642	2.0968
CRIE Other Crops	0.0159	334.2640	4.9173	366.9450	5.3980	480.7990	7.0729	1413.1500	20.7883
REIN Agricultural Intermediate Inputs for Other Crops	0.0171	160.9900	5.2747	183.8260	6.0229	426.2870	8.0694	-3.2153	-0.1053
LOAT Area Planted with Seed-Plants excluding Paddy	0.0108	276.4880	9.7199	192.3300	6.7613	164.2660	5.7747	263.2580	9.2548
YYTI Farmer Disposable Income	0.0032	173.4060	0.8740	177.0370	0.8923	221.9730	1.1188	1061.0300	5.3435
CTTI Total Consumption by Farmers	0.0032	154.8360	0.8733	158.0780	0.8916	198.2010	1.1179	943.1020	5.9450
DSTI Increase in Farmer Deposita & Savings	0.0035	26.6572	0.9716	27.2153	0.9919	34.1233	1.2437	163.4090	2.3363
LPMT Loans Payable from Cooperatives & Other Organizations	0.0097	423.8920	29.1934	612.4260	29.7582	5.1995	0.2526	33.9229	1.6483
IMMT Agricultural Fixed Capital Investment	0.0069	423.8920	20.5972						
ITTI Agricultural Total Fixed Capital Investment	0.0041	311.0000	10.9786	378.7410	13.3700	596.4410	21.0550	12.1782	0.4299
DKTI Agricultural Fixed Capital Write off	0.0241	68.6263	7.0398	76.4011	7.8373	100.9910	10.3598	2.1685	0.2224
ANNT Number of Farmers	0.0705	-76.5930	-17.3786	-87.6112	-19.8786	-120.7960	-27.4080	48.9984	11.1175
COTT Agricultural Production Cost	0.0128	215.3890	3.5784	238.6250	3.9644	314.8390	5.2306	6.1690	0.1025
AYYT Agricultural Income	0.0217	240.9060	6.0574	245.9490	6.1842	308.3770	7.7540	1474.0400	37.0638
TYYT Farmer Income	0.0035	240.9060	0.9687	245.6460	0.9889	308.3770	1.2400	1474.0400	5.9270
TAXT Farmer Tax Burden	0.0049	67.5000	1.3419	68.9131	1.3700	86.4048	1.7177	413.0150	8.2105
PYGT Net Agricultural Productivity	0.0861	1.8017	19.9662	1.9619	21.7410	2.4904	27.5979	2.6342	29.1917
RCAPT Total Domestic Fixed Capital Formation	0.0018	82.2969	0.1346	128.0160	0.2094	156.4570	0.2560	303.9730	0.4973
LSTI Balance of Farmer Deposita at the End of F.Y.	0.0168	392.7110	1.0260	317.7460	0.8301	269.2110	0.7033	1696.8300	4.4331
WTWI Total Agricultural Wage	0.0028	0.4092	0.1411	0.1133	0.0391	-0.0234	-0.0081	-0.1741	-0.0600

Table 10

Factor	Theil-U	PPPT Input Goods Price		PR Rice Price Index		SAG Area Allotted for Production		PIMP P Imported Agri. Production Price	
		value	Percent	Value	Percent	Value	Percent	Value	Percent
CSPF Domestic Food Supply Volume	0.0077	-19.0430	-0.1287	391.5520	2.6470	-51.7539	-0.3499	-4086.9400	-27.6289
RPCE Personal Consumption	0.0054	166.9450	0.1693	663.7970	0.6731	467.9840	0.4746	509.8520	0.5170
RIMPA Imported Agricultural Products	0.0051	3.2339	0.0797	-1.8467	-0.0435	81.5728	2.0106	-4099.0100	-101.0320
PMF Market Price of Foods	0.0003	0.0523	0.0444	1.9753	1.6788	0.3012	0.2560	2.2622	1.9226
PCF Consumer Price of Food	0.0003	0.0491	0.0402	23.2125	19.0165	0.2826	0.2316	2.1226	1.7389
PAG Agricultural Product Prices	0.0001	0.2162	0.1911	18.8087	16.6241	0.3832	0.3387	1.7518	1.5484
PCT General Consumer Price	0.0119	0.1537	0.1399	15.1001	13.7495	0.3686	0.3356	2.3158	2.1086
RCNP Net Domestic Product	0.0036	-29.9219	-0.0195	1135.2500	0.7415	183.3130	0.1197	457.3750	0.2988
WR Labor Wage Rate	0.0062	0.0283	0.0262	11.2016	10.3514	0.1206	0.1115	1.4618	1.3509
RDNG Personal Disposable Income	0.0061	244.7970	0.1920	973.3120	0.7636	686.2030	0.5383	747.5860	0.5863
RFBT Food Expenditure	0.0059	54.7207	0.1682	-51.4238	-0.1581	60.5117	0.1861	163.9370	0.5040
RGYTT Domestic Agricultural Product Supply	0.0102	-22.2773	-0.2436	393.3980	4.3019	-133.3270	-1.4580	12.0684	0.1320
CYYT Agricultural Product	0.0164	-39.2207	-0.3924	692.6030	6.9287	-234.7310	-2.3482	21.2471	0.2126
RCORP Corporate Income	0.0049	17.4297	0.1547	69.2979	0.6153	48.8564	0.4338	53.2275	0.4726
RPING Personal Income	0.0066	344.1560	0.2073	1368.3600	0.8244	964.7190	0.5812	1051.0200	0.6332
RDTAX Personal Burden	0.0082	99.3594	0.2580	395.0470	1.0257	278.5160	0.7232	303.4300	0.6879
RIFD Private Housing Investment	0.0063	25.6064	0.1991	101.8090	0.7917	71.7773	0.5582	78.1982	0.6081
RIOD Corporate Equipment Investment	0.0010	9.7148	0.0322	38.6250	0.1280	27.2324	0.0903	29.6680	0.0983
RIDTAX Indirect Tax	0.0021	7.5479	0.0643	30.0127	0.2558	21.1582	0.1803	23.0518	0.1964
RSCS Net Productivity in Secondary Industry	0.0021	43.2734	0.0645	172.0630	0.2566	121.3050	0.1809	132.1560	0.1971
RTHS Net Product in Tertiary Industry	0.0041	112.3050	0.1284	446.5160	0.5104	314.7890	0.3598	342.9610	0.3920
RCNEM Total Domestic Expenditure	0.0041	225.1250	0.1277	895.1250	0.5077	631.0630	0.3580	687.5310	0.3900
RTAX Indirect Taxes	0.0046	23.4189	0.1434	93.1123	0.5700	65.6455	0.4019	71.5186	0.4378
RAGR Net Production in Primary Industry	0.0134	-187.1380	-2.8718	578.4380	8.8766	-242.8200	-3.7623	7.1299	0.1094
RGCR Government Revenue	0.0041	52.5937	0.1273	209.1090	0.5062	147.4260	0.3569	160.6130	0.3888
LAAG Total Planted Area	0.0102	-211.6750	-3.9327	280.4560	5.2105	-14.5098	-0.2696	31.0737	0.5273
LAAND Cultivated Area	0.0050	-23.0498	-0.4237	57.7031	1.0606	-18.1958	-0.3345	6.8394	0.1773
ACONV Area Converted to Agricultural Use	0.0806	1.2412	3.3115	-8.1579	-21.7659	1.7310	4.6183	-0.4500	-1.2007
RIN Intermediate Agricultural Inputs for Paddy Production	0.0489	-7.6158	-1.0300	210.7800	28.5082	-80.3350	-10.8654	4.4933	0.6080
LAR Area Planted with Paddy	0.0095	-24.9565	-0.9833	642.7990	25.3278	-294.7680	-11.6146	3.4524	0.1360
AGIN Intermediate Agricultural Inputs	0.0235	-1.6921	-0.0446	86.3892	2.2785	8.1660	0.2154	10.3093	0.2719
SKKT Agricultural Capital Equipment	0.0227	-3.3169	-0.0432	169.3240	2.2043	16.0054	0.2084	20.2065	0.2631
R Paddy	0.0173	-28.4495	-0.8895	746.4640	23.3386	-327.0200	-10.2244	7.1589	0.2238
GRIE Other Crops	0.0159	-10.7710	-0.1584	-53.8613	-0.7923	92.2881	1.3576	14.0879	0.2072
REIN Agricultural Intermediate Inputs for Other Crops	0.0171	5.9238	0.1941	-124.3910	-4.0755	88.5010	2.8997	5.8142	0.1905
LOAT Area Planted with Seed-Plants excluding Paddy	0.0108	-186.7190	-6.5641	-362.3440	-12.7381	280.2580	9.8524	27.6213	0.9710
YYTI Farmer Disposable Income	0.0032	-134.7030	-0.6790	133.2340	0.6716	-38.7930	-0.1955	5.1309	0.0259
CTTI Total Consumption by Farmers	0.0032	-120.2770	-0.6784	118.9670	0.6710	-34.6387	-0.1954	4.5820	0.0258
OSTI Increase in Farmer Deposits & Saving	0.0035	-20.7075	-0.7547	20.4817	0.7465	-5.9634	-0.2174	0.7888	0.0288
LPMT Loans Payable from Cooperatives & Other Organizations	0.0097	-6.8827	-0.4740	5.3984	0.3718	-2.5093	-0.1728	0.6384	0.0440
IMMT Agricultural Fixed Capital Investment	0.0069	-6.8828	-0.3344	5.3984	0.2623	-2.5093	-0.1219	0.6384	0.0310
ITTI Agricultural Total Fixed Capital Investment	0.0041	-2.5437	-0.0898	117.7560	4.1569	11.5186	0.4066	12.5154	0.4418
DKTI Agricultural Fixed Capital Write off	0.0241	-0.4476	-0.0459	22.8493	2.3439	2.1598	0.2216	2.7268	0.2797
ANNT Number of Farmers	0.0705	-3.6083	-0.8187	-8.2808	-1.8789	-9.5072	-2.1571	-2.8137	-0.6384
COTI Agricultural Production Cost	0.0128	147.9170	2.4574	114.1650	1.8967	8.0884	0.1344	14.1172	0.2345
AYYT Agricultural Income	0.0217	-187.1380	-4.7055	578.4380	14.5445	-242.8200	-6.1056	7.1299	0.1793
TYYT Farmer Income	0.0035	-187.1390	-0.7525	185.0980	0.7443	-53.8926	-0.2167	7.1289	0.0287
TAXT Farmer Tax Burden	0.0049	-52.4346	-1.0424	51.8628	1.0310	-15.1001	-0.3002	1.9976	0.0397
PGYT Net Agricultural Productivity	0.0861	-0.3479	-3.8552	1.4547	16.1205	-0.3488	-3.8650	0.0733	0.0255
RCAPT Total Domestic Fixed Capital Formation	0.0018	35.3203	0.0578	140.4340	0.2298	99.0078	0.1620	107.8630	0.1765
LSTI Balance of Farmer Deposits at the End of F. Y.	0.0168	-331.8910	-0.8671	264.5590	0.6912	-119.4100	-0.3120	29.6523	0.0775
WTWI Total Agricultural Wages	0.0028	0.0368	0.0127	12.6049	4.3463	0.3975	0.1371	1.6490	0.5688

intermediate inputs and planting area for paddy (29% and 25% increases) and consequently paddy production increased by 23%.

2. However, it also brought forth 13% decrease in the planted area of other crops than rice because of the relative advantage of rice production. The price increase caused a 4% decrease in intermediate inputs for other crops. Consequently, there was an 0.8% drop in the production of other crops.

3. It is characteristic that the effect of the increase on the total agricultural production remained at 7%, because of the effect of the decrease on other crops than rice.

4. The effect on the agricultural production caused a 0.7% rise in net domestic production through the effect of the 8.9% rise in primary industry, on secondary and tertiary industries.

5. The increase in net domestic product increased corporate & personal incomes. It increased (0.5% up) the total domestic final demand expenditures such as personal consumption, private housing investment, and corporate equipment investment, etc.. The increase of final demand meant an increase (0.5%) in tax revenue (such as indirect tax and other taxes) received by the government.

6. The rise in rice prices had a strong impact on the increase of agricultural product prices and foods prices (at 17% and 19% for each), resulting in a 10% rise in consumer prices.

7. The agricultural product price is geared to increases in agricultural fixed capital investment (by 4%). This caused a slight increase in secondary industry through the impact on fixed capital formation (production bases) within the industry.

8. The rise in foods prices brought slightly decreased expenditures for food (by - 0.2%)

② Impact of Measures to Rearrange Paddy Field Use (Allotment of Adjustments)

1. The increase in the area allotted for production readjustments decreased the planted area of paddy by 12%. The impact is a reduction in the paddy production of 10%, through an 11% reduction in the intermediate inputs for rice.
2. However, the increase in area converted from rice caused an increase in the planted area of other crops than rice (at 10%). The increase in the production amounts of other crops than rice is 1.4%, and an increase in the intermediate inputs to other crops.
3. The effect of the increase of other crop production than rice did not compensate for the decrease in paddy. It reduced the total agricultural production by 2%, and agricultural incomes by 6%. But, the decrease in farm incomes remained at 0.2% due to the increases in subsidies for crop conversion.
4. The decrease in agricultural production caused higher market prices of foods (shifted supply function upward) through the decrease in the domestic agricultural supply. As a result, it caused a slight rise in agricultural product prices and consumer prices.
5. The slight rise in agricultural product prices had the effect of increasing agricultural investment for fixed capital slightly, and also slightly raised fixed capital formation (as the production base for net production in secondary industry). The impact of this spread increased net production in secondary industry (by 0.18%) accompanied with an increase in land converted to non-agriculture.
6. The decrease in agricultural product increased the decrease in net production in primary industry. However, it increased the net domestic product by 0.7% due to the slight increase in net production in secondary and tertiary industry.
7. The increase in net domestic product affected a rise in corporate and personal income. The result was an increase in final demand (total expenditure, 0.36%), personal consumption, private housing, and corporate equipment investment. This means that there was a 0.35% increase in tax revenue (from indirect and direct taxes).

③ Effect of Land Improvement Expenditures

1. Expenditures for land improvement such as subsoil, drainage and cultivated land size improvements caused a great increase in fixed capital formation in agriculture (at 21%) by enabling the introduction of large size machinery. It also helped increase the agricultural intermediate inputs (by 10%) accompanied with the increase in total planted area.

2. The increase of fixed capital formation, planted area, and intermediate inputs raised agricultural production by 6.2%. Simultaneously, the introduction of large size machinery resulted in an increase in agricultural production costs (by 5.2%), this worked to keep the increase in agricultural incomes low (by 7.8%).

3. The increase in agricultural income effected a 0.6% increase in the net domestic product, through the rise of net production in primary industry (by 4.7%) and its effect on secondary and tertiary industry.

4. The increase in net domestic production affected an increase in corporate and personal incomes. This brought forth an increase in final demand (total expenditure) (by 0.56%), personal consumption, private housing investment, and corporate equipment investment, and also raised tax revenue (by 0.56%).

5. The increase in agricultural production caused a 0.1% reduction in the market price of food (a downward shift in the supply function) through the increase in domestic agricultural supply, it reduced agricultural production and consumer prices by 0.1%.

6. The reduction in consumer prices of food increased personal consumption.

This caused a slight rise in consumer prices (by 0.03%) exceeding the net domestic product (an upward shift in demand > a downward shift in supply).

④ Effect of Institutional Loans

1. Most investment in agricultural fixed capital comes from agricultural in-

stitutional loans, and such agricultural institutional loans greatly increased the investment in fixed capital, by 29.8%. Like the expenditure for land improvement, this promoted fixed capital formation in agriculture, and had great impact in increasing agricultural intermediate inputs.

2. The large increase in agricultural intermediate inputs, similar to the expenditure for land improvement, raised agricultural production (by 4.8%). Simultaneously, this increased agricultural production cost by 3.9%, and consequently kept agricultural income low, with an increase of only 6.1%.

3. The increase in agricultural income spread to increases the net product in primary industry (by 3.8%), and also secondary and tertiary industry. Consequently, net national production rose 0.5%.

The above impact also affected the raise in corporate income, personal income, and final demand, by 0.47%, tax revenue increased by 0.46%.

4. The increase in agricultural production reduced the market price of foods slightly (by 0.02%) through the increase of domestic agricultural supply. This affected the decrease in agricultural product prices and consumer prices of foods, by 0.07% and 0.02%. It also accelerated the increase in expenditures for food and personal consumption.

With the increase in agricultural production exceeding the increase in net domestic product, the impact was a raise in the consumer prices (by 0.05%).

⑤ Effect of Agricultural Price Support

1. As a whole, the impact from the price support policies promoted fixed capital formation in agriculture (11%), very similar to the impact of institutional loans. However, the increase in capital loans from cooperatives and other organizations was large (29%), and this differs from the case of the institutional loans.

2. The above effect, similar to the effect of institutional capital, also increased the agricultural product by 4.6%, and agricultural production cost by 3.6%. As a result, agricultural income was kept to a low increase of 6%.

3. On the other hand, the increasing agricultural production caused an increase in domestic agricultural supply. However, the rise in agricultural product prices was very large, (7.5%), and the rise in the market price of food was smaller (at 0.7%). There was a rise in the consumer price of food, a characteristic effect.

⑥ Effect of Expenditures for Extension Services

1. There was a 37% increase in agricultural income, different from the rice price, expenditures for land improvement and agricultural price supports, and agricultural institutional loans. This is considered to be due to the increase in agricultural production contributing greatly (by 14.8%) by seed improvements, soil and fertilizer development, herbicides and pesticides, high yield cuops, etc. On the other hand, the increase in production costs remained very low (0.1%), different from other expenditures.

2. The increase in agricultural income caused increased net products in primary (22.6%), and also in secondary and tertiary industry, raising the net domestic product by 1.7%. This is the greatest increase among all of the policies considered (the rice price, expengitures for land improvement and agricultural price supports, and institutional capital).

This increase in agricultural income increased the corporate income, personal income, and finl demand (total expenditure) (by 1.1%). It had the greatest impact on tax reyenues (by 1.1%).

3. While, increases in agricultural production reduced the market price of food by 0.4% through the rise in domestic agricultural supply (by 9%), it showed a reduction in consumer prices of food, agricultural product price and general consumer price, by 0.4%, 1.3%, and 0.4%, respectively.

⑦ Effect of Input Goods Prices

1. In response to the price rises of input goods there was a great de-

crease in the total planted area (by 3.9%), which caused a decrease in agricultural production (by 0.4%) through a slight decrease in the agricultural intermediate inputs (by 0.04%).

2. The price rise in input goods largely caused the raise in agricultural production cost (by 2.5%). Accordingly, the increase in agricultural income was reduced by 4.7%.

3. This also caused the greatly reduced net product in primary industry (by 2.9%). However, it did not directly spread to decrease the net product in secondary and tertiary industry, but increased these slightly through the small rise in fixed capital formation. This small rise, consequently, reduced the net domestic product slightly, without effecting the raise in the net product of primary industry.

4. On the other hand, the decrease in agricultural production raised the market price of food (by 0.04%) and through that reduced the domestic agricultural supply (by 0.2%). This raised the market price of foods, agricultural product prices and, consumer prices.

We showed that for fixed capital formation in agriculture, the effect of the raise was in the order of the expenditures for land improvement, institutional loans, agricultural price supports. This may be explained by the following : first, the expenditure for land improvement is the condition for introducing large machinery ; second, the agricultural price supports promote investment ; third, institutional loans outlays for the introduction of machinery. This condition appeared in saving labor⁴⁾, as with the farmer population, the expenditure for land improvement, institutional loans, and expenditure for price supports saved labor by 27%, 19.9%, and 17.4%, respectively. The rise of rice price contributed somewhat to capital formation (by 4%), but the effect of saving labor was only 1.9%. The expenditure for extension services promoted an in-

4) Labor savings through the introduction of machinery and agricultural technical improvement, are also considered to be a response by farmers to cope with the increase in employment opportunities in the non-agricultural sector, the outflow of labor, and the wage rates in the non-agricultural sector.

crease in the farm population, different from other policy expenditures.

For agricultural production cost, the rise in input goods price had the greatest effect (by 25%) of the policy expenditures. The expenditure for agricultural extension services did not raise production cost directly, but indirectly it was raised very slightly.

Concerning agricultural income, the expenditure for agricultural extension services and rice price had greater effect than other policy expenditures, by raising it. The following is the order of importance in its rise : rice price, expenditure for land improvement, institutional loans, and expenditure for price supports. Accordingly, expenditure on technical propagation caused a greater impact than other policy expenditures, in raising the net product in secondary and tertiary industry, even the net national product in the non-agricultural sector. Conversely, the price rise of input goods reduced the net product in primary industry, which further reduced the net national product.

Expenditure for extension services had the largest effect in raising tax revenue, followed by the expenditures for land improvement, rice prices, and institutional loans.

The factors with the strongest impact on agricultural product prices, market prices of food, and consumer prices were the rice prices, next the expenditures for agricultural price supports, allotments for production adjustment, and input goods price. The expenditure for extension services reduced prices of agricultural products, foods and general consumers prices. The expenditure for land improvement and institutional loans also had the effect of reducing agricultural products prices and food, but this did not extend to reduce consumer prices, and ultimately caused it to rise slightly.

5. Conclusions

The following are the conclusions, and some observations on the future of agricultural policies.

We believe that the attempt made here with a macro econometric model

for the whole nation is meaningful. However, there are also some points to reconsider.

The goodness of fit and predictive power of the results are acceptable, and the hypothesis tested for establishment of the model are quite adequately supported.

The physical measures, agricultural fiscal expenditure and institutional loans have somewhat raised agricultural capital formation, agricultural productivity, and agricultural income. The increases in farm machinery and agricultural materials have contributed slightly to a production enlargement in the non-agricultural sectors, in secondary and tertiary industry.

However, when we break down the fiscal expenditures, the effect of raising agricultural production by institutional loans and agricultural price supports slightly exceeded the rising production cost⁵⁾, and this kept the increase in agricultural income low. Expenditures for agricultural price supports contributed greatly to increase loans, but among the policy expenditures, these showed the smallest impact on agricultural production, agricultural income, and production increases in the non-agricultural sectors. The increase in producer rice prices raised agricultural income, but it also increased the prices of other agricultural products and the consumer price of foods. Consequently, there was a decrease in expenditures for foodstuffs. From these facts, policies to raise rice prices and agricultural product price, which have been demanded most strongly by farmers, must be investigated more vigorously and their effects should not be overestimated. These price increases have not only brought a reduction in demand but have also created an increasing differential with world prices.

5) This was considered because the expenditures from fiscal and monetary policies did not reduce agricultural production costs, the production adjustment for rice crop (started in 1970) and planned production for milk (currently started) have failed to reduce costs, although raw milk is produced by farmers with higher productivity. It is considered that the expenditures did not consider crops, resource allocation and income redistribution to farmers.

The impact of expenditures for extension services had the greatest impact in raising agricultural productivity, production, and income, and the smallest impact in pushing up costs. It also induced production in the non-agricultural sector most, and raised relatively more taxes. It also reduced agricultural product prices, market prices of fords, and consrmer prices. The expenditure for extention services promotes not only the welfare of producers but also of consumers.

In Japan prices for tractors, fertilizers, feed, and so on are higher than the worked prices, and especially the price of tractors reflects an oligopoly position of the manufacturers. As a result, price increases in input goods cause agricultural production costs to be extremely high. This increase in input goods prices greatly reduces agricultural income, and even offsets the expenditures on land improvement, agricultural price supports, and institutional loans, affecting a reduction in net product in primary industry. In caused a reduction in net product, through a decrease in net product in primary industry, which slightly exceeded the total increase of net product in secondary and tertiary industry.

In Japan, manufactures, processors, distributors add 69% to the price of food. Therefore, to obtain a reduction in food prices it is necessary to reduce prices in input goods produced from the non-agricultural sector together with price reductions in inputs in the agricultural sector.

For future fiscal and monetary policies in agriculture, it is necessary to make allowances for the economic impact of the policies. The following policy implications are suggested : (1) institutional loans to promote capital formation, (2) the reinforcement of loans with institutional loans to induce a higher productivity incentive in the non-agricultural sector, combined with expenditures for technical propagation which have the greatest impact on production, income, and tax revenue, (3) reduction of input goods price rather than expenditures to raise the price of rice and other agricultural products, (4) cutting back the cost of the marketing process.

Problems on this study for the future are as follows.

1. In this model, agriculture is divided in two sectors, paddy production and other crops, and the effect on production in the dairy and seed-plant sectors are not clear.
2. The import function has not been adequately considered. Especially, there may be some defects in the statistical significance because the *t*-values for the prices are too low.
3. The food demand structure needs to be divided into the direct consumption and processing uses, there also needs to be a remodeling of the impact spread throughout the non-agricultural sector of each structure.
4. There are problems with the specification of production functions in secondary and tertiary industries, particularly in dealing with worker populations. At present, we are continuing the study to try to overcome the defects and problems.

References

- 1) Hiroya Ueno and Masahiro Tatemoto : "Econometric Analysis of Economic Behavior", Yuhiku Pub. Co., 1957.
- 2) L. R. Klein and A. S. Goldberger : "An Econometric Model of the United States 1929-1952", North-Holland Pub. Co., Amsterdam, 1969.
- 3) Fumio Hamada : "Econometric Analysis of Firm Investment", Toyokeizaishinpo Pub. Co., 1971.
- 4) E. Kuh and R. L. Schmalensee : "An Introduction to Applied Economics", North-Holland Pub. Co., Amsterdam, 1973.
- 5) G. A. King : "Econometric Models of the Agricultural Sector", American Journal of Agricultural Economics, Vol. 57, No. 2, 1975.
- 6) Joel Pokin : "Some Avenues for the Improvement of Price Forecasts Generated by Macroeconomic Models", American Journal of Agricultural Economics, Vol. 57, 1975.
- 7) Akihiko Asaoka, Toshio Kuroyanagi and Masahiko Takashima : "Total Economic Effect of Agricultural Fiscal Investment", The Nokeironso (Hokkaido Univ.), No. 34, 1978.
- 8) Toshio Kuroyanagi : "Public Policy for Agriculture" (S. Sakiura and Y. Tanabe ed., "An Introduction to Agricultural Economics", Yokendo Pub. Co., 1978).
- 9) Enrique R. Arzac and Maurice Wilkinson : "A Quarterly Econometric Model of United States Livestock and Feed Grain Markets and Some of Its Policy Implications", American Journal of Agricultural Economics, 1979.
- 10) Keiichi Sakamoto : "Transformation of Japanese Agriculture", Mineruba Pub. Co., 1980.
- 11) Tsutomu Ohkawa : "Econometric Analysis", 1980.
- 12) A. Asaoka, T. Kuroyanagi and M. Takashima : "Macroscopic Economic Effect of Agricultural

The Economic Effect of Public Expendure in Agriculture

- Fiscal Investment" (M. Takashima and T. Kuroyanagi ed. : "Economic Analysis of Agricultural Policy", No. 2, Meibun Pub. Co., 1981).
- 13) Yoshio Imai : "An Econometric Model of Subsidies", Jochi Keizai Ronshu (Jochi Univ.) Vol. 28, No. 2, 1981.
 - 14) Richard H. Day ed. : "Economic Analysis and Agricultural Policy", The Iowa State Univ. Press, 1982.
 - 15) E. S. Quade : "Analysis for Public Decisions", North-Holland Pub. Co., 1982.
 - 16) T. Kuroyanagi : "Economic Effect of Agricultural Policy and Policy Proposal", A Report in the Annual Meeting of Hokkaido Agricultural Economics Society, 1982.
 - 17) ——— : "Economic Effects of Government Investment in Farm Mechanization — A Japanese Experience — ", Journal of the Faculty of Agriculture (Hokkaido Univ.) Vol. 60, Pt. 4, 1982.
 - 18) Hideaki Abe and T. Kuroyanagi : "An Approach to Economic Effect of Agricultural Fiscal Expenditures and Institutional Loans on Agricultural Fundamental Law in Japan", A Report in the Annual Meeting of Japan Agricultural Economics Society, 1982.
 - 19) T. Kuroyanagi : "Problems of Agricultural Deficiency Payment in Japan", Food Policy Research Vol. 38 (Nosei Kenkyu Center), 1983.
 - 20) T. Kuroyanagi and H. Abe : "An Economic Analysis on the Economic Effect of Potato Processing", The Research on the Development Policy in Regional Industry (NIRA) 1983.
 - 21) Hiroaki Kobayashi and T. Kuroyanagi : "An Analysis on the Economic Effect of Japanese Agricultural Policy — A Simulation Analysis — ", The Nokei Ronso (Hokkaido Univ.) No. 39, 1983.
 - 22) H. Abe and T. Kuroyanagi : "A Simulation Analysis on the Economic Effects of Agricultural Fiscal Expenditures, Institutional Loans and Import of Agricultural Products", Report in the Annual Meeting of Japan Agricultural Economics Society and of Japan Public Finance Society.
 - 23) H. Abe and T. Kuroyanagi : "The Economic Effect of Agricultural Policy and Price Fluctuation of Oil", The Environmental Science (Hokkaido Univ.) Vol. 6, No. 1, 1983.
 - 24) T. Kuroyanagi : "The Economic Effect of Agricultural Subsidies and Import of Agricultural Product", Nogyo-to-Keizai, Vol. 50, No. 1, 1984.
 - 25) T. Kuroyanagi and H. Abe : "The Economic Effect of the Agricultural Policy in Japan — A Simulation Analysis — ", (Kenzo Henmi and Yuzuru Katoh ed., "Economic Analysis of Agricultural Policy in the Agricultural Fundamental Act", Meibun Pub. Co., 1985).