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Summary

Japan's agricultural border protection is high for food, but low for feed, thus effectively protecting both rice and meat products. This border protection is complemented by other governmental support in the form of direct subsidies, capital subsidies, price support, together amounting to 37% of agricultural GDP in 1985 and not offset by the taxes paid by farmers or on farm products. Changing this protective structure requires resource adjustment, which can be brought about by changing agricultural terms of trade, concomitant with an increase in average farm size and a decline in part-time farming, through a more liberal land-use policy.

1. Introduction

Japan is one of the largest food importers in the world and its imports of agricultural commodities have increased rapidly over the last three decades, resulting in the very low rates of food self-sufficiency. At the same time, Japan has raised the level of agricultural protection during the period of industrial growth following World War II. As several studies show the level of Japan's agricultural protection in recent years has been one of the highest in the world (Anderson and Hayami, 1986; OECD, 1987; USDA, 1987). Underlying the increase in agricultural protection and the decrease in food self-sufficiency is a sharp decline in comparative advantage in Japanese agriculture. Much higher rates of industrial productivity growth in Japan than in other developed countries since World War II have created a serious intersectoral adjustment problem of reallocating agricultural resources to industry at such a speed as to yield stronger social tension that the political system could have withstood. Japan has preferred to trade the cost of agricultural protection for the cost of industrial adjustment and thereby to postpone the structural reform of agriculture. Despite the rising level of

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protection, decreasing comparative advantage in agriculture has manifested itself in the form of increasing imports of agricultural commodities.

The purpose of this paper is to investigate the structure of agricultural protection in Japan and to examine the possibilities for structural adjustment of Japanese agriculture consistent with the open trade system. First, we review the structure of agricultural protection of Japan in terms of trade policy (Section 2) and fiscal policy (Section 3). Then, the roots of protection policies are related to the difficulties of intersectoral adjustment (Section 4) and the possibilities of structural reform in agriculture are discussed (Section 5). Finally, suggestions for the direction of Japan's agricultural policy for developing viable agriculture under the free trade system are presented (Section 6). The Conclusion emphasizes the basic need for the government to reduce its market interventions and to increase the supply of public goods to the agricultural sector (Sector 7).

2. Structure of border protection[1]

The conditions that have characterized agricultural trade policy in Japan can be understood from international comparisons of food self-sufficiency rates and the level of agricultural protection. As shown in Table 1, the declines in the self-sufficiency rates of wheat and coarse grains are precipitous, whereas complete self-sufficiency for rice and high rates of self-sufficiency for livestock products have been maintained. The average self-sufficiency rate for grains went down from 83% in 1960 to 34% in 1985, the lowest among major industrial countries. The real value of imports of agricultural commodities to Japan increased at an average rate of 13% per year from 1960 to 1985. In 1985, the total value of agricultural imports reached the level of 17 billion U.S. dollars, equivalent to about one-quarter of domestic agricultural output value. In this regard, the agricultural production and trade performance of Japan has been diametrically different from that of the EC countries that maintain high levels of food self-sufficiency under the protection of the Common Agricultural Policy (CAP).

For understanding Japanese agricultural policy it is important to know that the sharp increases in agricultural imports and declines in food self-sufficiency have occurred despite rapid growth in the protection of domestic agriculture. Table 2 summarizes changes in the average nominal rates of protection (NRPs) in 15 industrial and industrializing countries from 1955 to 1985. The NRP is defined as the ratio of the difference between domestic and border prices to the border price. The average NRPs were obtained by averaging NRPs for individual commodities weighted by their shares in the total output value at border prices. Commodities covered in the calculation are limited to twelve tradable commodities (specified in the footnote of Table 2). In the calculation, producer prices are used as domestic prices for

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Table 1. *Comparison of food self-sufficiency rates between Japan and other industrial countries*

(%)

	Japan			1982					
	1960	1975	1985	U.S.A.	U.K.	France	Germany (F.R.)	Italy	Netherlands
Grains	83	43	34	183	111	179	95	89	31
Food grains	91	76	74	312	109	208	104	99	59
Rice	102	110	107						
Wheat	39	4	14	320	111	216	109	94	62
Coarse grains	66	2	2	161	114	156	90	79	14
Pulses	44	9	8	147	51	119	16	98	9
Vegetables	100	99	95	102	66	92	36	122	255
Fruits	100	84	76	90	18	69	51	117	28
Dairy products	89	82	89	99	96	116	127	67	183
Eggs	101	97	98	103	99	105	71	95	298
Meat	91	77	81	98	78	100	89	75	213
Total final food consumption	91	76	73						

Source: Japanese Ministry of Agriculture, Forestry and Fisheries, *Shokuryo Jikyu Hyo* (Food Balance Sheets). OECD, *Food Consumption Statistics*.

Table 2. *Comparison of the nominal rates of agricultural protection between East Asian countries and twelve other developed countries, 19 5 to 1985*

(%)[a]

	1955	1960	1965	1970	1975	1980	1985	(1987)[b]
East Asia:								
Japan	18	41	69	74	76	95	108	(302)
Korea	−46	−15	−4	29	30	117	137[c]	(141)
Taiwan	−17	−3	−1	2	20	52	43[c]	(97)
European Community:								
Denmark	5	3	5	17	19	25	34	(97)
France	33	26	30	47	29	30	37	(95)
Germany, F.R.	35	48	55	50	39	44	40	(119)
Italy	47	50	66	69	38	57	72	(147)
Netherlands	14	21	35	41	32	27	38	(115)
United Kingdom	40	37	20	27	6	35	39	(80)
Average[d]	35	37	45	52	29	38	43	(108)
Non-allianced Europe:								
Sweden	34	44	50	65	43	59	65	(115)
Switzerland	60	64	73	96	96	126	181	(356)
Food exporters:								
Australia	5	7	5	7	−5	−2	na	(na)
Canada	0	4	2	−5	−4	2	0	(8)
New Zealand	na	2	0	5	7	−3	na	(na)
United States	2	1	9	11	4	0	11	(11)

[a] Defined as the percentage by which the producer price exceeds the border price. The estimates shown are the weighted averages for 12 commodities, using production valued at border prices as weights. The 12 commodities include rice, wheat, barley, corn, oats, rye, beef, pork, chicken, eggs, milk and sugar.

[b] Calculated by applying the exchange rates at the end of 1987 to the 1985 prices.

[c] Estimated for 1984.

[d] Weighted average for all six countries shown for 1975, 1980 and 1985, but excluding Denmark and the United Kingdom for earlier years.

Source: For 1955–1980, Kym, Anderson and Yujiro Hayami, *The Political Economy of Agricultural Protection: East Asia in International Perspective*, (Sydney, London and Boston: Allen and Uwin, 1986), p. 26; 1985 data are new estimates by the authors.

the comparison with border prices because of the necessity to include the effects not only of border protection but also of more direct agricultural supports such as deficiency payments. Thus, the NRPs calculated in Table 2 include an estimation bias to the extent that there are costs of marketing from the farm gate to a point in the marketing chain equivalent to the importing port. This bias is evident in the negative estimates of NRPs for some years of large food-exporting countries such as Australia and the United States. However, in so far as this bias is similar across countries and over time, it does not present a serious problem for the purpose of broad international comparison.

The first point worth noting about Table 2 is the high level of agricultural

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protection in Japan and two other newly industrializing countries (NICs), especially, Korea, in East Asia. In 1985, the average NRPs of Japan (108%) and Korea (137%) were considerably higher than the EC average (43%) and comparable only with those of Switzerland and Sweden which are known for the high level of agricultural protection for the purposes of national security and environmental conservation. In 1985 the U.S. dollar was still high relative to the currencies of other industrial countries due to the money supply control of the Reagan administration with the effect of lowering the domestic prices of agricultural commodities in other countries relative to the import prices in dollar terms. In order to assess the impacts of the depreciation of the dollar since then, the NRPs of 1985 are recalculated by substituting the exchange rates at the end of 1987 for the 1985 rates. The results of recalculation, as shown in parentheses, indicate that the average NRPs of Western Europe and Japan increased sharply corresponding to the adjustments in exchange rates, while that of Korea whose currency is linked with the U.S. dollar did not increase much.

In any case, there is no doubt that the level of agricultural protection in Japan, as measured by the average NRPs, is among the highest in the world. With that level of protection, it is not surprising to see strong external pressure mounting on Japan for agricultural trade liberalization, given her large trade surplus.

However, it is noteworthy that the high rates of agricultural protection in Japan and two East Asian NICs are relatively recent phenomena. The average NRP of Japan in 1955 was 18%, only half the EC average of 35%. It rose rapidly reaching the EC level in 1960 and the Swiss level in 1965. This was the period when Japan's economic growth was especially fast. More dramatic were the cases of Korea and Taiwan. Before the mid-1960s when the spurt of their industrial development began, the average NRPs were negative, reflecting the practice of agricultural exploitation policies common to low-income countries. During the 1970s their protection levels rose sharply and Korea caught up with Japan by 1980.

The average NRPs increased from 1955 to 1970 not only in Japan but also in industrial countries in general. This was the period when the international terms of trade turned against agriculture under the pressure of accumulated surpluses of grains in the United States and other major exporters. On the other hand, precipitous drops in the average NRPs of industrial countries were experienced from 1970 to 1975 corresponding to sharp increases in agricultural prices relative to manufactured commodity prices during the so-called World Food Crisis. The inverse correlation between NRP and the terms of trade for agriculture implies that industrial countries tried to insulate domestic markets from fluctuations in agricultural commodity prices in the international market with the logical consequence of domestic price stability at the expense of international instability (D.G. Johnson, 1975). However, even during the World Food Crisis

Table 3. *Nominal rates of agricultural protection for individual commodities in the European Community and Japan, 1955–85*

(%)

	European Economic Community						Japan					
	1955	1960	1970	1980	1985	(1987)	1955	1960	1970	1980	1985	(1987)
Grains:												
Rice	17	39	40	44	33	(91)	24	47	135	192	287	(647)
Wheat	46	36	54	18	25	(79)	31	51	134	261	331	(733)
Barley	31	26	67	23	31	(87)	24	52	158	307	428	(919)
Corn	20	14	23	38	21	(73)	na	na	na	na	na	(na)
Oats	0	5	25	26	0	(48)	na	na	na	na	na	(na)
Rye	47	44	46	32	11	(69)	na	na	na	na	na	(na)
Average	33	29	47	23	25	(78)	24	48	135	196	290	(653)
Livestock:												
Beef	71	61	75	93	58	(128)	39	84	108	100	111	(307)
Pork	29	31	21	13	10	(63)	2	97	−9	17	0	(92)
Chicken	78	52	22	13	27	(81)	−52	19	18	23	11	(114)
Eggs	16	26	15	5	41	(103)	−19	−7	−9	−1	13	(117)
Milk	16	29	86	53	98	(189)	4	5	212	186	200	(479)
Average	34	37	52	42	50	(118)	−8	22	24	40	41	(171)
Other:												
Sugar beet	101	100	91	40	37	(100)	na	na	214	141	205	(490)
All commodities:	35	37	52	38	43	(108)	18	41	74	85	108	(302)

Source: Same as for Table 2.

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period, Japan continued to increase her agricultural protection level, as did Korea and Taiwan.

What are the major characteristics of agricultural protection in Japan on a commodity-by-commodity basis? Table 3 compares the NRPs of individual agricultural commodities between the EC and Japan. A distinctive characteristic of Japan is that the level of protection on grains is higher than on livestock products, while the reverse is the case with the EC. The protection on grains in Japan has a two-tier structure. It is extremely high for food grains, especially rice, but feed grains such as maize were imported with virtually no trade barrier to such an extent that no appreciable amount was produced domestically and, therefore, no domestic producer price was recorded.[2]

Such strong bias in favour of food grains in Japan's agricultural protection seems to be explained by the traditional lack of substitutability between rice and feed grains that made it possible to increase the price support on rice and, at the same time, to import feed grains without protection (Hemmi, 1970). In European countries it would have been difficult to maintain the prices of food grains at a high level if cheap feed grains were imported freely because their food grains such as wheat and rye are highly substitutable for feed grains. Likewise, it would have been difficult for European countries to raise the level of support for food grains too high because it would have necessarily resulted in high feed costs to domestic livestock producers.

In Japan, the lack of substitution between rice and feed grains enabled the simultaneous achievements of both very high support of domestic food grains and low feed costs to domestic livestock producers. Yet, past trends show that the NRP of livestock products in Japan increased faster than that of grains; in 1955 it was negative (considered to be zero if adjusted for marketing margins from the farm-gate to the wholesale level) and obviously much lower in Japan than in the EC (with 33%) but it rose rapidly, reaching almost a par with the EC in 1980. Considering the lower rate of protection of feed grains, the effective rate of protection of livestock products in Japan in 1980 may well have been higher than in the EC.

Comparison of Table 3 with Table 1 reveals a tendency that the commodity structure of agricultural production is determined by protection policy as well as by comparative advantage. Japan is characterized by the scarce endowment of land relative to labour and capital. Therefore, comparative advantage is lower in land-intensive crops such as grains and soybeans than labour- and capital-intensive commodities such as vegetables, pigs and poultry. However, among grains, domestic surpluses of rice have been maintained by very strong protection. Also, among livestock products, beef and dairy products have been heavily protected. Furthermore, among chickens a higher tariff rate has been applied to boneless chicken than boned chicken in carcass for the sake of protecting the former from the competition of low-wage countries such as Thailand.

3. Structure of government subsidies

What is the structure of agricultural protection in Japan by means of government subsidies? As shown in Table 4, the total agricultural budget of the Ministry of Agriculture, Forestry and Fisheries (MAFF) grew at the rate of 20% in the 1960s and by more than 10% in the 1970s. The ratio of agricultural budget to agricultural GDP was less than 10% in 1960 but rose sharply and reached to about 50% in 1980. Since 1980 the Ministry of Finance has enforced budget cuts on all ministries including the MAFF in order to reduce the swollen financial deficit. But the ratio of agricultural budget to agricultural GDP remained as high as 38% in 1985.

Table 4. *Structure of national government budget for agriculture in Japan*

	1960	1970	1980	1985
Total agricultural budget[a] (billion yen)	137	883	3094	2712
Ratio of agricultural budget to total budget (%)	7.8	10.8	7.1	5.1
Ratio of agricultural budget to agricultural GDP (%)	9.2	27.1	49.7	38.3
Composition of agricultural budget by economic function:				
Final consumption[b] (%)	15	8	9	11
Capital formation[c] (%)	46	27	38	40
Transfer payments[d] (%)	39	65	53	49

[a] General account budget of the Ministry of Agriculture, Forestry and Fisheries deducting budget for the Fishery Agency and the Forest Agency.
[b] Equivalent to the cost of government services such as administration, research, education, etc.
[c] Include capital subsidies for land improvement.
[d] Include transfer to the food control special account.
Source: Japan Ministry of Finance, *Kessan Sansho* (Reference to Settled Accounts); Japan Ministry of Agriculture, Forestry and Fisheries, *Nogyo oyobi Noka no Shakai Kanjo* (Social Accounts of Agriculture and Farm Households).

The characteristics of the agricultural budget in Japan can be understood by observing its classification by economic function. Traditionally, the budget has been classified into the three categories, final consumption, capital formation and transfer payments. Only the first two are part of the effective demand for GDP. As shown in Table 4, the MAFF's budget is characterized by the major share of transfer payments which occupy about a one-half of the total agricultural budget in 1985. In general, the government is supposed to play three major roles: provide public goods, adjust resource allocation and redistribute national income. It is evident that the MAFF's budget allocation in 1985 was geared for income redistribution more than anything else. In 1960, however, it was not transfer payments but capital formation that had the largest budget share. Increases in the share of transfer

payments in the 1960s correspond to the increases in Japan's NRP during the same period (compare Tables 2 and 4). The main source of the increases in transfer payments was a rapid growth of the deficit in the Food Control Special Account due to continuous increases in government support of the producer price of rice. The high support price stimulated domestic production to expand in excess of consumption, resulting in an accummulation of surplus rice in government storage. This made it necessary to adopt an acreage-control programme in 1969 with incentive payments for retiring paddyfields from production or for diverting them to non-rice crops. The acreage-control programme was strengthened under the pressure of accumulating surplus stock and escalating government deficit. In the new plan, started in 1987, the target acreage of diversion was raised to 770,000 hectars, which is equivalent to almost one-third of total paddy acreage in Japan. Although the subsidies for the acreage control programme were reduced by 23% in total, the cost of the Food Control is still about 500 billion yen in the 1988 budget and comprises the largest share in the transfer payments.

The government budget can be reclassified from the standpoint of resource allocation. We consider four categories for this purpose in terms of public-good characteristics. It is the prime responsibility of government to provide public goods which can not be efficiently supplied in markets. Government expenditure on non-public goods, or private goods, which can be transacted through markets, is considered to result in less efficient resource allocation, although the government provides them for other policy purposes than efficient resource allocations (such as for income redistribution). Table 5 shows the results of a classification of the agricultural budget according to public-good characteristics. In reality, the government make outlays for many items which have a hybrid nature between pure public goods and pure private goods. Thus, we tried to classify government budget into four categories by adding two categories, 'semi-public goods' and 'semi-private goods' in between 'public goods' and 'private goods'. (For items included in each category, see footnotes to Table 5).

For the earlier period as compared with the later period, the composition of agricultural budget was more strongly oriented towards the provision of public and semi-public goods amount to 58% of the total in 1960. Their share showed a drastic change from 1960 to 1970. During that decade, the share of private goods, mainly for price supports, increased twice as much and occupied 55% of the total agricultural budget in 1970. The government's efforts to reduce spending for rice programmes resulted in decreases in the share of private goods to 35% in 1980 and 30% in 1985. The share of semi-public goods recovered from 23% in 1970 to 36% by 1985, reflecting the fact that public investments (such as land improvement) were kept constant even in the period of the budget cut.

Japanese agriculture needs to undergo a structural reform so as to be viable without protection. For this reason, the structure of the agricultural

Table 5. *Breakdown of agricultural budget of the national government in Japan by public good characteristic*

(billion yen)

Budget for:	1960	1970	1980	1985
Public goods[a]	19.0	66.3	215.7	270.4
	(14)[e]	(8)	(7)	(10)
Semi-public goods[b]	60.5	207.0	980.8	981.0
	(44)	(25)	(32)	(36)
Semi-private goods[c]	25.5	121.3	819.2	640.5
	(19)	(14)	(26)	(24)
Private goods[d]	32.1	488.8	1078.6	820.5
	(23)	(55)	(35)	(30)

[a] Budget for general government service, statistical information, research and development, and extension service.

[b] Budget for land improvement, land development, land preservation, and reconstruction due to natural disasters.

[c] Budget for agricultural finance and insurance, agricultural promotion, structural improvement, and market and distribution.

[d] Budget for food control and market price intervention.

[e] Figures in parentheses are percentages of total agricultural budget.

Source: Ministry of Finance, *Kessan Sansyo* (Reference to Settled Budget Accounts).

budget must be re-examined. A critical element in the structural reform for improving labour productivity in Japanese agriculture is the expansion of operational farm size. With the present average of a little above one hectare per farm, it can hardly be expected to exploit economics of scale inherent in the use of modern labour-saving technology. Land improvements such as leveling crop fields and their consolidation into a large unit together with the development of irrigation and drainage facilities are vital for expansion in the scale of farm operation. It is difficult for small farmers in Japan to carry out those land improvements individually, especially for ricefields interlinked by a gravity irrigation system. Therefore, public expenditure for land improvements is critically important for the future development in Japanese agriculture. The budget should be reallocated for this purpose away from that for private and semi-private goods. Even more important is it for the government to supply public goods such as research and development. Agriculture is entering a new era in which science-based technology plays a dominant role. Government should attempt bold increases in public expenditures for strengthening agricultural research, development and extension systems.

Agricultural policy in Japan relies heavily on subsidies to farm producers and their organizations. It is well known that agricultural subsidies in Japan are characterized by a large number of items and relatively small disbursement per item. In 1984, the number of subsidy items under the MAFF was 549, one of the largest among the ministries of the central government. but

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the average disbursement per item was only 3.5 billion yen, which was much less than the all-ministrial average of 5.6 billion yen. Such a large number of small subsidies has been considered essential for inducing the participation of a large number of small farmers in various policy programmes.

Subsidies take various forms and it is difficult to ascertain how effective they are for the purpose of protecting domestic producers. The narrowest definition of subsidies working for protection may be the subsidies which are directly paid to farmers by government without requesting any return. Such direct subsidies are recorded in the system of national accounts as well as indirect taxes to drive a wedge between total domestic spending and domestic factor incomes generated in the economy. Thus, the data of the direct subsidies are available for the countries that apply the system of national accounts to the economic accounts of the agricultural sector. Table 6 shows the direct agricultural subsidies in Japan in comparison with those of some other countries, expressed in their ratio to agricultural GDP. Japan's level of direct subsidies was 7.2% of agricultural GDP in 1980 and 5.3% in 1984. This level is judged about the same as those for other developed countries except the Netherlands and Australia. It is interesting to see much lower rates of direct agricultural subsidies in developing than developed countries. This pattern across countries is consistent with the pattern of border protection as discussed in Section 2.

In addition to direct subsidies, there are many indirect subsidies which

Table 6. *International comparison of direct subsidies to agriculture in the ratio to agricultural GDP*[a]

(%)[b]

	1976	1980	1984
Japan	3.4	7.2	5.3
EC:			
France	5.7	3.8	4.2
Germany, F.R.	11.4	7.4	10.6
Netherlands	1.6	1.4	0.3
Other developed countries:			
Austria	3.5	4.7	5.0
Sweden	2.3	2.6	4.1
Australia	0.4	2.5	1.7
Developing countries:			
Mexico	0.6	1.6	1.6
Colombia	0.2	2.8	0.4
Thailand	0.5	0.4	0.4

[a] Subsidies here are defined in the system of national accounts, including only direct government subsidies and not including those paid through other agencies.

[b] Ratio of direct subsidies to agricultural GDP in percent.

Source: FAO, *Economic Accounts for Agriculture, 1976–1985.*

play a function similar to that of direct subsidies. For example, transfer payments to semi-governmental agencies such as the Livestock Industry Promotion Corporation and the Silk and Sugar Price Stabilization Corporation are used for price support operations by these agencies. The subsidies to agricultural financial agencies such as the Agriculture, Forestry and Fishery Finance Corporation and other financial institutions for agriculture are used to subsidize the interest rates offered by these institutions.

Furthermore, there are two other large items in the agricultural budget. One consists of transfers from the general account to Food Control Special Account for the sake of offsetting the latter's deficits created by the high rice price support for domestic producers. Since World War II, rice has been under direct government control based on the Food Control Law of 1942. Initially, it was designed to ration distribution of all staple food items during the severe shortages, but the role changed from protecting consumers to protecting producers in the course of the economic development that followed Japan's postwar recovery. Currently the price of rice is not only far above the world price but also above the market equilibrium price under autarky. Thus, the transfer to the Food Control Special Account is characterized as a protective expense for agriculture.

Another large item is subsidies to agricultural capital formation. It is one of the characteristics of Japanese agriculture that agricultural investments, especially investments in land infrastructure, are heavily dependent on government subsidies. It may appear that such subsidies should not be included in the cost of protection, considering their public-good characteristics. It must be recognized, however, that the portion of land infrastructure investment allocated to major canals and other overhead facilities is only about 20% and the rest is allocated to farm ditches, farm land consolidation and reshaping for which individual beneficiaries can be easily specified.

Table 7 summarizes all those subsidies discussed above. As this table shows, the direct subsidies are just a part of the budgetary aid for agriculture. The total of all subsidies amounts to 2,626 billion yen in 1985, equivalent to 37% of the agricultural GDP in that year. It is notable that the share of the transfer to the Food Control Special Account decreased from 1970 to 1985 and the share of capital subsidies increased instead.

Such subsidies paid to the agricultural sector are, to some extent, offset by tax burdens on agriculture as shown in Table 7. We subtract the sum of indirect taxes on agricultural production and income tax imposed on agricultural income (B) from the subsidies (A) to obtain the net subsidies to agriculture (A − B). The total of agricultural taxes (B) amounts to just 572 billion yen or 8% of the agricultural GDP in 1985. Thus, the net subsidy (A − B) becomes 2,047 billion yen or 29% of agricultural GDP, which can be considered net transfer from non-farm taxpayers to agriculture. Farm households bear other tax burdens such as income tax on non-agricultural income and local government taxes. However, even if we take account of

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Table 7. *Agricultural subsidies and tax burdens on agriculture in Japan*

(billion yens)

	1970	1980	1985
Subsidies:			
Direct subsidies[a]	135	450	345
Other subsidies[b]	82	500	419
Deficit in Food Control Account[c]	375	585	356
Capital subsidies	301	1492	1506
Total (A)	893	3027	2626
(Ratio to agricultural GDP (%))	(27)	(49)	(37)
Tax burdens:			
Indirect taxes in agricultural production[d]	97	360	431
Agricultural income tax[e]	46	72	148
Sub-total (B)	143	432	572
(Ratio to agricultural GDP (%))	(4)	(7)	(8)
Other direct taxes	177	1071	1544
Total (C)	320	1503	2123
Net subsidies (A − B)	750	2595	2047
Net subsidies (A − C)	573	1524	503

[a] Subsidies defined in the system of national accounts.
[b] Include transfers to agricultural agencies which provide agricultural support programmes.
[c] Transfer from the General Accounts to the Food Control Accounts.
[d] Indirect taxes defined in the system of national accounts.
[e] Estimated by agricultural income tax per farm household multiplied by the number of farm households.
Source: Japan Ministry of Agriculture, Forestry and Fisheries, *Nogyo oyobi Noko no Shakai Kanjo* (Social Accounts of Agriculture and Farm Households). *Noka Keizai Chosa Hokoku* (Farm Household Economy Survey Report), Japan Ministry of Finance, *Kessan Sansho* (Reference to Settled Budget Accounts).

those non-agricultural direct taxes, the subsidies exceed the total tax burdens of farm households (C) as the net susbidies (A − C) show positive numbers in Table 7. Thus, it is clear that current fiscal policy is used to transfer income from farm to non-farm households.

4. Problems of intersectoral resource adjustment

The level of agricultural protection in Japan rose rapidly during the period of high economic growth in terms of both producer price support and budgetary support. Underlying the increase in agricultural protection during that period was the sharp decline in comparative advantage in agriculture. Table 8 compares the growth rates of labour productivity in agriculture with those of the manufacturing sectors from 1960 to 1980 among developed and developing countries for which data are available. During this period, labour productivity in agriculture in Japan increased at an average rate of 5.3% per

Table 8. *International comparison in the growth rates of labour productivity in agriculture and manufacturing, 1960 (1958–62 averages) to 1980 (1978–82 averages)*

	Labour productivity growth rate (%/year)[a]		
	Agriculture	Manufacturing	(1)−(2)
	(1)	(2)	=(3)
Developed countries:			
U.S.A.	6.3	3.2	3.1
U.K.	5.5	2.6	2.9
France	6.4	4.2	2.2
Germany (F.R.)	7.7	4.1	3.6
Japan	5.3	6.7	−1.4
Developing countries:			
Korea	4.0	7.5	−3.5
Philippines	3.2	3.5[b]	−0.3
India	1.3	2.1	−0.9

[a] Calculated from the ratios of the real output index to the employment index.
[b] Growth rate from 1960 to 1975.
Source: FAO, *Production Yearbook*; UN, *Yearbook of Industrial Statistics*; ILO, *Yearbook of Labour Statistics*; OECD, *Labour Force Statistics*.

year in real terms, which was about the same speed as in other industrial countries. However, labour productivity in the manufacturing sector of Japan increased at a rate of 6.7% per year which was considerably higher than in the United States and many European countries. This suggests a decline in agriculture's comparative advantage in Japan relative to other industrial countries.

The decline in comparative advantage in agriculture created a demand for agricultural protection. If adjustments in intersectoral resource allocation corresponding to the rapid shift in comparative advantage from agriculture to industry had been left to the market, the cost of adjustment that rural people would have borne in such forms as rural depopulation, low income and unemployment would have been very large. In order to shift a part of the cost of intersectoral adjustment in resource allocations to the general public, farmers lobbied for protection.

The cost of intersectoral adjustment can be assessed in terms of the effects of lowering the level of agricultural protection in the labour market. In the Appendix we developed a simple two-sector econometric model to explain labour demand and migration. It consists of three behavioural equations and one definition with four endogenous variables. Using this system of equations, a simulation analysis is made to evaluate what would have happened if the level of agricultural protection had been lower than actual since 1961. In the simulation model, changes in agricultural protection are treated as

changes in the terms of trade (producer price index of agricultural commodities divided by the wholesale price index of manufactured goods). The domestic terms of trade are considered a policy variable which the government can control through import control or direct price support. In Japan the actual terms of trade were rising at the annual rate of 6.0% during the 1960s and 1.4% during the 1970s. We examined three cases in changing this policy variable: the first case assumes that the government controlled the terms of trade so that its growth rate had been zero; the second and the third cases assume the growth rates had been 50% and 75%, respectively, of the actual rate since 1961. Those three cases are called Policy 1, Policy 2 and Policy 3, respectively.

The simulation results are summarized in Table 9, in which the effects of each policy on endogenous variables are compared with actual values. In setting the endogenous variables, we consider two types of models; in model A agricultural labour employment, industrial labour employment, agricultural wage rate, and industrial wage rate are endogenous, whereas in model B the unemployment rate is endogenous instead of the industrial wage rate. The reality must be somewhere in between the two models because the unemployment rate and the industrial wage rate are simultaneously determined. We examine the two cases separately with the simplifying assumption that the causality is one way in each case.

First, let us look at the case of model A in which labour employment and wage rates in both agricultural and industrial sectors are affected by changes in the terms of trade. If the terms of trade had been fixed at the level of 1960 (Policy 1; in other words, if changes in the price of agricultural products had been parallel to those in industrial goods since 1960) agricultural employment would have been 5.3 million (83% of the actual) in 1970 and 2.3 million (49% of the actual) in 1984. The results reflect multipliers of the terms of trade in the reduced form of the model. As seen in the Appendix, the impact multiplier to show the direct effect of changes in the terms of trade on agricultural labour is 0.3 but the total multiplier showing the long-run effect becomes 0.9. Those results tell us that depressing agricultural prices parallel to industrial prices would have caused more rapid migration with the result of a decline in employment to about a one-half of the actual number by 1984. In other words, agricultural labour has a high ability to adjust in the intersectoral labour market to relative product price changes in the long run. However, the price changes might have serious effects on both agricultural and industrial wage rates in the short run. Table 9 shows that the Policy 1 would have depressed both agricultural and industrial wages to less than one-half of the actual in 1970, though it would have recovered to 80% after adjustment in the intersectoral labour market. Indeed, the impact multipliers of the terms of trade on wages are greater than the total multipliers; the impact multipliers are 0.5 and 0.7 for agricultural and industrial wage

Table 9. *Results of dynamic simulations for assumed policy changes*[a]

Dependent variable	Year	Actual value	Policy 1[b] ($\Delta P=0$) Model A	Model B	Policy 2 ($\Delta P=50\%$ of actual) Model A	Model B	Policy 3 ($\Delta P=75\%$ of actual) Model A	Model B
Agricultural labour force[c] (million)	1970	7.6	6.3	6.4	7.0	7.0	7.4	7.4
	1980	5.2	2.5	3.1	3.6	3.9	4.2	4.4
	1984	4.7	2.3	2.8	3.3	3.7	4.0	4.2
Industrial labour force (million)	1970	39.7	41.0	38.8	40.3	38.0	39.9	38.2
	1980	37.5	40.2	38.8	39.1	38.0	38.5	38.2
	1984	38.4	40.9	38.8	39.8	38.0	39.1	38.2
Agricultural wage (1980 = 100)	1970	60	29	23	36	33	40	40
	1980	100	86	71	94	86	100	96
	1984	113	88	76	97	90	103	100
Industrial wage (1980 = 100)	1970	52	24		31		35	
	1980	100	83		91		96	
	1984	117	93		102		107	
Unemployment rate (%)	1970	1.1		4.8		3.7		3.1
	1980	2.1		5.0		3.5		2.6
	1984	2.6		6.4		4.9		4.0

[a] Figures are three-year averages.

[b] Policy 1, Policy 2, and Policy 3 are the cases in which the growth rate of terms of trade (ΔP) is set at 0, 50 and 75% of the actual rate, respectively, since 1961.

[c] Labour force is evaluated in terms of manpower of 1980 for working days or working hours used for the labour variables.

rates, respectively, but the total multipliers are less than 0.4 for both the wage rates as shown in Table A2 in the Appendix.

In the case of model B where industrial wage is treated as fixed, the effect of Policy 1 on agricultural wage would have been more serious. Agricultural wage would have been depressed to less than 40% of the actual in 1970 and it would have recovered only to 70% even in 1984. Furthermore, unemployment would have grown assuming no corresponding changes in labour demand in the industrial sector. Policy 1 would have increased the unemployment rate of 4.8% in 1970 as compared with the actual 1.1% and 6.4% in 1984 as compared with the actual 2.6%; such high rates of unemployment should have reduced labour migration estimated under the assumption of model A. Policy 2 and Policy 3 in Table 9 examine the effects of less drastic policy change in the terms of trade assuming the growth rates in the terms of trade had been 50% and 75% of the actual, respectively. The tendency is the same as under Policy 1, but the effects are naturally much more moderate.

Such results of the simulations suggest that reduction in the level of agricultural protection would have resulted in a serious decline in the return to labour in agriculture in the short run. However, this problem could have been offset in the long run to the extent that labour migration would have been accelerated in response to the agricultural price changes. Thus, the results of the simulation analysis may appear to justify the use of protection policies in order to counteract the agricultural income decline in the short run. However, there are several alternative policies. According to the impact multipliers of exogeous variables in the simulation model (summarized in Table A2 in the Appendix), the interest rate in the industrial sector and employment in the service sector will have large positive effects on both the agricultural and the industrial wage rates as well as the unemployment rate. It means that such policies as lowering interest rate or public investment influencing the accumulation of industrial capital and expanding employment in the service sector would be effective to offset the wage declines that might result from lowering agricultural protection. Thus, if appropriate public policies are adopted, the negative effects of lowering the agricultural protection level as illustrated in Table 9 can be minimized.

5. Structural adjustment in agriculture

If the increase in demand for agricultural protection in the course of postwar economic development stemmed from the shift in comparative advantage from agriculture to industry, would it not have been possible to reverse the trend by accelerating the growth rates of agricultural productivity through structural adjustments? In fact, ever since the 1961 Agricultural Basic Law was enacted with the goal of making per-capita farm family income equal to

that in non-farm sectors, the MAFF has worked untiringly to achieve this target through improving the agricultural structure. As indicated by the 'selective expansion' slogan, this has meant policies designed to raise agricultural production efficiency and farm income by transferring resources from the production of farm products of low-income elasticities to those of high-income elasticities and by expanding the scale of operations. Yet despite these policy efforts, it has proven impossible to achieve income equalization through agricultural restructuring alone. Protective policies had to be resorted to, primarily because the rapid economic growth induced such rapid increases in non-agricultural income that agricultural restructuring and the improvements in labour productivity in agriculture could not keep pace.

The chief restraint on raising labour productivity in Japanese agriculture has been the small size of farms. Japan's average farm size is still only 1.2 hectares, and less than 5% of farms operate on more than three hectares. The average farm size showed virtually no increase during the period of high economic growth. As shown in Table 10, the number of workers engaged mainly in agriculture declined by over 50% between 1960 and 1985. Yet there was a

Table 10. *Changes in agricultural labour force, number of farms, and arable land area in Japan*

	1960	1970	1980	1985	1985/1960
Workers engaged in agriculture[a] (10,000):					
Mainly engaged[b]	1454	1025	697	636	0.44
Supplementally engaged[c]	312	522	557	527	1.69
Total	1766	1547	1254	1163	0.66
Farms (10,000):					
Full time	208	83	62	63	0.30
Part-time type I[d]	204	180	100	78	0.38
Part-time type II[e]	194	271	304	297	1.53
Total	606	534	466	438	0.72
(Core farms)[f]		(124)	(103)	(87)	
Arable land (10,000 ha)					
Lowland	338	342	306	295	0.87
Upland	269	238	241	243	0.90
Total	607	580	546	538	0.89
Arable land area per farm	1.00	1.09	1.17	1.22	1.22
Land utilization rate[g]	133	108	103	104	0.78

[a] Farm household members above 16 years old who engage in farming for any amount of time.
[b] Engaged in farming more than in other economic activities.
[c] Engaged in farming less than in other economic activities.
[d] Farms with farm income larger than off-farm income.
[e] Farms with farm income smaller than off-farm income.
[f] Farms with economically active male (16 to 59 years old) engaged in farming for more than 150 days per year.
[g] Ratio of total area planted in a year to total arable land area.
Source: Japan Ministry of Agriculture, Forestry and Fisheries, *Noringyo Census* (Census of Agriculture and Forestry), *Nogyo Chosa* (Agricultural Survey); *Kochi Oyobi Sakuzuke Menseki Tokei* (Statistics of Arable Land and Area Planted).

decline of only 28% in the number of farm households, and this, together with the conversion of some agricultural land to non-agricultural uses, kept the average farm size increase at 22% over the period (0.8% per annum)—a growth rate which would require some 90 years for a mere doubling.

Obviously, the reason there was so little decline in the number of farm households despite the decline in the agricultural population is the increase in the number of part-time farm households. Whereas approximately one in three farm households was engaged in farming full-time in 1960, the number of type II part-time farm households (those whose non-agricultural income exceeds their agricultural income) has jumped from 30% to 70% of the total. It thus became common for farmers with secure non-agricultural employment to hold on to their land and to continue farming in their spare time by drawing upon supplemental labour from available farmily members.

As a result, full-time farmers have found it difficult to expand their scale of operations. As of 1984, the average land area under cultivation of full-time farm households was only 2.2 hectares, and the average of 'core' farms (those retaining at least one male worker from 16 to 59 years old engaged in farming for more than 150 days per year) was only 2.6 hectares. Consequently, full-time or core farmers wishing to expand their scale of operations have had to develop land-saving enterprises such as poultry, pigs and greenhouse crops.

Part-time households tend to concentrate on rice farming because it is a very stable crop offering a high return on only intermittent labour. Because rice marketing is carried out by the government, rice farmers are guaranteed a high price and can easily sell their harvest through agricultural co-operatives. In addition, agricultural research and extension services have traditionally concentrated on the rice crop to the extent that rice cultivation has become highly standardized and there is relatively little difference in productivity between part-time and full-time farmers. The fact that the production of Japan's staple crop has been geared to part-time farming in this way is thus a major factor encouraging part-time farming and impeding the consolidation of farms.

The Japanese government's efforts since the 1961 Agricultural Basic Law to foster efficient agriculture by concentrating land and other agricultural resources in a small number of large-scale viable operating units have not been successful so far mainly because of the nationwide spread of type II part-time farming as discussed above. However, there is a sign that conditions are now being prepared for achieving the structural adjustments envisaged with the enactment of the Basic Law.

First, with a series of amendments of the Land Laws (1962, 1970 and 1980) and the enactment of the Farm Land Utilization Promotion Law in 1980 (by which contracts for short-term land leasing with the mediation of village headmen are exempt from the regulations of the Land Laws)

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institutional barriers for farm-size expansion through land leasing have largely been removed.

Second, the continuation of part-time farming by older family members due to increased life expectancy is now reaching a limit. By 1985, as many as 51% of male workers in agriculture were older than 60 years (36% above 65 years) compared with 23% in 1960. The proportion of male workers below 30 years old in now only 8%. About one-half of farm households have no son who expects to continue farming. It is reasonable to expect a substantial decrease in the number of farm households as aged people will retire from farming.

Third, the large-scale farm mechanization that began in the 1970s has given rise to economies of scale. Farm mechanization in Japan progressed in three stages. The first stage was the diffusion of static machinery such as threshers and water-lifting pumps that began before World War II. The second stage was the small-scale mechanization with power tillers and sprayers during the 1960s. This was a partial mechanization leaving tasks such as transplanting and harvesting to manual labour. The third stage, which began around 1970, has been marked by large-scale mechanization with riding tractors, combines and transplanters. During this stage the whole process of rice farming has been mechanized. With the emergence of economies of scale associated with the use of large machinery, land transfers from small to large farms have accelerated.

Thus, after two decades since the 1961 Agricultural Basic Law, social and technological conditions are becoming ripe for ushering in major structural adjustments in Japanese agriculture.

6. Toward the development of viable agriculture[3]

In seeking economic development that is based on international co-operation, it is necessary to liberalize agricultural trade. When applied to Japan, this implies the need to foster agriculture of comparable productivity with the industrialized countries of the West, so that domestic agriculture will become viable under liberalized trade. The critical condition for raising the productivity of Japanese agriculture is to expand the scale of farm operations. Because the farmer's strong attachment to the land and the expectation that such land will become increasingly valuable make it difficult to expand the scale of agricultural operation through transfering land ownership, the way left to expand the operational scale is through land leasing. Thus, activation of the land rental market is essential. The liberalization of land rental contracts must be further promoted. As explained previously, major institutional impediments to the transfer of land-use rights have been removed. Yet, unneccesary regulations of land tenure still remain. For example, share tenancy is prohibited despite its advantage in reducing risk

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for active young farmers who try to rent more farm land as well as facilitating retirement of old farmers by forming partnerships with the young.[4] Rent control was removed with the 1970 amendment of the Land Law. But, the MAFF sets a 'standard rent' to which land rental contracts based on the Farm Land Utilization Promotion Law are supposed to conform. Such unnecessary regulations and administrative guidance should be removed as soon as possible.

Even if an expanded scale of operation is promoted through the activation of the land rental market, this will not in itself mean the achievement of internationally competitive agriculture, given the current production structure. Even if Japan achieves a farm size equal to that in the EC, it will be difficult to compete internationally in wheat or feed grains with countries such as the United States and Australia. A major re-orientation of agricultural production will be required for the shift to an open trade system. The Netherlands (see Table 1) is an illustrative case. The Netherlands has the lowest self-sufficiency in grains of any European country, even lower that Japan's but at the same time it is a major exporter of horticultural and livestock products because it has succeeded both in using its scarce land very efficiently and in maintaining a good pastoral environment. When cheap grains began to pour into Europe from the New World in the nineteenth century, France, Germany, and other European states erected tariff barriers to protect domestic agriculture, whereas the Netherlands and Denmark transformed their agriculture by making use of these cheap grains and specializing in the production of the commodities in which they had a comparative advantage. The Netherlands exemplifies the direction Japanese agriculture should take.

We know that it will not be easy for Japanese farmers, accustomed to agriculture centering on the traditional rice and cereal crops, to switch to livestock-centered farming and to bring their productivity up to international standards. Therefore, greater governmental investment in land infrastructure, agricultural research, and the education and training of farmers will be needed if the desired agricultural adjustments are to be achieved.

The main obstacle to such a restructuring of Japanese agriculture is the high level of rice price supports. The price of rice paid to Japanese farmers was virtually at the international level until the early 1950s. It was raised sharply during the era of high economic growth. During the period when the producers' price for rice soared, investments in technological development, extension services, and land improvement were concentrated on rice production to make rice Japan's most stable and most standardized crop. The result is that part-time farmers have come to rely upon rice as discussed previously. Meanwhile, there has been little expansion in the scale of operation of full-time farmers. The shift of agricultural resources from rice to other crops with high income elasticities has been impeded.

The price of rice must be held down so that structural adjustments can be

made that would lead to an open trade system. Although the producer price of rice was cut by 5.95% in 1987 for the first time since the 1961 Agricultural Basic Law, it is still far above domestic equilibrium under autarky. It should be recognized that lower prices will ultimately benefit even those full-time farmers who specialize in rice cultivation by promoting the transfer of cultivated land and, thereby enabling them to expand their scale of operation. The price of rice must be held down so as to encourage the shift away from rice, where demand has been declining 2 to 3% per annum, to other crops where demand is increasing such as forage crops for livestock production. Although it is not an easy task, it should be possible to develop highly efficient mixed farming if farm size can be increased and appropriate research and extension activities be focused more on the livestock sector.

Meanwhile, the conditions of structural adjustments are ripening with the emergence economies of scale in agricultural production and a large proportion of the agricultural labour force coming close to retirement age. It is vital for preservation and development of domestic agriculture to reformulate trade policies in directions which promote its structural adjustment. It appears that the new GATT round offers an excellent opportunity for such policy re-orientation.

A major offer to multilateral trade negotiations that Japan should be able to make is the abolishment of all the import quota (IQ) restrictions (except on processed grain products). At present, 22 agricultural and marine products are subjected to IQ. Of the 22 products, however, 10 quotas were judged illegal by the GATT multinational panel and Japan accepted the panel's ruling in February 1988. Further, the recent Japan–U.S. negotiations concluded in June 1988 with an agreement that the quota on beef will be removed from April 1991 and those on oranges and orange juice from April 1991 and 1992, respectively.

In designing the removal of the IQ restrictions, it is useful to classify them into three categories. The first group includes minor agricultural products of mere local significance, such as beans and peanuts. The decline in these crops corresponding to trade liberalization may have serious impacts on specific local economies but the same applies to mines and factories in the declining industries. The standard approach to the liberalization of such commodities, either agricultural or manufactured, is to assist industrial adjustments, such as giving subsidies to the producers for the shift of resources to other economic activities while inducing the location of new enterprises in substitution of the declining ones by giving tax preference and subsidies.

The second group includes the products of sufficient international competitiveness. Japanese *mikan* (tangerines), is representive of this group. For the 1982–85 average, the wholesale price of *mikan* was about 30% lower than the cif price of imported oranges and only half if the seasonal duty (applicable in December to May) of 40% *ad valorem* is added. Given that

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much of price difference, it is inconceivable that the import of oranges will increase so much as to imperil domestic *mikan* production.

The third group include beef and dairy products which are now weak in international competition but are expected to become major industries in Japanese agriculture in the future, especially in remote hills and mountains. For these products, too, IQ restrictions can be removed with large social gains and with little sacrifice to domestic producers if they are substituted by less distortive measures such as deficiency payments and tariff quotas.[5]

In exchange for the removal of IQ restrictions, Japan should seek an agreement to exempt rice from trade liberalization until such time as the liberalization of the domestic market will be completed. Indeed, under the present food control system, the import of rice would have no benefit to consumers because the increased supply from imports would be compensated for by the increase in acreage control in order to maintain the domestic producer price. At the same time, the enlarged acreage control would impede the exploitation of economies of scale. Under the present system, the large gap between the domestic and the import prices of rice is captured by the Food Agency and is used to maintain inefficient protection policies.

Therefore, before trade liberalization is undertaken, it is necessary to reform the food control system. The first step should be a shift from the total control of rice marketing to partial control in which the government purchase and distribution of rice is limited to producers who voluntarily participate in acreage control. The distribution of the produce by the non-participants should be left to the free market. As a second step, the government purchase price should be lowered gradually until an equilibrium in autarky is reached. At that stage, the government role should be limited to price stabilization by means of buffer stock operations. Once such a state is reached, gradual increases in rice imports will become beneficial to consumers, and will also act as an incentive for domestic producers to reduce the cost of production.

7. Conclusion

The general tendency is that agricultural protection and supports increase when a country reaches an advanced stage of economic development characterized by high per-capita incomes and low shares of the agricultural sector in the total economy. A common source of agricultural protectionism in industrial countries is the difficulty of reallocating resources, especially labour, from the agricultural to the non-agricultural sector. This is associated with a relative contraction in the demand for foods in the process of economic growth.

We have examined the case of Japan, a country that has faced the most severe agricultural adjustment problem among advanced industrial nations

over the past three decades owing to the extremely rapid shift in comparative advantage away from agriculture to industry. Correspondingly, the level of agricultural protection in Japan has been raised to the highest among industrial countries. Meanwhile, flooding exports of manufactured commodities from Japan have increased the demand for agricultural trade liberalization from its trading partners and forced Japan to face the sharp conflict between the internal resistance to and the external pressure for agricultural trade liberalization.

The long-run solution to this conflict is to raise the productivity of domestic agriculture to make it viable under the free trade system. The government's efforts in that direction have not been successful so far mainly because of the nationwide spread of part-time farming. Recently, however, the necessary measures for achieving the required structural adjustments have been embarked upon; this opens the possibility for liberalization of Japanese agriculture. In order to continue this momentum, one of the critical conditions is the growth in the entrepreneurial ability of farmers. It can hardly be expected that such human capital will develop unless the institutional framework is such that entrepreneurial ability is well rewarded. Therefore, the restoration of competitive market mechanisms by reducing government interventions into the market while the government concentrates on the supply of public goods such as land infrastructure, and agricultural research and development activities is the key to the development of viable agriculture in Japan.

Appendix: Estimation of a two-sector labour demand model

In this appendix, a simple two-sector econometric model is developed for the purpose of estimating the effects of reduction in agricultural protection on the labour market, which are discussed in Section 4 in the text.

First, we consider two economic sectors, agriculture and industry, with the following production functions:

$$\text{Agriculture:} \quad Y = F(LA, KA, A) \tag{1}$$

$$\text{Industry:} \quad X = G(LM, KM) \tag{2}$$

where Y and X are output, LA and LM are labour, KA and KM are capital of agriculture and industry, respectively, and A is land which is treated as a specific factor for agriculture.

Each production function is assumed to be continuously twice differentiable and linearly homogeneous, and the normality property of the factor of production is assumed on the second partial derivatives.

The profit maximization under perfect competition ensures the following marginal condition for each sector.

$$WA = P \cdot F1(LA, KA, A) \tag{3}$$

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$$RA = P \cdot F2(LA, KA, A) \tag{4}$$

$$WM = P \cdot G1(LM, KM) \tag{5}$$

$$RM = P \cdot G2(LM, KM) \tag{6}$$

where WA and WM are real wages, RA and RM are real capital rentals in agriculture and industry, all of which are measured in terms of the price of the industrial good. P is the relative price of agricultural product in terms of the industrial good, which is called the terms of trade. Fi and Gi are partial derivatives of function F and G, respectively, with respect to the i-th factor.

Solving (4) and (6) for KA and KM, and substituting into (3) and (5), respectively, results in labour demand functions written as follows.

$$\text{Agriculture:} \quad LA = f(P, WA, RA, A) \tag{7}$$

$$\text{Industry:} \quad LM = g(WM, RM) \tag{8}$$

The sign conditions are $f1 > 0, f2 < 0, f3 < 0, f4 > 0, g1 < 0$, and $g2 < 0$, where fi and gi are partial derivatives of functions f and g, respectively, with respect to the i-th factor.

Now, we introduce the expectation on industrial wage that farmers form when they decide whether to move to industry from agriculture or not. The expected wage in industry is assumed to be a function of the real wage in industry and unemployment rate. This assumption is based on Harris and Todoro (1970). Let We denote the expected wage, then We is written as

$$We = h(WM, U) \tag{9}$$

where U is unemployment rate.

If the expected wage in industry is greater than the agricultural wage, labour migration from agriculture to industry takes place. It lasts until equalizing the expected wage to agricultural wage has been achieved. Thus, at equilibrium the two wages are equalized.

$$WA = We \tag{10}$$

Based on Eqs. (7) through (10) and a definition of the total labour constraint, we can construct a system of equations in linear form to express the labour market as follows.

$$LA = a_0 + a_1 P + a_2 WA + a_3 RA + a_4 A \tag{11}$$

$$LM = b_0 + b_1 WM + b_2 RM \tag{12}$$

$$WA = c_0 + c_1 WM + c_2 U \tag{13}$$

$$TA = LA + LM + LS + TL * U \tag{14}$$

where TL is total labour in the economy and LS is labour in other sectors, mostly in the service sector.

In this system of equations, we consider two sets of endogenous variables to be determined by the system. We call the first set Model A and the second Model B, each of which has the following endogenous variables.

Model A: LA, LM, WA and WM

Model B: LA, LM, WA and U

Table A1. *Estimated results of system of equations for labour demand in a two-sector model of Japan*[a]

Regression number[b]	(1)	(2)	(3)	(4)	(5)	(6)
Model[c]	A	A	A	B	B	B
Dependent variable[d] (Y)	LA	LM	WA	LA	LM	WA
Explanatory variable:						
Terms of trade (P)	0.434** (2.83)[e]			0.427* (2.80)		
Agricultural wage (WA)	−0.265** (−3.11)			−0.263** (−3.27)		
Agricultural capital rental (RA)	−0.075 (-1.00)			−0.075 (−1.00)		
Agricultural land (A)	0.556** (3.45)			0.563** (3.52)		
Industrial wage (WM)		−0.051** (−4.54)	0.674** (5.27)		−0.058* (−4.35)	1.067** (37.99)
Ind. capital rental (RM)		−0.125** (−4.33)			−0.120** (−4.18)	
Unemployment rate (U)			−0.139** (-2.85)			−0.209** (−5.51)
Lagged dependent variable ($Y-1$)	0.634** (8.19)	0.821** (22.61)	0.370** (3.15)	0.630** (8.19)	0.817** (22.60)	
Intercept	−30.34	36.43	12.10	−30.14	35.98	15.90
Coeff. of Det. ($R^{**}2$)	0.994	0.973	0.995	0.994	0.973	0.997
SEE[f]	3.26	1.28	2.55	3.26	1.27	2.02

[a] Estimation period is 1961–1985.
[b] Equations were estimated by 2SLS method.
[c] Endogenous variables are as follows: LA, LM, WA and WM in MOdel A; LA, LM, WA and U in Model B.
[d] Dependent variables are agricultural labour (LA), industrial labour (LM), and agricultural wage (WA).
[e] Student t-values are in parentheses, with levels of statistical significance shown as ** (1%) and * (5%).
[f] SEE is standard error of estimate.

Namely, the two models are different in the choice of industrial wage or unemployment rate as the fourth endogenous variable.

We examine both the cases of Model A and Model B in the estimation and the simulation applied to Japan's experience for 1961 through 1985.

Data sources for the statistical estimation are as follows: Bank of Japan, (a) *Bukka Shisu Nenpo* (Annual Report on Price Index), (b) *Keizai Tokei Nenpo* (Annual Report on Economic Statistics); Management and Coordination Agency, (c) *Rodoryoku Chosa Nenpo* (Annual Report on the Labour Survey); Ministry of Agriculture, Forestry and Fisheries, (d) *Noka Keizai Chosa* (Farm Household Economy Survey), (e) *Noson Bukka Chingin Tokei* (Price and Wage Statistics in Rural Areas), (f) *Sakumotsu Tokei* (Crop Statistics); Ministry of Labour, (g) *Maigetsu Kinro Tokei* (Monthly Labour Survey).

The variables of labour are expressed in terms of flow rather than stock because of changing working hours over time; agricultural labour *(LA)* is expressed in an index of workers engaged in agriculture (source: (c)) adjusted by average annual working days for agriculture per worker (d), and industrial labour *(LM)* is expressed in an index of employment in industry (g) adjusted by weekly working hours per worker (g).

The agricultural wage index obtained from (e), the industrial wage index from (g) and the agricultural price index from (e) are divided by the wholesale price index of manufactured goods *(PM)* obtained from (a) for the variables of *WA*, *WM*, and *P*, respectively. Capital rentals in agriculture *(RA)* and in industry *(RM)* are calculated by bank lending interest rates multiplied by the price index of agricultural producer goods obtained from (e) for *RA* or the price index of capital goods from (a) for *RM*, both of which are divided by *PM*.

Agricultural land *(A)* is expressed in total area planted in a year whose data are obtained from (f). Data for unemployment rate *(U)* and labour in other sectors *(LS)* are available in (c). Total labour *(TL)* is defined as the sum of *LA*, *LM*, *LS* and unemployed labour force obtained from (c).

All the variables are expressed as indexes with the value in 1980 set at 100. The estimations of Eqs. (11), (12) and (13) are conducted introducing the partial adjustment process for each equation by using the two stage least squares (2SLS) method. The results of the estimations are summarized in Table A1. All the coefficients safisfy the sign conditions and most are highly significant statistically. (In regression (6), the lagged dependent variable was not significant and deleted in the final regression.) The estimated coefficients represent elasticities evaluated at the value in 1980 for each variable.

Using the estimated equations for *LA*, *LM*, and *WA* and the definition of labour constraint, we can conduct simulations for four endogenous variables. The labour constraint is expressed as the following definition in which labour variables are weighted by shares in 1980.

$$TL = 0.091 \bullet LA + 0.663 \bullet LM + 0.226 \bullet LS + 0.020 \bullet U \qquad (15)$$

The impact and total multipliers for exogenous variables for the system used in the simulations are summarized in Table A2 and the statistics of goodness of fit for historical dynamic simulations are shown in Table A3 in terms of root mean square (RMS) error and RMS per cent error.

Table A2. *Impact and total multipliers for exogenous variables in the simulation model*

Variable	Model[a]	P	RA	RM	A	TL	U	WM	SL
Impact multipliers:									
AL	A	0.31	−0.05	0.26	0.40	3.13	−0.04		−0.71
	B	0.34	−0.06	0.17	0.45	2.19		−0.14	−0.50
ML	A	−0.04	0.01	−0.04	−0.05	1.08	−0.03		−0.24
	B			−0.12				−0.06	
WA	A	0.47	−0.08	−0.98	0.60	−11.82	0.14		2.67
	B	0.32	−0.06	−0.66	0.42	−8.35		0.53	1.89
WM	A	0.69	−0.12	−1.45	0.89	−17.54	0.41		3.97
U	B	−1.55	0.27	3.18	−2.05	40.02		2.56	−9.04
Total multipliers:									
AL	A	0.90	−0.16	1.20	1.16	2.60	0.07		−0.59
	B	0.69	−0.12	1.92	0.91	4.42		0.48	−1.00
ML	A	−0.12	0.02	−0.17	−0.16	1.15	−0.04		
	B			−0.66				0.32	−0.26
WA	A	0.39	−0.07	−1.66	0.50	−3.59	−0.10		0.81
	B	0.65	−0.11	−2.71	0.86	−6.23		−0.68	1.41
WM	A	0.36	−0.06	−1.55	0.46	−3.36	0.12		0.76
U	B	−3.13	0.54	12.99	−4.13	29.88		8.34	−6.75

[a] For Model A and B, see note c in Table A1.

Table A3. *RMS errors and RMS per cent errors for endogenous variables based on 1961–85 dynamic simulation*

Variables	Model A RMS errors	RMS % errors	Model B RMS errors	RMS % errors
LA	3.72	3.0	3.57	2.8
LM	0.51	0.5	1.58	1.5
WA	11.72	19.8	8.87	14.0
WM	15.10	31.2		
U			41.94	62.5

NOTES

1. This section draws heavily on Anderson and Hayami (1986), especially Chapter 2.
2. Coarse grains to be used as materials for mixed feeds at the factories approved by the Customs Office upon the recommendation of the MAFF are exempted from tariff. Otherwise, the tariffs are imposed, because coarse grains, especially maize, are competitive with domestically produced potatoes and sugar beets as materials for the production of starch and glucose.
3. This section draws heavily on Hayami (1982; 1988, Chapter 6).
4. Share tenancy has been prohibited because it has been considered a remnant of feudal exploitation and a tenure form leading to inefficient resource allocations. Recent developments in the economic theory of contracts show that such a view is untenable (Osuka, 1986).
5. For such a policy proposal, see Hayami (1979).

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