PRICES, INCOME AND FARM POLICY IN TAIWAN*

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The key strategy underlying Taiwan's economic policy has always been to "foster industrial development with agricultural resources and further agricultural prosperity with industrial sinews" (Council of Agriculture, 1986). Policies to change the terms of trade for agricultural products were used as a main part of this strategy during the process of economic development. Agriculture was the mainstay of Taiwan's economy in the 1950s through the early 1960s. The rapid growth of agricultural production through institutional and biological innovations, not only produced sufficient food for the nation but also generated surplus capital and released productive labor for development projects in non-agricultural sectors. Contributing substantially to the nation's efforts at speeding up industrialization and promoting overall economic progress, agriculture has indeed successfully performed its function of fostering industrial development.

With the rapid structural changes in the economy, the value of its industrial product exceeded agricultural product by the mid-1960s. Several structural adjustment issues have emerged, resulting in sizable increases in agricultural production costs. The competitiveness of farm products thus declined, the rate of agricultural growth fell, and farm family incomes did not keep pace with urban incomes. In light of these agricultural problems, amidst economic structural changes, the government has switched its policies from "development of agriculture to foster industury (taxing producers)" to "development of industry to support agriculture (subsidizing farmers)". From 1973 forward, a series of farm development programs were put into effect to revitalize agriculture.

The objectives of this paper are to analyze the impacts of Taiwan's agricultural policies on the relative level of agricultural prices and hence on the allocation of resources and the pattern of agricultural production; to assess the effects of relative price levels for traditional and nontraditional factors on incentives for technical change and input substitution; and, to investigate the sources and distribution of farm family income through the process of economic development. The data for this paper are mainly from 1952 to 1987. The analysis, however, emphasizes the last two

decades when the position of the agricultural sector declined. The paper includes a review of the change in the terms of trade for agricultural products and agricultural prices and income policies, an analysis the characteristics of input-output relationship in Taiwan's agriculture, and an evaluation of the sources and distribution of farm family income in Taiwan.

I. Agricultural Price Situation

(I) Changes in the General Price Level

Changes in the general level of farm prices affects farm operations, investment and competitiveness of export products. Changes in relative prices, frequently referred to as the terms of trade for farm products, affects the welfare of farm families and the level and distribution of income between the farm and nonfarm sectors of the economy (Tomek & Robinson, 1982). An improvement in the terms of trade for farm products leads to a gain in the welfare of farmers, conversely, a relative reduction in agricultural product prices can contribute to capital formation only if productivity of agricultural production can be improved. Taiwan's farm prices, like those of other commodities and services, are strongly influenced by overall trends in the domestic economy as well as the international economy, and farm prices are much more volatile than are the prices of most nonfarm goods and services. Both farm and nonfarm prices fluctuated widely during the last four decades. This period may be divided into five phases distinguished mainly by source and fluctuation rates. The 1945-1951 period was characterized by hyperinflation. The 1952- 1960 period was one of moderate inflation. From 1961 to 1972 prices were stable. In the 1970s two oil crisises and food shortages created hyperinflation and price instability. The 1980s were characterized by decreasing prices. The rate of increase for different prices are shown in Table 1.

(1) Hyperinflation Period, 1945-1951

After World War II, Taiwan experienced hyperinflation and a large population influx from mainland China. Food production was insufficient for the rapidly increasing population and military. Moreover, land ownership was unequally distributed and the industrial sector was undeveloped (Lee, 1961). To solve this problem, from 1949 to 1953, a series of land reform programs

were successfully implemented, including the 37.5 percent reduction in farm rent in 1949, the sale of public land in 1951 and the land-to-the-tiller act in 1953. These land reform programs provided both incentive for farmers to increase agricultural production, and a strong financial base for industrial development. Intersectoral link between agriculture and industry were also strengthened. By the end of 1952, inflation slowed and agricultural and industrial production climbed to historic pre-World War II levels.

(2) Moderate Inflation Period, 1952-1960

The first four-year economic plan started in 1953 with the assistance of U.S. aid. The basic policy to accelerate the economic development was called "Development of Agriculture to Foster Industry", because the plan acknowledged agriculture to be the most important sector in the economy. From 1953 to 1960, the annual growth rate of agricultural production was 4.6 percent, which exceeded the population growth, despite unfavorable agricultural price policies. Meanwhile, industrial production increased annually by 10.8 percent. The general economic situation improved and the price level stabilized, but the balance of payments problem remained intractable.

(3) Stable Price Period, 1961-1972

Two successive four-year economic plans laid the groundwork for agricultural and industrial development. The scope of the economic plan from 1961 to 1972 was widened to target not only in agricultural and industrial production, transportation and communication, but also social construction, and external sectors. Taiwan's economy continued to progress rapidly under accelerated economic development programs. The threat of inflation almost disappeared, the balance of payment position substantially improved and an export surplus was realized in 1964. The annual economic growth exceeded 10 percent, while the annual rate of price increase averaged less than 4 percent. However, agriculture was troubled by the widening income gap between the farm and nonfarm sectors. In 1969, the government announced an important policy, "The New Agricultural Policy Guideline", to increase farm profit and to improve farmer welfare.

(4) Worldwide Inflation Period,1973-1981

From 1973 to 1981, Taiwan's price fluctuations were substantially influenced by changes in the international economic situation, such as the collapse of the international currency system, food shortages and the oil crisis. Domestically, industrial growth exceeded agricultural growth and a considerable outflow of labor resulted in a farm labor shortage. Consequently, the farm wage rate rose substantially, and the growth rate of agricultural production declined due to extensive use of farmland. On the other hand, a successive increase in industrial exports and a substantial expansion of production plants and equipment created demand-pull inflation. Demand-pull and import cost-push inflation, caused strong inflationary expectations in the economy. In January, 1974 the "Stabilization Contemporary Economic Program" was implemented to adjust major product prices "once and for all" to reflect the increased production costs and to offset expected inflation. The Consumer Price Index sharply increased 47.5 percent in 1974. Although this price increase was greater than in the industrial advanced countries, it was not sustained or institutionalized as in some Latin American countries. The annual rate of inflation was around 10 percent from 1973 to 1981.

(5) Price Declining Period, 1982-1988

Due to the worldwide adoption of energy saving technology and changes in production structures following the economic recession after the second oil crisis, energy prices fell significantly. This lowered industrial production costs. Since the 1980s the domestic demand decreased and the government made great efforts to liberalize trade barriers which cause the general price level to decline. Both WPI and CPI dropped annually 2 percent and 0.8 percent, respectively, during 1982 to 1988, as shown in Table 1.

(II) Relative Price Level of Farm Products

To achieve stable and sustained economic growth, a proper growth rate between the agricultural and industrial sectors should be maintained. From a technical viewpoint, agricultural production is highly constrained by natural conditions. The annual growth rates of agricultural and industrial production in Taiwan from 1952 to 1987 were 3.1 percent and 12.4 percent, respectively. Since World War II, the agricultural terms of trade have improved if measured by the long-run trend. The data

are shown in Table 2 and Figure 1, where agricultural price index each year is divided by the industrial price index and by the wholesale price index for the base year of 1971.

The prices of farm products increased relative to prices of nonfarm products during 1945-1949, 1973-1976, and again after 1981. In general, the terms of trade were unfavorable to agricultural products before the early 1970s, but this changed after 1973. In the early stage of economic development in Taiwan, the government adopted price distortion and taxation approaches to siphon agricultural surplus to nonagricultural sectors. Traditionally, rice is a staple and the most important food grain, therefore production and marketing of rice was always tightly controlled. The government implemented the rice-for-fertilizer barter system with an exchange ratio unfavorable to rice farmers, a compulsory government procurement of paddy rice at a lower market price, and a paid-in-kind land tax to siphon off agricultural surplus. Rice collected was rationed to the armed forces and distributed to military dependents and civilian government employees. Moreover, the stocks were sold on the free market to stabilize rice prices or they were exported. The terms of trade, therefore, were unfavorable to agricultural products, particularly in the case of rice, from 1938 to 1972 except during the early 1940s hyperinflationary period.

Since 1973, the government implemented a series of rural development programs to speed the process of agricultural modernization. Instead of implementing a lower price policy for rice, the government enacted price support and stabilization schemes (these will be elaborated on the next section). The price of farm products, especially for rice, increased relative to the prices of nonfarm products since 1974. In the 1977-1981 period, agricultural prices dropped sharply due to higher livestock production in the business cycle trough period and the influx of foreign agricultual products.

Relative growth of supply and demand has been another factor affecting the movement of the relative price for farm products. Generally speaking, the growth in demand for any commodity or service depends on the growth rate of population, real per capita income, and the income elasticity of demand for any particular commodity or group of commodities (Johnson, 1973). An increase in per capita income means, not only a smaller percentage of income is spent on food (Engel's Law), but also that the pattern of food consumption changes. The proportion of calories an individual consumes from

the basic starchy staple is expected to decline, usually this is known as Bennett's Law (Timmer, Falcon, and Pearson, 1983). This has a considerable impact on agricultural production and its structure.

In Taiwan, the annual economic growth rate was 8.8 percent from 1953 to 1987. The proportion of food expenditure to household consumption expenditure decreased from 54.4 percent in 1953 to 30.4 percent in 1987. The consumption of starchy foods dropped considerably over the last two decades in Taiwan, while the indirect consumption of grain in high quality foods increased dramatically. According to the "Food Balance Sheet" published by Council of Agriculture, per capita annual consumption of rice and sweet potato fell significantly, while annual per capita consumption of meat, eggs, dairy products, vegetables and fruit rose significantly from 1953 to 1987, as shown in Table 3. As for the per capita consumption of grain (including rice, wheat, corn, soybean, barley, and sorghum), direct consumption was increased before 1974 and then dropped. Indirect per capita consumption of grain, on the other hand, rose consistently, causing total grain consumption to increase from 171.0 kilograms in 1953 to 411.4 kilograms in 1987. Calories from starchy staples declined (see Figures 2 and 3).

Both the population growth rate and the income elasticity of food demand declined from 1962 to 1981 in Taiwan. The growth rate of aggregate demand for food, therefore, also slowed. However, the rapid change in food consumption patterns, and natural constraints on producing high quality food,the increasing rate of agricultural production is less than the growth rate of aggregate demand for food and has increased slower than the output in the rest of economy, as shown in Table 4. As a result, farm product prices increased quickly relative to nonfarm products prices, see Table 1, and a large amount of agricultural products have been imported.

As for the relative prices among the different agricultural products, the price level of crops, such as rice, coarse grain, fresh vegetables, and fruits are relatively high compared to livestock and fishery products in Taiwan, as shown in Table 5. For crop products, the prices of rice and coarse grain have been guaranteed at high level, and the demand for vegetables and fruits are so strong that the prices are maintained at a reasonable level. The demand for high quality food, such as pork, poultry,

meat, fish, milk, and eggs are strong. The livestock and fishery industry are highly commercialized and through modernization, productivity in these industries increased fast enough to absorb the increase in production costs. Thus, the prices for these products have increased slightly over the last two decades. The real retail price of eggs in Taiwan has even declined during the last decade.

(III) Major Agricultural Price Policies Affecting Farm Prices

As far as agricultural development planning is concerned, two phases of agricultural policy in Taiwan after World War II can be defined. The year 1969 can be chosen to separate the two phases of policies. Prior to 1969, the focus of policies were to increase commodity production and reduce the real prices of food through technological changes and institutional innovation. Taxation and price distortion were used to extract agricultural surplus to foster economic expansion in the nonfarm sector. The strategy and policy for creating and siphoning off agricultural surplus in Taiwan is widely discussed in the literature (Hsieh and Lee, 1966; Lee, 1971), so I will not repeat the discussion here. Since the late 1960s, Taiwan's agriculture has been hard hit by developments on the domestic and international fronts. Domestically, the income gap between the farm and non-farm sectors has continually widened. Internationally, due to the favorable balance of export trade, particularly for manufactured products, Taiwan has imported cheap food and grains which depressed farm prices.

In view of the difficulties confronted by agriculture, the government announced the "Accelerated Rural Development Program (ARDP)" in September 1972. The importance of this program was comparable to the land reform program of the 1950s (Yu, 1978). Since 1973, the ARDP has been operational. Beginning in July 1979 and effective for three years, the "Program for Increasing Farm Incomes and Strengthening Rural Reconstruction" was implemented. In 1980 the "All-out Grassroots Development Promotion Program" was launched. The programs for rural and grassroots development were amalgamated in July 1981 into a new program known as the "Strengthening Grassroots Reconstruction and Raising Farm Family Income Program." In July 1985, the "Program for Improving the Agricultural Structure and Boosting Farm Income" began. The major objectives of these policies were: (1) to raise farm income and narrow the gap between farm and non-farm income; (2) to ensure

stability of the food supply and achieve self-sufficiency of major crops; (3) to improve the rural environment and farmer's welfare (Council of Agriculture, 1986).

In September 1973, the long awaited Agricultural Development Act was enacted. These regulations encouraged the modernization of agriculture by enlarging the scale of farming operations, promoting vertical integration of demand-oriented production, coordinating land administration and financial institutions for smooth development, and providing incentives for extension. Based on the Agricultural Development Act, concerning the agricultural production structure, the "Second Stage of the Agricultural Land Reform Program" was announced in April, 1980. The government also established a "Rice Stabilization Fund" to purchase rice from the market at a guaranteed price, which is higher than the production cost in 1974. The highlights of these programs include readjustments of agricultural production, enlargement of the farming scale, improvement of agriculture's public facilities, government purchase of rice at guaranteed prices, modernization of the marketing system, and the improvement of farmer's welfare and agricultural financing facilities. The general framework of the present agricultural policy in Taiwan can be summarized in Figure 4.

As in many other developed countries, agricultural price and income policies play an important role in Taiwan. The objectives of price and income policies are to stabilize and support agricultural prices at reasonable levels and to reduce production costs and the financial burdens associated with subsidies. The major instruments are price support programs, price stabilization programs, direct payments, and input subsidies.

(1). Price Support Program

The purposes of a price support policy are to protect domestic production, to increase self-sufficiency, to maintain production levels, and to enhance farm income. Three methods exist to support prices: guaranteed prices, deficiency payments, and border measures. The major programs are briefly described as follows:

a. The Rice Stabilization Fund

In 1974, the Rice Stabilization Fund was initially designed as a buffer stock scheme. The floor support price is in principle fixed with a 20 percent profit. With this reasonable support price level, rice production reached its highest recorded level of 2.71 million m.t. in 1976. Since 1975, domestic rice production accumulated 200-400 thousand m.t. of surplus each year. To protect the income of rice growers, the government has absorbed this surplus at the support price. From 1974 to 1977, the government purchased an unlimited surplus. Heavy burdens on the public treasury changed the procurement policy limiting the purchase to 970 kg per hectare since 1977. Due to the low price of rice in the international markets, the government had to sell a part of the surplus rice to foreign buyers at a great loss. However, the subsidized export of Taiwan's surplus rice was limited by the Sino-American rice export agreement. Since 1984, Taiwan has implemented the rice field conversion program to encourage conversion of riceland to other crops, particularly soybeans and feed grains which have low self-sufficiency ratios. Rice production has dropped significantly, but the program is costly to the government. This scheme so far has benefitted the rice growers but increased the financial burden to the treasury.

b. The Small Grains Deficiency Payment

Small grains include corn, soybeans, wheat, barley, and sorghum, all are essential raw materials for processing edible oils and animal feeds. Aside from changes in the rice policy, the government began to liberalize its trade policy in the mid-1960s. Along with other trade liberalization measures, the government reclassified small grain imports from the "controlled" to the "permitted" category in 1967. This change promoted increases in feed grain imports. To avoid import price fluctuations and to ensure an uninterruped foreign supply of small grains, a stabilization fund called the "Small Grains Deficiency Payment" was established in November, 1971. Additional objectives of this fund were to encourage domestic production of small grains, improve farmland utilization, develop feed-related industries, and accelerate livestock production. The sources for this stabilization fund are derived from an endowment of one million NT$ donated by two public and six private organizations, the collection of fees per ton of small grains imported, and government subsidies.

Due to the government's encouragement since 1984 to shift a part of the paddy land to small grains, the support price level for small grains is equivalent to the per hectare profit of growing rice. Based on this calculation, the guaranteed price for corn per kg. is NT$15, for soybean, NT$25; and for sorghum, NT$ 14. The support prices for these crops are twice as high as the import prices. The price differential is covered by this scheme. Due to natural constraint and the shortage necessary farm machines, the production of these crops has not significantly increased. The self-sufficiency rate for these crops remained below 5 percent. With recent efforts to liberalize agricultural trade, small grain import barriers fell, therefore, fee collection is impossible.

c. The Sugar Stabilization Fund

After rice, sugar cane is the most important crop in Taiwan in terms of cultivated land area and foreign exchange earnings among agricultural products. As an export crop, the price of sugar is determined by supply and demand in the international markets. To protect the grower's income, the Sugar Stabilizatin Fund was established in November 1966. The Taiwan Sugar Corporation (TSC) was asked by the government to take charge of this Fund. Since it is a buffer fund scheme, the Taiwan Sugar Corporation can collect, as a fee, a percentage of the sugar export value in excess of the guaranteed price and this is to be used as a Fund reserve. The TSC also established the guaranteed price for sugar so the profit made from sugar plantations is not less than that of competitive crops. The Fund's reserve is used to subsidize the price and to generate interest earnings. The Fund's interest earnings are used to improve production techniques, to offer low interest production loans, and to promote farm mechanization for cane growers. However, due to the tremendous surplus in international markets, and the production cost increases during the last decade, Taiwan's sugar was mainly sold in domestic markets, and the fund became inoperable.

d. Contract Guaranteed Price Scheme

The government also assists farmer's organizations to promote the planned production-marketing system through contract agreements between producers and buyers including processing factories or exporters, similar to what has been done with sugar cane growers. The products under contract agreements include bananas, fresh fruits, mushrooms, asparagus, onions, seedless watermelons,

bamboo, bamboo shoots, ginger, tomatoes and some summer vegetables. This system strengthened the link between producers and buyers avoiding exploitation by middlemen and provided forward price assurance to the producers. Contract production between producers and processing plants or exporting agencies is on the basis of contract guaranteed price. The objectives of this scheme are mainly to stabilize the production of raw materials for processing plants, to guarantee the contract producer's revenue, and to regulate exports. The contract guaranteed price is negotiated by representives of both parties under government supervision based on production costs and the market situation. The fund mainly collected as a percentage of the export price above a specific level.

e. Border Measures

Before the mid-1960s, a serious deficit existed in the balance of payment situation in Taiwan. Agricultural policy was protectionist and it emphasized increasing domestic production through tariffs and import controls. Imports of several major products were prohibited and the tariff rates were over 100 percent. Since the government reformed the foreign exchange system in the late 1950s, and gradually relaxed control over foreign trade in the 1960s, foreign trade increased rapidly and evolved as the leading force in Taiwan's economic development.

Taiwan has reduced many barriers, including tariff and nontariff restriction, especially since the Sino-American bilateral trade negotiation started in 1978. Recently, the government has put great effort into further liberalizing imports in order to enhance a sizeable trade surplus. Tariff rates on hundreds of farm products have been lowered. The weighted average tariff on farm products decreased from 28 percent in 1978 to 8 percent in 1988 (Wang, 1988; Peng,1988). Nontariff barriers are not used extensively in Taiwan, therefore, the policy of lowering tariffs on farm products brought a sizeable influx of foreign final products into Taiwan's already saturated markets. The farmer's interests have been substantially affected and farmers have strongly protested.

At the present time in Taiwan, politicians, farmer's groups, and consumer's groups agree that protection of the food supply, in the short-run, is justified considering national security. Three basic principles underlie the agricultural trade policy (Wang, 1988):

i) Commodities which can be domestically produced at reasonable costs should be produced as much as possible.

ii) Some border measures must be maintained for important products so as to secure their stable domestic supply, though restrictive trade measures should be minimized.

iii) Revenue loss caused by sudden sizable foreign agricultural product imports should be compensated.

(2). Price Stabilization Program

To stabilize the major agricultural product prices, the govenment established buffer fund schemes for flour, soybeans and corn. The domestic marketing stabilization fund is also encouraged to help small farms sell their products at reasonable prices.

a. Import Product Price Stabilization Fund

Since over 90 percent of raw materials for processing edible oils, flour, and animal feeds are imported, the international price for small grains affects directly the domestic prices of compete products and the operation of related industries. Drastic price fluctuations in small grains existed during the food crisis in the early 1970s. Three key imported commodities, soybeans, wheat and corn, were regulated by import quotas and through group purchases coordinated by a government licensing procedure. Also, the bulk commodities were placed under a system of "uniform import prices". The price paid by domestic users for these commodities was administratively set at the stabilization price, which was based on the prevailing international price of the commodity. This price remained fixed for a few months to over a year. The scheme was terminated in 1988 except for the flour stabilization fund because it is close substitute for rice.

b. Producer Marketing Price Stabilization Fund

The price of hogs, vegetables, fruits and fish are usually more volatile than that of grains. To help small farms sell their products profitably, Taiwan has promoted and strengthened the joint marketing programs on hogs, vegetables, fruits, bamboo, bamboo shoots, and inland and marine fish products through farmer's associations and marketing cooperatives. The goal of these organizations

is to reduce the unit marketing costs, to raise the producer's bargining power, and to establish strong bonds between the producers and the traders through large volume marketing. To stabilize the price received by farmers, guaranteed prices were established and these were based on average prices prevailing in different wholesale markets. The participating farmer contributes a fee to the stabilization fund and after meeting their obligation, prices are guaranteed. This is a self-financing program with the government, market agencies and farmer's organization have contributed some matching funds.

(3). Direct Payment Program

Due to the high guaranteed price for rice and the drastic reduction of rice consumption, rice surpluses have become a major burden for the government. Increases in production costs and the Sino-American rice export agreement limit Taiwan's rice export. The most effective solution to the rice surplus problem, without affecting farmer's interests, is restricted rice production, thus the paddy field conversion program. As an incentive for rice farmers to diversify to other crops, the government guaranteed prices for growing corn, sorghum and soybeans, and adopted a payment-in-kind (PIK) approach to minimize yield risks associated with converting to new crops. The government pays 1000 kg. paddy for those who grow corn, sorgum and soybean, pay 1,500 kg. paddy for those who grow fruit, vegetables and grass for livestock . Those who take land out of production can also get 1,500 kg. of paddy from the government.

(4). Input Subsidy Program

To lighten the burden of farm production, the government abolished the 25-year old rice-fertilizer barter system and the education surtax on farmland in 1973. The government also improved the agricultural taxation system to reduce production costs and alleviate the financial burdens on farmers. Moreover, the government subsidized part of the energy costs associated with agricultural production, and the farm credit system was improved to encourage farmers to adopt new technology and to utilize their resources more efficiently. Over the years, farm credit terms eased significantly, and the government provided low-interest loans to farmers under specific programs or projects.

(5). General Comments

Taiwan's price and income policies can be summarized as follows:

(1) In Taiwan, each product or product group has its own specific price regime, reflecting the nature of the product and its historical background. However, only the rice price support and the rice field conversion program are financially supported by the government. The price scheme for fruits, vegetables, and livestock products are financially self-sufficient. These schemes, mainly operated by farmer's associations and cooperatives, have very weak financial membership. Because the free-rider problem of collective action is uncontrollable, the bargaining power of these organizations appears weak and the price schemes are ineffective.

(2) The level of agricultural subsidization in Taiwan is much lower than in other developed countries. Taiwan's agricultural budget in recent years accounts for 2-3 percent of total government expenditure (Chen, 1987). The budget allocates funds for the improvement of infrastructure and disaster restorations, agricultural research and extension, and the price supports for rice and paddy field conversion programs. The producer's subsidy equivalent (PSE) of Taiwanese major land-base crops, from 1982 to 1986, were 30 percent to 70 percent. The average PSE in Taiwan was 19.2 percent, much lower than Japan's 71.1 percent, Korea's 59.5 percent, EEC's 35.4 percent, Canada's 31.0 percent, New Zealand's 25.4 percent and USA's 24.6 percent (USDA, 1988).

(3) The social cost of government policy in Taiwan is much less than that in other developed countries. Accordingly, the policy cost, in terms of the dollars of government and consumer's payments required to increase producer's surplus by $1, are lower in Taiwan than those of developed countries. The policy cost for rice in Taiwan was 1.29 in 1986 (Peng, 1988 b) which was lower than that of Japan's 2.58 in 1976, EEC's 1.50 in 1980 and USA's 1.38 in 1985 (World Bank, 1986). The government and consumer shares for the cost increase in producer's surplus are 56 percent and 44 percent, respectively.

(4) Annual increases are generally greater in agricultural prices than nonagricultural prices. Moreover, agricultural prices are more volatile than the prices of most nonfarm goods or services. Factors affecting price fluctuations for agricultural and industrial commodities in Taiwan have changed since the oil crisis in 1973. Industrial product prices, however, were more volatile than agricultural prices during this period. The instability index for agricultural prices was 18.5 percent

from 1973-1976 and 8.7 percent from 1977-1981, while the index for industrial prices was 19.9 percent and 10.7 percent during the same periods, as shown in Table 6. The farm price stabilization and support programs implemented in the 1970s were successful in moderateing price fluctuations. Fluctuations in export demand for industrial products stemming from worldwide protectionism and oil crisises contributed to the instability in industrial product prices since the 1970s.

II. Aggregate Agricultural Structure

Rapid economic development since the mid-1960s changed the structure of Taiwan's agriculture and also the structure of farm expenditure. Cash expenditures accounted for about 66 percent of the total farm expenditure in 1960 and 90 percent by 1987. This signifies Taiwan's transition to a modern commercial agriculture. In this section, first, the influences of price change of input and output on the allocation of production are reviewed, then technologial change and input substitution in agricultural production is analyzed.

(I) Changes of Farm Expenditure Per Farm

The economic growth of Taiwan has changed the relative price of human input to nonhuman inputs, such as fertilizer, pesticides, and farm machinery. The agricultural growth of Taiwan originated from improvements in the quality of human and nonhuman resources with captial substituting for labor (Chen and Wang, 1980). The sustained period of industrialization and urbanization which occurred in Taiwan over the last two decades created abundant nonfarm employment opportunities for farm labor. In the 1970s a period of unusually rapid growth in nonfarm employment substantially increased wages in agriculture relative to the price of nonhuman inputs. The annual increase in wage rate was 11.8 percent, as shown in Table 7. The annual rate of price change for different input at various times was in accordance with the general price level and farm products. Specifically, rapid increases occurred in 1951 to 1960 and again from 1973 to 1981. Since 1982, input prices showed a decreasing trend and wage rate rose 3.4 percent annually from 1982 to 1987.

The price of nonhuman inputs relative to the farm wage rate in 1987 was only one-tenth of that in 1952. Relatively cheaper capital inputs, therefore, were substituted for farmland and farm labor.

Consistent with these changes in farm wages, labor input per farm decreased 3.3 percent annually from 1960 to 1987. At the same time current capital inputs, including fertilizer, agricultural chemicals, feed, and water, increased about 3.8 percent due to technological change, relatively cheaper current capital input and the expansion of livestock. Farmland (in terms of crop area) shows a decreasing trend since 1970 mainly due to the extensive use of farmland. Fixed capital inputs, including farmbuildings, equipment, perenial crops, and animals, rose 2.6 percent annually, slower than current capital inputs.

In general, farm expenditures rose 8.3 percent annually from 1960 to 1987. The most volatile period occurred in the 1970s when annual expenditures increased by 13.1 percent. As for individual input expenditures, current capital inputs increased the most among the factors, and fixed inputs came next. The annual labor growth rate expenditure from 1960 to 1987 was 8.2 percent, and the annual growth rate in the 1970s was 15.4 percent. Annually farm wages increased over 18 percent (in nominal terms), which exceeded agricultural productivity as well as rural labor productivity. During the 1970s, approximately 60 percent of the farm expenditure increase was attributed to labor. In the 1980s, the rural labor migration slowed and the farm mechanization operated successfully. Labor expenditures for farm operations eventually began to show a declining trend, and labor expenditure relative to total farm operations expenditure shrunk. The share of current capital inputs consistently increased, while the share of fixed inputs declined. However, the value of fixed capital inputs sharply increased, as shown in Table 8.

Individually, rice is the most important crop in terms of economic and political consideration in Taiwan. The trend and pattern of rice production cost changes almost mirrored those of farm expenditures. The annual increase in rice production cost was 10.6 percent per hectare which was higher than that of farming expenditures per family. Even though mechanization for major farm operation was over 95 percent by 1987, the share of labor cost to total production cost was 55.3 percent. Labor demand for rice production per hectare decreased from 99.7 days in 1950 to 36.3 days in 1987, however, labor cost per hectare rose about 11.2 percent per year. With the small area of a paddy field, the amount of machinery necessary for reducing labor demand is much more effective than that

for reducing labor cost. This is why the share of labor cost to total production cost was still so high in 1987. The increasing rate of production cost per kilogram is lower than per hectare, mainly due to yield increases per hectare. However, the contribution of yield increases to reducing production costs has decreased since the 1970s because of extensive management for rice production, as shown in Table 9.

(II) Analysis on Aggregate Input-Output Relationship

Since the first four-year economic plan started in 1953, agricultural production (including crops, livestock, fishery and forestry products) increased considerably. The annual growth rate of agricultural production was 3.5 percent, which was greater than 2.5 percent population growth from 1953 to 1987. Before agricultural development reached its turning point in the late 1960s, agricultural production increased 5.2 percent annually from 1953 to 1970. Since 1970, the average annual growth of agricultural production slowed to 1.9 percent. During the last three decades, fishery and livestock production increased annually at around 7 percent, crop production increased by about 2 percent, while forest production has shown a negative growth since 1970 due to the implementation of resource conservation program. Among crops, rice exists in surplus due to rising government assistance and decreasing consumption, leading to a rice conversion program and surplus disposal problems in 1984. Rice production decreased after 1970. However, fruit and vegetable production rose, respectively, 7.9 percent and 5.3 percent annually to meet the strong market demand during the analysis period.

The different growth rates of sub-industry within agricultural production significantly changed the structure of agricultural output. Crops contributed 68.6 percent to the total value of agricultural output in 1952 and 41.4 percent 1987. Livestock climbed from 15.8 percent in 1952 to 29.2 percent in 1987. Fisheries increased from 9.1 percent in 1952 to 28.2 percent in 1987. Forestry, however, plummeted from 6.5 percent to 1.2 percent during the same period, see Table 10. In general, Taiwan's agriculture has adjusted its production structure as market demand patterns and price changes. However, feed for livestock and aquaculture production showed a rapid increase and induced a strong import demand for feedgrains from the U.S.

The input utilization and technological change responded to the changes in relative input prices. These adjustments have led Taiwan's agricultural production to depend more on modern inputs and closer links with foreign markets. To evaluate the structure of aggregate agricultural production and the characteristics of input demand in Taiwan, aggregate output and input data from 1952 to 1982 (Chen,1984) is analyzed (Peng and Lin,1989) using the translog cost function (Christensen, Jorgenson and Lau, 1971,1973). The translog cost function places no a priori restrictions on substitution possibilities among the factors of production, and it allows economies of scale to vary with the level of output. We specify additive disturbances for each share equation and for the cost function. The iterative seemingly unrelated approach is used to estimate the coefficients and the results are quite satisfactory (Peng and Lin, 1989). The aggregate production function is also estimated to assess the sources of agricultural output increases.

In general, agricultural production can be continually expanded to respond to changes in relative input prices. The growth of agricultural output derives mainly from technological changes and increases in inputs usage. Technological innovations have been a vital factor in Taiwan's agricultural development. From 1952 to 1982, agricultural technical progress was mainly attributed to neutral technical change. Its importance declined in the process of agricultural growth. In the early stage of development, 1952 to 1966, induced innovation from changes in relative input prices caused aggregate production costs to increase because agricultural input prices were biased against technological change. However, the effect of biased technical change became an important factor in increased agricultural output from 1967 to 1982. The contribution of technical change to the expansion of agricultural output in Taiwan declined during the period of study. The share of agricultural technical change to total agricultural output growth decreased from 46.6 percent to 32.8 percent, as shown in Table 11. In other words, the annual increase of agricultural output was mainly due to the drastic increase in input utilization, especially in the later stage of agricultural development.

From the data on Table 11, several facts are worth mentioning. First, the major factors contributing to Taiwan's agricultural growth were dramatic increases in current input utilization and technological change during the study period. Second, the growth rate of agricultural output

declined since 1967 mainly due to the decrease of labor and land inputs and the relatively slower growth in technological change than in the earlier stages. However, current inputs were intensively used to keep the livestock sector growing. Next, fixed capital inputs made only a small contribution to the growth of agricultural output. These facts demonstrate that investment and appropriate farm scale for mechanical innovation was still far behind in Taiwan. Finally, the trends in prices paid and received by farmers were similar during the period of study. However, the contribution of current capital inputs to the growth of agricultural output increased from 36.8 percent in the early period to 105.2 percent later. This implies the rate of agricultural value added was smaller than agricultural output. Thus the functional income distribution squeezed traditional inputs, such as farm labor and agricultural land.

As far as input substitution is concerned, the relationships between labor and current captial inputs, and current capital inputs and fixed captial inputs were substituted, as shown in Table 12. The farm labor force decreased drastically during last two decades, and the significant increase in the farm wage rate on agricultural production was partly offset by the industrial sector providing relatively cheap modern inputs. This induced the structural changes in agricultural production. Therefore, during the modernization of farm operations, the effect of current capital inputs was greater than that of fixed capital inputs, and the increasing rate of fixed capital inputs was much slower than that of current capital inputs. Due to the highly complementary relationship between mechanical innovation and farm size, an inflexible regulation of land tenure following postwar land reform in Taiwan, and the long tradition keeping land as an assest in rural society impeded growth farm sizes. Allen's partial substitution elasticity between land and fixed captial input was not significant in Table 12. Therefore, given the emergence of economies of scale, the institutional rigidity and cultural constraint slowed the ability of mechanical innovations to absorb production costs due to the sharp decrease in farm labor since the 1970s.

(III) Agricultural Trade as an Adjustment Sector

As Taiwan is an island with limited resources, its economic development depends heavily on foreign trade. In the agricultural sector, the value and the structure of agricultural trade directly and

indirectly affects the growth of agricultural production, supply and demand of agricultural output and inputs, and hence the relative prices of agricultural products. In fact, the ratio of the value of agricultural trade (including import and export) to the total value of agricultural production was 99.5 percent in 1953, and it slightly declined to 88.7 percent in 1987. These figures demonstrate that Taiwan's agriculture relies heavily on foreign trade.

In the early stages of Taiwan's economic development, agricultural products were a major foreign exchange earner, greatly improving Taiwan's balance of payments situation. Agricultural products and their processed products accounted for 91.6 percent of total exports while industrial export products contributed only 8.4 percent in 1953. Prior to 1965, the share of agricultural product exports in total exports exceeded 50 percent. By 1987, industrial exports accounted for 93.2 percent of total exports. Agricultural and their processed products accounted for only 6.8 percent of total exports due to the rapid expansion of the industrial sector, as shown in Table 13. However, the annual growth rate of agricultural export was about 10 percent and the components of agricultural exports changed significantly. In the 1950s and 1960s, sugar, rice, bananas, tea, citronella oil and canned pineapple were major export products. In the 1970s, the major agricultural exports were processed products, such as sugar, canned mushrooms, and canned asparagus. By the 1980s, the major agricultural exports included frozen pork and marine products. The change in export structure revealed that the comparative advantage of agricultural products shifted from labor intensive crops to high-value capital intensive products. This is attributed to the change of supply and demand for domestic resources.

Agricultural imports did not change as much as exports. Raw materials, such as raw cotton, feed grains, logs and lumber, hides and leather, are always the major imports, and accounted for 90 percent of agricultural imports. Only 10 percent of agricultural imports were consumption goods, such as fruit, juice and beef. In other words, agricultural imports are a derived demand associated with the development of the textile, shoe, lumber and livestock industry. The aggregate relationship between agricultural imports and domestic industrial development is complementary rather than competitive. However, the importation of consumption goods exceeded that of raw materials after

1970, which competed with Taiwan's already saturated domestic market. In other words, Taiwan is not short of final products but it does need raw material imports. In general, agricultural imports accounted for 32.1 percent of total imports in 1952 and dropped to 14.1 percent in 1987. The annual growth of agricultural imports, was 13.0 percent, which was greater than agricultural exports, as shown in Table 13. This has turned Taiwan's agricultural trade from a surplus to a deficit situation since 1970. Several major reasons are cited for this phenomena:

First, the existence of an unavoidable productivity lag in countries with small farms from the impact of rapid economic structural changes in agricultural development (Peng and Chang, 1983). Agricultural development in countries with small farms without much cultivable land left for exploitation, face much more difficult adjustment problems than countries with large farms, when their economy goes through periods of rapid industrialization and urbanization. A result of the accelerated outflow of agricultural labor during the 1970s was a jump to an 18.7 percent annually wage increase, as compared to 8.8 percent during the 1960s. This was the major factor in increases in crop production costs in the 1970s. A lag in the process of farm mechanization exists on small farms, particularly in dryland crops. The one hectare farms are individually too small to economically absorb investments in small machines. The labor productivity in the 1970s increased significantly mainly due to the drastic outflow of farm labor, and the increased use of modern inputs. However, labor productivity was still far behind the increasing wage rate. Such a severe lag in labor productivity caused by the same reason that caused a sharp rise in farm wages would not have happened in:

(a) countries with large farms where the impact of decreasing farm labor is offset by farm consolidation and mechanization. The existence of productivity lags on small farms make their products uncompetitive with developed countries such as the U.S., which have already experienced an outflow of farm labor, have stabilized farm wages at a high level, and have kept productivity increases ahead of rising production costs,

(b) less developed countries which have not yet experienced a rapid outflow of farm labor, have maintained crop yields at relatively low levels, and have kept the increases in farm wages below

the increases in productivity. In terms of a revealed comparative advantage index, Taiwan's agricultural products had a small comparative advantge than either developing counties or developed countries as a whole (Anderson,1982).

Second, with changes in income, income distribution, relative prices, urbanization, and the opportunity cost of women's time, food consumption patterns have changed significantly during last two decades in Taiwan. Considering the limited endowment of agricultural land, and natural constraints on agricultural production and the change of food consumption patterns, the increase of food demand was greater than the agricultural production during last decade, as shown in Table 4. The discrepancy between the increase of production and demand widened. Therefore, as per capita income growth in countries with small farms and without additional cultivable land, the economy will increase its dependence on food imports.

Finally, during the rapid, multi-phased structural adjustment, agricultural development and resource utilization in countries with small farms are extremely vulnerable. Japan adopted a high protection policy during the 1960s and the 1970s to ensure her consumers protected farmers. Instead Taiwan reduced many trade barriers, including tariffs and nontariff restrictions. The increasing trade surplus, particularly with the United States, prompted further efforts to liberalize trade, including agricultural trade. As a result, agricultural imports for final consumption goods increased. Therefore, agricultural production faces two pressures, to compete for resources with the domestic industrial sector, and to compete with foreign agricultural imports. Under the unavoidable productivity lag for an agricultural sector in rapid economic structural adjustment, farm operational scale was expanded to increase agricultural production efficiency and new industries were encouraged in the rural areas to raise farm family incomes.

III Farm Family Income and Its Distribution

During the process of industrialization in an economy, farmer's income increase with increased in productivity. Because agricultural production is biological process and agricultural products are inelastic in both supply and demand elasticities, the increases in farmer's income are usually less

than nonfarmer's income, especially with small farms. A low ratio of farm to nonfarm income suggests the possibility of off-farm employment to improve income. Farm family income, therefore, comes from on-farm and off-farm income, so problems of improving farm family income are intricately interwoven with opportunities in agriculture and off-farm employment. In this section, the present agricultural policies stimulating off-farm income will be discussed, and the growth and distribution of farm family income is analyzed to reflect the overall performance of farm economy in Taiwan.

(I) Programs Stimulating Off-Farm Income

The basic structural problem in Taiwan's agriculture is the extremely small farm size. It is insufficient to maintain the family and gain maximum economic efficiency. As laid down in the Agricultural Development Act, the expansion of farm size is one of the prime objectives of policy. The Second Stage of the Agricultural Land Reform Program was officially proclaimed in April 1980, encouraging farm size expansion to 15 to 20 hectares through joint operations, entrusted farming, cooperative farming, and joint management. Such organized group farming has many advantages. First, it enlarges the land base without affecting land ownership and remains efficient for mechanical operations. Second, it maintains a high level of land productivity resulting in lower production costs per unit of total output. Third, it helps divert surplus farm labor toward better-paying jobs in the non-farm sector to increase farm family income. Next, it avoids the landlord-tenant relationship by having the land entrusted to other members of the group for cultivation. Fifth, it enables small farms to perform with large-farm efficiency in farming operations, including buying and selling. Finally, it maintains the family farming system as a basis for small farm development (Ong, 1984).

The program also set up the Farm Mechanization Fund to accelerate the mechanization and the Farmland Purchase Fund to encourage farmers to buy land from their neighbors to expand the size of individual farms. Land consolidation is a major measure in the program to improve transportation, and irrigation and drainage facilities, which are essential for the adoption of technological innovations. The second stage of the land reform program attempted to raise productivity within the

context of rapid industrialization (Li, 1988), while the first stage in the 1940s was mainly designed to equalize the landownership distribution.

The development of transportation, communiciations networks, and utilities in the 1950s provided favorable conditions for rural industrialization. Under the ARDP program, labor intensive industry, primarily food processing and textile industries, establishing new plants in rural area was encouraged. The government established the "Industrial Zones", in which infrastructure was provided. In 1976, the total number of established plants was 431,000, with a spatial distribution of 36 percent urban and 64 percent rural (Peng, 1987).

The absorption of workers from farm families by rural industry greatly changed the pattern of labor and land utilization in farm families and rural communities. The group farming system operates highly mechanized farms, releasing farm labors to work in the factories regularly by commuting, and spend their time on the farms during the busy farming seasons or on the weekends. On the average, farmers only spent 30 percent of their available time on farm activities in 1986 (Peng and Chen, 1986). Rural industrialization provided rural labor with opportunities for earning attractive income in the nonfarm sector. As a result, it has great contribution to increase farm family incomes.

However, the intensity of land utilization declined, and farms became more specialized and market oriented. This phenomena can be examined on Table 14. The multiple cropping index has declined. It peaked at 188.8 in 1965 and fell to 142.4 in 1985 as farmers gave up summer and winter cash crops and inter-crops, which accounted for the high productivity per hectare per year during the late 1950s and early 1960s. The diversification index for individual farms declined from 3.0 in 1965 to 1.9 in 1982 from utilization of farm machinery and lack of farm labor. While the aggregate product mix from farming has been diversified to meet market demand, the aggregate diversification index almost tripled between 1952 and 1985. According to the census data, the full time farm family decreased from 49.3 percent of total farm families in 1960 to 11.4 percent in 1985, and part time farm families increased from 50.7 percent to 88.6 percent with nonfarm jobs as main their employment, see Table 15.

(II) Structure of Farm Family Income

Given that available farm family labor has been allocated to on-farm and off-farm activities, family income consists of on-farm and off-farm income. The off-farm income includes wages and salaries, sidebusiness income, property income and other miscellaneous income transfers. According to survey data, the annual increases in farm family income were attributed to off-farm income from 1964 to 1987. Real family income, on-farm income and off-farm income increased annually by 4.2 percent, 1.8 percent and 6.7 percent, respectively, during the same period. The growth rate and structure of farm family income from these two income sources can be divided into three stages between 1964 and 1987. Changes in structure of farm family income paralleled those in economic development and in agricultural policy strategies, as shown in Table 16.

Stage I: Before 1970, earnings from farming were the major source of family income, accounting for 52 percent (in 1969) to 65 percent (in 1964). As mentioned before, agricultural production in the late 1960s fell into a price-cost squeeze dilemna due to unfavorable terms of trade. The widening gap of labor productivities between farm and nonfarm labor, caused an extensive use of land by an increasing number of farmers. On-farm income fell 5.3 percent annually from 1964 to 1970, while off-farm income increased by 5.7 percent per year. However, off-farm income could not offset on-farm income and real farm family income fell 0.7 percent annually, see Table 17. The gap between farm family income and nonfarm family income widened. The ratio of farm family income to nonfarm family income dropped from 94.8 percent in 1964 to 72.2 percent in 1970. Accordingly, the ratio of farm family income to worker family income sharply decreased from 121.9 percent to 79.6 percent.

Stage II: Between 1970 and 1980, off-farm activities gradually played a more important role in increasing total family income because of the rapid growth of industrialization and the encouragement of rural industrialization. The ratio of off-farm income to total family income increased from 51.3 percent in 1970 to 70.4 percent in 1980. Annual on-farm income increased 2.1 percent, while off-farm increased 10.7 percent. In other words, the annual 7.2 percent growth in total farm family income was 89 percent atrributed to off-farm income, as shown in Table 17. However, the interrelationship between farm sector and nonfarm sector was interwoven through different markets,

such as the labor market, capital market, product market, and current input markets. Therefore, the relative income ratio between farm and nonfarm families shifted irradically depending on the market situations and government policies. In general, the farm family income situation improved during this period.

Stage III: After 1981, the measures implemented in the 1970s already produced gratifying results in increasing agricultural output, accelerating modernization and raising on-farm income. The proportion of on-farm income to total farm family income increased from 36.7 percent in 1980 to 38.1 percent in 1987 (Table 16). The annual increase of on-farm income was much faster than off-farm income during this period (Table 17). With declining competitiveness, Taiwan's agriculture has been hard hit by large amounts of agricultural imports. Shrinking farm product prices returned a flimsy profit margin, causing a decline in relative income for farm families in early the 1980s. By 1987, the ratio of per capita farmer income to per capita nonfarmer income was 72.6 percent.

In general, the ratio of farm family income to nonfarm family income was substantially influenced by the business cycle in Taiwan. The larger the share of off-farm income in farm family income, the larger the income gap between farm and nonfarm family. This might imply that increased efficiency in farming is important to narrow the income gap between the two sectors.

(III) Farm Family Income Distribution

The distribution of farm family income is affected by patterns of on-farm and off-farm income. According to most literature, the high rate of economic growth and spatially decentralized pattern of industrialization in Taiwan, meant that off-farm sources of employment and income in rural areas contributed to the improvement of both income and income distribution among farm families. Therefore, to accelerate the process of rural development, stress should be placed on the policies for supporting non-farm activities in accordance with the supply of infrastructure service in the rural areas (Ho,1979; Chinn,1979; Oshima,1984). According to the inequality index of farm family income distribution in terms of folds of the 5th income group to the 1st income group and the Gini Coefficient in Taiwan from 1966 to 1987, both figures suggest the income distribution improved with income growth from the 1960s to the mid-1970s. While the income distribution became skewed with income

growth since the mid-1970s. In other words, the value of Gini Coefficient revealed a "U" shape in the process of economic development, as shown in Table 18.

In the earlier period of Taiwan's economic development, farm earnings were the major source of farm family income. The larger the farmholdings, the higher the farm family income. The distribution of farmland, therefore, directly affected the distribution of farm family income. The Gini Coefficient of farm land distribution should be almost equivalent to that of farm family income distribution. Given the size of the farmholdings, the land/man ratio for small farms was less than large farms. The small farms released unemployed to nonfarm activites as the opportunities arose. Therefore, the proportion of off-farm income was inversely related to the farm size, the smaller the size of farm, the higher the reliance on off-farm income. Thus, with off-farm activities the distribution of income among different farm size groups of farmer has been more even. The Gini Coefficient fell from 0.31 in 1966 to 0.28 in 1975, and the folds of the 5th income group to the 1st income group fell from 5.16 to 4.12 in the same period. This indicates a considerable improvement in income distribution among farm families.

However, capital investment requirements for larger farms increased sharply during the last decade. As farms were modernized, machinery and modern inputs increased. The labor demand for the larger farms decreased and the excess workers found off-farm employment to increase their farm income. The off-farm income for the larger farms increased much faster than for the smaller farms since the mid-1970s. The annual increase in off-farm income was 15.6 percent for farms less than 0.5 hectare and 8.9 percent for farms greater than 2.0 hectares from 1965 to 1968. While the annual growth rate for these two farms was 2.6 percent and 7.4 percent, respectively, from 1974 to 1982. The effect of improving the income distribution by increasing off-farm income for small farm income was offset as the larger farms increased their off-farm income through modernization. The Gini Coefficient for farm family income increased from 0.28 in 1975 to 0.33 in 1982. The folds of the 5th income group to the 1st income group also increased from 4.12 in 1975 to 5.01 in 1987, indicating a unfavorable improvement in income distribution among farm families.

In general, as the economy evolves into a highly industrialized economy, the benefit of off-farm activities to farm family income may diminish, and the farm family income distribution may not be desirable. Instead, farm labor migration may be a more efficient and desirable strategy. According to the census data, the percentage of full time farm households to the total number of cultivating farm households increased from 9.0 percent in 1980 to 11.4 percent in 1985, as shown in Table 14. This might imply that as per hectare productivity growth slows down with extensive small-scale mechanization, the growth of on-farm income tapers off, indicating the extremely small part-time farm family may eventually migrate to nonagricultural employment.

V. Concluding Remarks

Under the family farm system in Taiwan, prices received by farmers allocated scarce resources among alternative uses and induced relatively expensive resource saving technological changes, and dictated the level of on-farm income. Taiwan's agriculture, however, became highly dependent on modern inputs. Factor prices were the primary determinant of on-farm incomes. Without exception, Taiwan's government, like every government in the world, directly and indirectly influenced farm prices and income to pursue specific policy goals in the process of economic development. With two-thirds of farm family income consisting off-farm income, the relative income problem for farm families remain. Several possible reasons are responsible for this phenomena:

1. Before the mid-1960s, increases in agriculture production on the small family farm were obtained through biological and institutional innovations. Biological innovations are a kind of scale neutral technology, under strict agricultural protection measures and successful institutional innovation, that provide incentives for farmers to increase agricultural production despite unfavorable terms of trade. After the turning point of economic development in the late-1960s, the number of farm workers substantially decreased without affecting the number of farm families. By 1987, the average farmholding was 1.17 hectares smaller than that the 1.29 hectares in 1952. Several ways have been found of circumventing regulation on rental contracts, such as group farming. Under shadow of the land-to-the-tiller act, widespread fear exists that land, once let, is lost forever.

Thus, non-farmers who inherit land tend to hold on to it and farm it part-time rather than releasing or selling it. Labor saving mechanical innovation has been impeded by small farm size. Because the rate of technical change was behind the rate of production costs increase in Taiwan, some export agricultural products became unprofitable businesses and lost their competitiveness in the world market.

2. The structure of market pricing also affected the profit of agricultural production in Taiwan. This influence comes mainly from increased use of inputs, especially in the later stage of agricultural development. Agricultural production in Taiwan relied mainly on small farms where farmers maximize their profit by investing large amounts of current capital inputs to increase output per hectare. The change in food consumption habits of Taiwan's consumers oriented agriculture to the production of higher input-output ratio commodities to satisfy the wants of consumers. As the derived demand for inputs from the rise of agricultural production also increased, most of these inputs were provided by agribusiness. Generally speaking, the price of agricultural products in Taiwan is determinded by the forces of supply and demand, while the price of industrial products is determined by businessmen, who have the ability to adjust, to some extent, the quantity of supply by means of changing inventory and production to meet the market demand. With the different pricing functions between industry and agriculture, the agricultural product market bears the burden of unbalanced growth between these two sectors. Moreover, the contribution of current capital input to the growth of agricultural output was over 100 percent in the later stages of agricultural development, the functional income distribution was against farmers inputs, such as labor and land, so that the farm family income from farming was squeezed.

3. Small farmer's bargaining power was very weak in product marketing and input purchasing in Taiwan. Four kinds of farmer's organizations, the farmers' associations, irrigation associations, fishermen associations and fruit marketing cooperatives, are multiple purpose cooperative organizations, except the fruit marketing cooperative. The farmer's organizations were recognized as an indispensable factor for agricultural development in Taiwan. However, with part-time farming agriculture and the increasing concentration of economic power in agribusiness, these multiple purpose

organizations cannot represent farmers effectively as a bargaining group for supplying inputs and marketing their products like the Japanese farmer's cooperatives. They lack the legal support to alleviate the free-rider problem of collective action to compete with well organized agribusiness. This is the reason why farmers see their prices decreasing due to sizable foreign product import and the prices they pay increasing due to the concentration of economic power in the hand of big business without much resistance. The government implemented several price and income programs to protect farmer's interests. Price policy as a means of farm income support has been diminishing as support price levels have not been adjusted for 7 years because of rice surpluses and budgetary constraints.

To cope with further production cost increases and the widening income gap between farmers and nonfarmers, the productivity of labor in agriculture must be increased relative to the productivity of labor in the nonfarm sectors in the economy. A policy of labor migration must be publicly accepted and programs must be developed encouraging the part-time farmers to transfer their farmland and the assimilation of farm people into nonfarm population. This can provide an opportunity for those who remain in farming to consolidate farm units of sufficient size to promote efficiency with modern machines and improved management. Also, it revises the regulations governing farmer's organizations, improving the bargaining power of the farmer's group and representing farmer's political and economic interests. Further efforts should be made to increase competitiveness of agricultural input markets, change product-mix, promote farming efficiency, and improve farm marketing channels. Moreover, in the transitional period, a reasonable level of protection is needed and justified for faciliating the structural adjustment in Taiwan's agriculture.

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Table 1. The Annual Change Rate of Price Index Unit:%

Period	WPI	CPI	Agri. Prod. Price	Agri.Process Product	Industrial Product
1945-51	290.1	-	445.0	240.0	300.5
1952-60	10.3	-	14.0	12.5	8.6
1961-72	2.0	3.3	2.5	2.4	1.1
1973-81	10.2	13.4	16.3	12.8	13.4
1982-88	-2.0	-0.8	-1.4	-2.1	-2.0

Source: Directorate-General of Budget, Accounting & Statistics, Executive Yuan, Monthly Report of Price Statistics, Taiwan District.

Table 2.The Relative Price of Agricultural Products in Taiwan
(Base year:1971)

Period	Agri.Product	Rice
	%	%
1938-44	67	74
1945-49	108	89
1950-60	76	70
1961-72	93	94
1973-76	110	119
1977-81	97	114
1982-84	100	106
1985-88	110	112

Source: Same as Table 1.

Table 3. Per Capita Food Availability in Taiwan Unit:kg

Item	1953	1960	1970	1980	1987
Cereals					
Total	157.1	159.7	164.1	138.8	110.2
Rice	141.2	137.7	134.5	105.5	78.2
Vegetable	60.2	61.1	84.8	129.6	125.4
Fruit	17.9	22.1	45.8	70.2	93.5
Meat	17.8	16.2	25.3	42.6	57.7
Egg	1.4	1.6	4.1	8.0	11.5
Fish	16.1	21.7	34.2	38.7	44.9
Milk	1.6	3.2	10.4	24.6	33.6
Other	100.4	110.9	84.6	81.3	96.3

Source: Council of Agriculture, Basic Agricultural Statistics,R.O.C. 1988

Table 4. Growth Rate of Food Demand and Agricultural Production

Period	Growth Rate of		Income	Growth Rate of	
	Population	Income	Elasticity	Demand	Production
1962-66	3.1	5.4	0.5	5.8	5.8
1967-71	2.9	7.8	0.4	6.3	5.7
1972-76	1.9	5.7	0.4	4.1	3.3
1977-81	1.9	4.9	0.3	3.6	1.1

Source: Peng, T. K., (1988)a

Table 5. Annual Increasing Rate of Agricultural Product Price

Year	Crops Product	Livestock Product
	Base Year: 1951=100	
1951-66	9.0	8.1
1967-81	8.1	6.2
1982-87	-0.2	-3.8

Source: PDAF, Monthly Report on Agricultural Price in Taiwan, 1988.

Table 6. The Instability Index* of Price Index Unit:%

Period	WPI	Agri Prod. Price	Agri. Process Price	Industrial Pro.Price
1946-51	290.1	445.0	240.6	300.5
1952-60	10.5	15.4	12.7	9.3
1961-72	2.9	3.5	4.9	2.4
1973-76	18.1	18.5	13.9	19.9
1977-81	9.9	8.7	7.2	10.7
1982-88	0.02	0.02	0.03	0.02

Source: Same as Table 1.

* Instability Index (Michaley Index) = $\sum\left(\left|(P_t - P_{t-1})\right| / P_{t-1}\right)/n\text{-}1$.

Table 7. The Annual Increasing Rate of Input Price Unit:%

Period	Farm Wage	Farm Machinery	Fertilizer	Feed
1951-60	14.6	10.2	13.1	14.5
1961-72	8.8	1.8	-1.9	1.8
1973-81	18.7	3.6	7.8	6.1
1982-87	3.4	0.6	-4.8	-4.4
1951-87	11.8	5.0	4.9	5.3

Source: Provincial Food Bureau, Statistics of Food Production.

Table 8.Change of Input Utilization and Farm Expenditure in Farm Household

Year	Labor		Rent		Current Capital		Fixed Capital		Total Farm
	Input	Exp.	Input	Exp.	Input	Exp.	Input	Exp.	
Index (1960 = 100)									
1960	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100;0	100.0
1970	73.6	182.0	179.7	229.9	131.4	168.6	134.8	227.4	162.8
1980	43.9	763.9	179.1	621.3	186.9	573.7	153.2	258.8	559.7
1987	40.2	848.3	159.6	668.4	275.3	1,153.0	197.8	856.0	851.9
Annual Growth Rate (%)									
1960-70	-3.0	6.1	6.0	8.6	2.8	5.4	3.0	8.6	5.0
1970-80	-5.0	15.4	-0.4	10.5	3.6	13.0	1.3	1.3	13.1
1980-87	-1.2	1.5	-1.1	1.1	5.7	10.5	3.7	18.6	6.2
1960-87	-3.3	8.2	1.7	7.4	3.8	9.5	2.6	8.3	8.3
Share of Expenditure (%)									
1960		46.2		0.9		31.9		21.0	100.0
1970		51.6		1.3		33.1		14.0	100.0
1980		55.1		1.0		32.7		11.2	100.0
1987		46.0		0.7		43.2		10.1	100.0

Source: PDAF, Report on Farm Family Bookkeeping in Taiwan, various years.

Table 9. Rice Production Cost of First Crops In Taiwan

Year	Labor	Rent	Current capital	Fixed capital	Cost per hectare	Cost per kg
Index (1950 = 100)						
1950	100.0	100.0	100.0	100.0	100.0	100.0
1960	476.4	403.5	668.9	327.9	483.9	429.6
1970	1022.0	456.6	1,076.4	1,283.1	913.6	684.8
1980	4,233.7	2,537.6	2,894.3	3,570.4	3,468.0	2,573.8
1987	5,058.5	2,774.8	4,213.1	3,108.5	4,160.5	3,071.7
Annual Increasing Rate (%)						
1950-60	16.9	14.9	20.9	12.6	17.1	15.7
1960-70	7.9	1.2	4.9	14.6	6.6	4.8
1970-80	15.3	18.7	10.4	10.8	14.3	14.2
1980-87	2.6	1.3	5.5	-1.9	2.6	2.6
1950-87	11.2	9.4	10.6	9.8	10.6	9.7
Share of Input Cost to Total Cost (%)						
1950	45.5	24.8	20.6	9.1	100.0	
1960	44.8	20.7	28.5	6.0	100.0	
1970	50.9	12.4	24.3	12.4	100.0	
1980	55.5	18.2	17.2	9.1	100.0	
1987	53.3	16.6	20.9	7.5	100.0	

Source: Provincial Food Bureau, Report on Rice Production Cost, 1987.

Table 10. The Change of Agricultural Production in Taiwan

Year	General Index	Crops				Forestry	Fishery	Livestock
		Total	Rice	Fruit	Vegetable			
Index (1981 = 100)								
1952	34.8	49.1	66.3	8.8	17.0	79.0	11.3	13.3
1960	49.0	64.8	80.6	15.0	22.9	149.2	21.5	22.2
1970	80.2	93.6	103.8	51.4	63.8	214.0	57.6	47.1
1980	100.7	101.9	99.2	92.2	110.0	106.9	100.0	96.5
1987	110.2	94.8	80.0	126.2	106.1	79.1	133.5	150.3
Annual Growth Rate (%)								
1952-70	5.2	3.6	4.1	10.1	7.9	5.6	9.5	7.3
1970-87	1.9	0.1	-1.5	5.4	3.0	-6.3	5.1	7.1
1952-87	3.5	1.9	0.5	7.9	5.3	0.0	7.3	7.2
Share of Subindustry (%)								
1952	100.0	68.6 (100.0)	- (58.7)	- (3.5)	- (4.8)	6.5	9.1	15.8
1960	100.0	64.1 (100.0)	- (57.0)	- (4.2)	- (5.7)	5.5	9.2	0.9
1970	100.0	57.2 (100.0)	- (40.5)	- (11.8)	- (16.0)	5.2	13.5	24.1
1980	100.0	47.2 (100.0)	- (41.8)	- (14.5)	- 23.2)	2.3	21.6	29.0
1987	100.0	41.4 (100.0)	- (26.8)	- (24.4)	- (26.1)	1.2	28.2	29.2

Source: PDAF, Taiwan Agricultural Production Yearbook, 1988.

Table 11. The Annual Growth Rate of Agricultural Output Unit:%

Items	1952-1967	1967-1981	1952-1981
Agri. output	4.5(100.0)1	3.4(100.0)	3.9(100.0)
Technical change	2.1(46.4)	1.1(32.8)	1.7(43.7)
neutral	2.2	0.8	1.6
biased	-0.1	0.3	0.1
Labor input2	0.5(10.1)	-1.4(-40.9)	-0.5(-12.2)
Current capital2	1.7(36.8)	3.5(105.2)	2.5(64.5)
Fixed capital2	0.1(2.6)	0.3(7.8)	0.2(5.1)
Land input2	0.2(4.2)	-0.2(-4.8)	-0.04(-1.0)

Note: 1.The number in ( ) is the contribution rate of specific factor to the growth of agricultural output.

2. The change rate of individual input is derived from the derivative of aggregate production function $Y = f(X_i, T)$, that is $\dot{Y} = E_{Yi}\,\dot{X}_i + \dot{T}$, where $\dot{Y}$ is the growth rate of output, E_{Yi} is output elasticity of i input, $\dot{X}_i$ is the growth rate of i input, $\dot{T}$ is the rate of technical change.

Source: Peng and Lin (1989).

Table 12. Allen's Partial Substitution Elasticities of Input Demand

Elasticity	1952-66	1967-81	1952-81
b_{LL}	-0.8975 (0.0958)*	-0.8511 (0.0935)*	-0.8609 (0.0947)*
b_{LC}	1.2395 (0.2405)*	1.1585 (0.1591)*	1.1910 (0.1917)*
b_{LK}	0.0640 (0.4090)	-0.1158 (0.4876)	-0.0181 (0.4449)
b_{LA}	0.5437 (0.3042)	0.1239 (0.5841)	0.4010 (0.3994)
b_{CC}	-3.3459 (0.7809)*	-1.9087 (0.3505)*	-2.4843 (0.5026)*
b_{CK}	3.1477 (1.4104)*	2.7367 (1.1404)*	2.8857 (1.2384)*
b_{CA}	-0.3012 (0.8483)	-0.6946 (1.1047)	-0.3790 (0.8990)
b_{KK}	-9.0500 (3.1624)*	-10.5593 (4.6060)*	-9.7634 (3.7881)*
b_{KA}	-0.1081 (1.4869)	-1.5995 (3.4881)	-0.6021 (2.1498)
b_{AA}	-0.8122 (1.2130)	2.5649 (4.5834)	-0.2180 (2.1168)

Note: The number in ( ) is standard deviation, and * indicates the coefficient is significant at 5% level.
Source: Peng and Lin (1989).

Table 13. Agricultural Trade in Taiwan

Year	Export		Import			
	Value	Agri./Total	Value	Agri./Total	Raw Mater./Agri	Consum./Agri.
	US$mil.	%	US$mil.	%	%	%
1952	114.2	95.5	66.5	32.1	73.4	26.6
1960	120.7	71.0	75.8	30.1	81.4	12.6
1970	310.2	21.7	376.5	24.7	93.5	6.5
1980	1,876.5	9.5	3,090.0	15.7	89.4	10.6
1987	3,617.4	6.8	4,827.2	14.1	89.1	10.9
Annual Growth Rate (%)						
1952-60	0.6	-	1.5	-	6.9	-2.9
1960-70	9.7	-	14.9	-	15.7	7.6
1970-80	19.7	-	23.4	-	23.1	29.9
1980-87	9.8	-	6.6	-	5.5	6.2
1952-87	10.4	-	13.0	-	13.6	10.3

Sourec: Same as Table 9.

Table 14. The Multiple Cropping Index and Diversification Index in Taiwan

Year	Cropping Index	Aggregate Diversification Index	Farm Diversification Index
1946	117.2	NA	NA
1952	173.6	3.5	NA
1955	172.7	4.0	NA
1960	184.1	4.0	NA
1965	188.8	5.7	3.0
1970	183.0	6.7	3.1
1975	180.9	6.2	2.5
1980	154.4	8.4	2.1
1985	142.4	10.7	1.9(1982)

NA: Not available.
Source: PDAF, Agricultural Production Yearbook and Report on Farm Family Bookkeeping, various year.

Table 15. Number of Farm Households by Full-Time and Part-Time

Year	Total Farm	Full-time farm	Part-time farm	Farm as main occupation	Sideline as main occupation
1960					
Number	776,002.0	382,578.0	393,424.0	239,981.0	153,443.0
%	100.0	49.3	50.7	30.9	19.8
1970					
Number	879,398	274,281	605,117	369,570	235,547
%	100.0	31.2	68.8	42.0	26.8
1980					
Number	871,705	78,318	793,387	313,496	479,891
%	100.0	9.0	91.0	36.0	55.0
1985					
Number	771,906	88,001	683,905	153,193	530,712
%	100.0	11.4	88.6	19.8	68.8

Source: Same as Table 9.

Table 15. Sources and Relative of Farm Family Income

Items	1964	1970	1975	1980	1985	1987
Per family	29,503	35,439	86,061	197,533	261,456	303,479
Per capita	3,845	5,350	14,274	36,752	54,558	67,969
Structure (%)						
On-farm	64.7	48.7	46.3	29.6	36.7	38.1
Off-farm	35.3	51.3	53.7	70.4	63.3	61.9
Farm family income as % of nonfarm family (%)						
Per family	94.8	72.2	79.6	74.2	71.3	72.9
Per capita	69.8	60.2	76.1	66.4	69.0	72.6
Farm family income as % of laborer family (%)						
Per family	121.9	79.6	92.3	84.8	80.2	81.5
Per capita	88.1	70.0	81.5	79.9	83.5	87.3

Note: Laborers include production workers, and transport equipment operators and laborers.

Source: Taiwan Provincial Government, Report on the Survey of Family Income and Expenditure, 1987.

Table 17. The Annual Increasing Rate of Real Farm Family Income

Period	Farm Family Income	On-Farm Income	Off-Farm Income	Increase of Family Income from	
				On farm	Off-Farm
1964-70	-0.7	-5.3	5.7	-451.9	351.9
1970-80	7.2	2.1	10.7	10.9	89.1
1980-87	4.0	7.8	2.1	64.9	35.1
1964-87	4.1	1.8	6.7	21.1	78.9

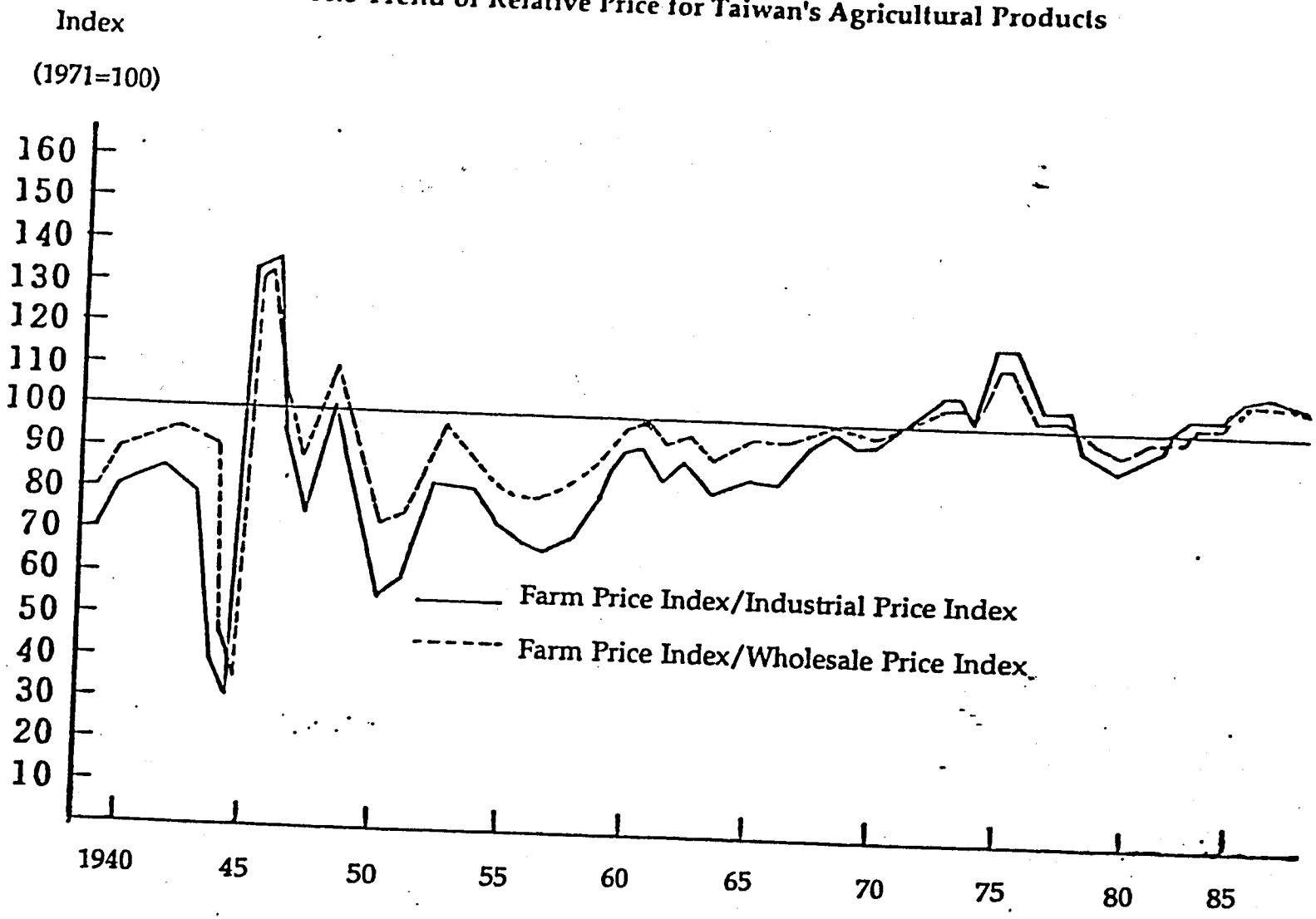
Source: Peng, T. K. (1987).

Table 18. The Inequality of Farm Family Income

Year	5th income group / 1st income group	Gini Coefficient
1966	5.16	0.31
1970	4.26	0.29
1975	4.12	0.28
1980	4.81	0.31
1985	4.52	0.33(1982)
1987	5.01	NA

Source: Peng, T.K. (1987).

Figure 1. The Trend of Relative Price for Taiwan's Agricultural Products



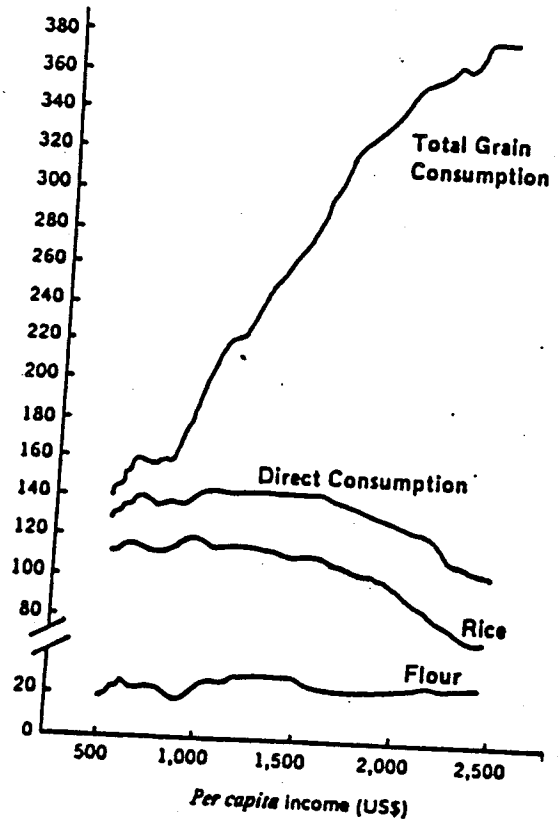


Fig. 2. *Per capita* consumption of grain relative to income

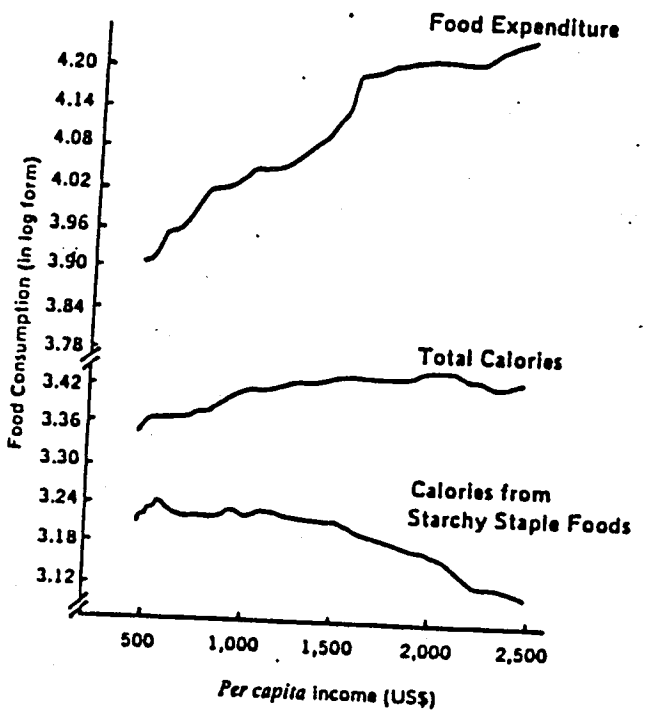


Fig 3. Food consumption in relation to income level

Figure 4.Overall Framework of Taiwan 's Agricultural Policies

Policy area	Aims	Major projects /measures
1. Structural Policy	*Expansion of farm size *Encouragement of joint farming	*Second Stage of Agricultural Land Reform Program *Farmland Purchase Scheme *Regional Planning Prgram *Nucleus Farmer Program *Encouragement of rural industrialization
2. Production Policy	*Adjustment of agricultural production structure *Promotion of agricultural efficiency and self-sufficiency on major production *Improvement of agricultural infra-structure	*Paddy Field Conversion Program *Research and extension *Water and land resource development *Farm Mechanization Scheme *Rural public investment
3. Price and Income Policy	*Price stabilization and support *Farm family income enhancement	*Price Stabilization Scheme for rice, small grain, sugar, major crops *Livestock insurance *Agricultural Development Scheme and Loan Program *Border measures
4. Marketing Policy	*Rationalization of marketing channels *Improvement of food quality	*Agricultural Marketing Act *Food Processing Development Program *Joint Marketing Program *Wholesale market modernization program
5. Rural Life Policy	*Improvement in environmental factors in rural villages *Improvement in farmers' welfare	*Farmer Health Insurance Program *Rural Village Reorganization Scheme *Establishment of farmer shopping centers