

## 2 Agricultural and Industrial Development in Taiwan

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Over the past four decades Taiwan's economy has experienced significant structural change. At the outset of this period, Taiwan was just recovering from the ravages of World War II, and the economy was heavily dominated by the agricultural sector, which accounted for one-third of the net domestic product, more than half (56 percent) of total employment, and 92 percent of total exports. By 1988 agriculture's share of the net domestic product (NDP) had dropped to 6 percent, its share of total employment was down to 13.7 percent, and the sector accounted for only 6.1 percent of the total exports, including processed foods. These were years of high and stable economic growth: the real gross national product (GNP) grew at an average rate of 8.8 percent from 1952 to 1989, and two oil crises of the 1970s seemed to have little negative impact.<sup>1</sup> Between 1952 and 1987, per capita GNP, at 1981 constant prices, increased more than seven times, for an annual increase of 6.2 percent. In view of this growth, Taiwan is likely to be classified as an industrial economy by the turn of the century (Klein 1986).

In the period since 1952, Taiwan's economy has also become increasingly dependent on trade. Total trade as a percentage of gross domestic product at current prices grew at a steady pace, from an average of 24.6 percent in the 1950s to 101 percent in the 1980s. Since 1970 the trade balance has been positive except for 1974, 1975, and 1980, when Taiwan was hit by the oil crises and economic recession. Taiwan has exported more than half of its GNP since 1978, and its trade surplus was equivalent to 9 percent of GNP in the 1980s.

The impact of high economic growth on the distribution of wealth has been equally impressive. The ratio of the income of the highest fifth of households to that of the lowest fifth was less than 5 during the 1970s and 1980s. This ratio is comparable to the rates recorded by Japan and some European countries, whose income distribution is the most equitable in the world.

1. The growth rate by decades was 8.3 percent (1952-1959), 9.1 percent in the 1960s, 10.2 percent in the 1970s, and 7.7 percent in the 1980s.

This pattern of growth in Taiwan lends substantial support to the view that accelerated growth in the agricultural sector can promote development in the nonagricultural sector and therefore should be of considerable interest to other countries seeking to promote development. As the largest sector in the economies of underdeveloped nations, agriculture can provide savings as well as labor for nonagricultural development. Part of the agricultural surplus can be exported to finance the import of much needed foreign capital goods. Such exports can help alleviate the foreign exchange constraint. In addition, an expanding agricultural sector, accompanied by rising farm family income, can represent a major market for consumer goods produced by domestic manufacturers. The agricultural sector would share in the heavy protection costs related to the import-substitution strategy widely pursued in the developing world. By providing an adequate food supply, agricultural growth can help stabilize general prices and thereby mobilize and reallocate domestic resources more effectively. Furthermore, the existing agricultural infrastructure can be used by the nonagricultural sector. In all these ways, agriculture can contribute substantially to economic development.

To make such a contribution, agriculture must undergo growth, which cannot be achieved without the strong support of public policy, particularly in the area of physical investment, technological upgrading, and institutional arrangements for distribution and credit. During this process, the agricultural sector must adjust to changes in the economic environment. For example, it may be necessary to raise farm wages because incomes in general are rising, surplus agricultural labor is disappearing, or food demand is changing. Another important point about agricultural-led growth is that it does not mean agriculture would hold an increasing share in the economy, or that resources would flow only one way between the agricultural and nonagricultural sectors. Instead, the growing agricultural sector would pave the way for a more balanced pattern of development through stable prices, more equitable income distribution, less regional dualism, and probably a higher degree of social stability. As a result, the role of agriculture in development would change over time, as would the interaction between the agricultural and nonagricultural sectors. It is vital to understand that policy issues will shift once agriculture takes on this role in development.

### **Agricultural Development**

Taiwan's agricultural development can be divided into two distinct periods: the colonial years from 1895 to 1945 and the postwar years from 1945 on.

#### *The Colonial Period, 1895–1945*

During the colonial period from 1895 to 1945, Taiwan was under the rule of Japan and became an important part of its agricultural sector. The principal

goal of the colonial government was to make Taiwan's subsistence agriculture more productive so that large supplies of food could be exported to Japan to support its industrialization effort. In this report, the history of Taiwan's agricultural development differs from that of other economies, most of which exported only a small part of their agricultural output. The fact that agricultural output, particularly food, was not limited by domestic demand, is important in understanding its development process.

In the 50 years of Japanese occupation, agriculture accounted for about 40 to 45 percent of Taiwan's NDP and about 65 to 70 percent of the total labor force. In 1946, soon after Taiwan was returned to the Republic of China, the farm population was 3.52 million, cultivated land area was 832,000 hectares, and the average farm was 1.58 hectares. In 1937, about 50 percent of the rice and nearly all of the sugar produced in Taiwan were exported to Japan. Sweet potato was the main food of the local people.

In the period from 1913 to 1921, the average annual growth rate of total agricultural production was 2 percent, and that of gross value added was only 1.4 percent. The main factor contributing to the increase was the expansion of cultivated land area, from 687,187 hectares in 1911 to 752,800 hectares in 1921, an increase of 1 percent per year. The yield of rice and sugarcane did not increase significantly. That of sugarcane seldom exceeded 30,000 kilograms per hectare. Labor inputs measured in terms of total working days increased moderately as a result of a rise in the number of average working days per worker per year. Production techniques were labor intensive and relied on farm-produced fertilizer.

From 1921 to 1936, a period of agricultural transformation, total production increased at an annual rate of 4.2 percent and agricultural output at the rate of 4.3 percent (Chen and Wang 1980). Crop yields and multiple cropping also increased, as did the land under cultivation. Improved varieties of crops and the use of chemical fertilizers helped raise crop yields significantly. Over the 1920s and 1930s the yield of rice increased from 1,435 kilograms per hectare to 2,217, and the yield of sugarcane from 25,481 kilograms per hectare to 70,883. In addition, the area of irrigated land increased from 364,100 hectares to 528,000 hectares, and the irrigated portion of cultivated land from 48.4 to 61.6 percent. With improvements in irrigation, the multiple cropping index rose from 120 in 1921 to 137 in 1937. The rapid adoption of high-yielding ponlai rice from Japan and new farming techniques greatly contributed to these increases. Livestock production also rose significantly in this period.

Taiwan's success in applying new agricultural technology was due to the efforts of rural institutions, particularly agricultural research stations, farmers' associations, and rural credit and extension services. In the mid-1920s experimental stations developed improved seeds and modern inputs as part of a labor-intensive package and made them available to farmers. This activity explains the sharp increase in labor productivity, growth, and employment up to the

beginning of World War II. The experimental stations continued to play a significant role in the postwar restructuring.

During the war, agriculture suffered a serious decline. Production decreased by 36 percent from 1937 to 1946 as a result of both typhoon and war damage. Per hectare yields dropped 30 percent as both crop area and cultivated land decreased slightly. And livestock production fell an average of 7.8 percent per year. Nevertheless, because traditional agriculture had already begun using modern inputs, by the end of the war Taiwan was also in a position to have agricultural development take off. That is to say, it had a labor-intensive technology that relied on modern inputs; an improved physical infrastructure, particularly irrigation and drainage facilities and rural roads; and rural institutions that could disseminate knowledge, provide extension and credit services, and create markets for both inputs and outputs.

Despite the transformation of agriculture in the colonial period, Taiwan was still a predominantly agricultural economy at this time. At the end of World War II about two-thirds of its labor force was employed in agriculture, but the sector generated only about 40 percent of NDP. It was not yet possible to convert rapid agricultural growth into nonagricultural growth because agricultural development had been geared to providing a surplus for export to Japan.

#### *Agricultural Development in the Postwar Period*

Taiwan's economy was in disarray when it was returned to the Republic of China in 1945. Agricultural production in that year was less than half the prewar peak, and industrial output less than one-third. The situation continued to deteriorate in the immediate postwar years, which were marked by high inflation, grave shortages of food and other necessities, a heavy defense burden, and a large influx of people from the mainland as a result of the social and political instability there. The government therefore gave the highest priority to economic stabilization, food production, and the repair of war damage. To alleviate the intense population pressure on limited land, it decided to grant incentives to farmers. The most effective incentive was the land reform program implemented between 1949 and 1953, which helped improve both agricultural production and farmers' income. In addition, war-damaged irrigation and drainage facilities were repaired, supplies of fertilizers and other farm inputs made available, and farmers' organization strengthened.

**GROWTH OF AGRICULTURAL PRODUCTION.** During the runaway inflation in the immediate postwar years, food prices in relation to general prices rose quickly. With high farm prices and a steady supply of inputs, agricultural production increased 19.2 percent annually between 1946 and 1950, and by 1951 output surpassed the prewar peak (table 2.1).

Three groups of factors contributed to the rapid agricultural recovery and rehabilitation during the 1946–50 period: (1) a rapid increase in labor input,

TABLE 2.1 Agricultural production, 1946-1988 (index, 1986 = 100)

Year/Period	Total	Crops	Livestock	Fisheries	Forestry
1946	10.9 (100.0)	24.1 (—)	3.6 (—)	4.1 (—)	15.7 (—)
1950	22.0 (100.0)	49.4 (63.8)	6.8 (19.1)	6.7 (10.6)	66.5 (6.5)
1953	28.9 (100.0)	59.4 (71.9)	11.5 (15.7)	10.4 ( 7.4)	74.6 (5.1)
1955	29.7 (100.0)	57.2 (66.2)	12.4 (15.7)	14.2 ( 9.4)	78.8 (4.8)
1960	37.1 (100.0)	68.9 (64.1)	15.9 (20.9)	19.3 ( 9.6)	128.1 (5.5)
1965	48.7 (100.0)	88.5 (64.7)	21.6 (21.2)	26.3 ( 8.7)	192.9 (5.5)
1970	61.5 (100.0)	98.8 (57.2)	34.1 (24.1)	45.2 (13.5)	187.4 (5.2)
1975	69.5 (100.0)	103.7 (57.9)	39.4 (25.0)	61.5 (14.2)	145.9 (3.0)
1980	90.4 (100.0)	108.9 (47.2)	70.6 (29.0)	84.5 (21.6)	103.2 (2.3)
1985	100.3 (100.0)	105.5 (47.0)	96.8 (27.3)	94.3 (24.8)	90.3 (1.0)
1988	109.6 (100.0)	105.6 (43.1)	110.0 (27.7)	118.2 (28.1)	60.1 (1.1)
Growth rate (percent)					
1946-50	19.2	19.7	17.2	13.1	43.5
1950-55	6.2	3.0	12.8	16.2	3.5
1955-60	4.5	3.8	5.1	6.9	10.2
1960-65	5.6	5.1	6.3	6.4	8.5
1965-70	4.8	2.2	9.7	11.4	-0.9
1970-75	2.5	1.0	2.9	6.4	-4.9
1975-80	5.4	1.0	12.4	6.6	-6.7
1980-85	2.1	-0.6	6.5	2.2	-2.6
1985-88	3.0	0.0	4.3	7.8	-12.7
1950-70	5.3	3.5	8.4	10.0	5.3
1970-88	3.3	0.4	6.7	5.5	-6.1
1950-88	4.3	2.0	7.6	7.8	-0.3

SOURCE: Taiwan (1989a).

NOTE: Figures in parentheses are percentage shares.

crop area, and multiple-crop diversification; (2) the introduction of better production techniques, rehabilitation of irrigation facilities, and reorganization of farmers' associations; and (3) the implementation of a land-rent reduction program in 1949 that induced tenant farmers to increase production. With the increase in crop area—from 832,000 hectares in 1946 to 874,000 in 1951 for cultivated land, and from 975,000 to 1.5 million for total crop area—the multiple cropping index rose from 117 to 172 over this period.

Total agricultural production grew 4.3 percent annually from 1950 to 1988, but the rate of increase declined sharply. In the 1980s crop production fluctuated with no growth, mainly because of the declining returns on crops and the government program to reduce the rice production in the wake of a drastic decline in consumption per capita.

A comparison of the production data for 1970 to 1988 clearly indicates that all major crops were being produced in smaller amounts except sugarcane, corn, and citrus. The liberalization of corn and soybean imports and depressed

international price for most agricultural products, particularly sugar, had put great pressure on domestic farmers, even for corn and sugarcane growers.

Forestry production has shown a similar trend since 1970, when national forestry policy changed its emphasis from cutting timber to preservation. Live-stock and fishery made up the loss from crops in total agricultural production. Stimulated by a rising demand in domestic and foreign markets, products in these sectors grew 7.6 and 7.8 percent per year from 1950 to 1988, respectively (table 2.1). On one hand, the increased use of feedgrains on large farms improved the efficiency and profitability of Taiwan's hog industry, and on the other, deep-sea fishing along with fish culture expanded fishery production. Nevertheless, both industries began having a difficult time in the 1980s because of environmental concerns, rising labor costs, and worldwide restrictions on fishing in coastal waters.

**TRENDS IN AGRICULTURAL INPUTS AND PRODUCTIVITY.** The cultivated area remained fairly constant during 1952–82. The number of agricultural workers and man-days of agricultural labor rose until about 1965 and then started falling. The number of draft cattle reached a peak in 1958 but fell substantially thereafter. The consumption of chemical fertilizer rose steadily (table 2.2). The decline in inputs of the late 1960s was a reflection of the increasing use of mechanical energy in place of human and animal energy.

From 1952 to 1960 capital productivity increased only 13 percent; it more than doubled during 1960–70 and then declined by 27 percent during 1970–80 (Chen and Wang 1980; Chen 1986). Land and labor productivity continued to rise rapidly in the early stage of agricultural development in Taiwan, when land resources were limited and farm labor was abundant, since the increase in capital investment could raise both land and labor productivity, particularly the former. In 1960–70 and thereafter, the rapidly growing industrial sector absorbed a great deal of farm labor, which helped improve labor productivity further. Consequently, the annual growth of labor productivity (5.7 percent) exceeded that of land productivity (4.9 percent). In the same period, capital productivity grew only slightly and from 1970 to 1982 exhibited negative growth because capital investment was constrained by the limited land area and farm labor.

In summary, the remarkable gains in Taiwan's agricultural output in the postwar period was attained through a rapid increase in capital investment and a reduction in surplus labor. As a result, the capital-land and capital-labor ratios rose significantly, making it possible to increase land and labor productivity.

### *Demand Shifts*

In the 1950s agricultural products accounted for about 90 percent of the island's total exports. Although agricultural exports continued to increase after 1965, their share of total exports decreased once the industrial sector began growing.

**TABLE 2.2** Agricultural inputs, 1952–1982

Year/Period	Cultivated Area (thousands of hectares)	Crop Area (thousands of hectares)	Multiple Cropping Index	Agricultural Workers <sup>a</sup> (thousands)	Total Man-Days (thousands)	Draft Cattle (thousands)	Chemical Fertilizer in NPK (thousands of metric tons)
1952	876	1,521	173.6	1,535	263	382	104
1955	873	1,508	172.7	1,556	266	410	130
1960	869	1,600	184.1	1,621	290	417	149
1965	890	1,680	188.8	1,622	300	370	198
1970	905	1,656	183.0	1,559	289	275	244
1975	917	1,659	180.9	1,493	261	196	371
1980	907	1,400	154.4	1,152	210	84	435
1982	891	1,380	154.9	1,149	197	n.a.	347
Growth (percent)							
Annual	0.1	-0.3		-1.0	-1.0		4.1
Total growth	1.7	-9.3		-25.1	-25.1		233.7
1952–55	-0.1	-0.3		0.5	0.1		7.7
1955–60	-0.1	1.2		0.8	2.1		2.8
1960–65	0.5	1.0		0.0	2.2		5.9
1965–70	0.3	-0.3		-0.8	0.3		4.3
1970–75	0.3	0.0		-0.9	2.0		8.7
1975–82	-0.4	-2.6		-3.7	-3.9		-1.0

SOURCE: Chen (1986).

n.a. Not applicable.

<sup>a</sup>Workers in crop and livestock farming only.

CHANGES IN AGRICULTURAL TRADE. From 1952 to 1965 agricultural imports amounted to about one-third of total imports. The most serious constraint on economic development in this period was the amount of available foreign exchange. The agricultural share of total imports subsequently declined and by 1988 accounted for only 12 percent of total imports.

The composition of Taiwan's agricultural exports has changed considerably since 1952. In that year sugar and rice accounted for 81 percent of total agricultural exports. By 1988 the leading agricultural exports were fishery products, hogs and pork, preserved vegetables, poultry feathers, preserved fruits, bamboo products, timber, fresh vegetables, and bananas. Fishery products alone accounted for 40 percent of agricultural exports. Over the years, several nontraditional agricultural exports were developed and are now performing well. These include asparagus and mushrooms, introduced to Taiwan in the early 1960s, and the aquaculture of eel and shrimp, introduced in the 1970s. In addition, there has been a steady flow of new technologies and vigorous promotion of foreign market opportunities. This diversification has been due largely to adaptations by a well-educated, highly motivated farm population to changing demand patterns and cost relationships.

The years from 1952 to 1988 also saw a greater than seventyfold increase in agricultural imports. Up to 1960 the main agricultural imports were soybeans, wheat, and cotton, but by 1970 lumber, corn, wool, dairy products, tobacco, and barley had become important. After 1970 imports of corn and fish meal increased rapidly in response to the growth in the livestock and aquaculture industries. The remarkable increase in the import of dairy products and beef can be attributed to the improved standard of living in Taiwan.

Japan was by far the most important export market for Taiwan's agricultural products in 1988, accounting for about 64 percent, far exceeding the United States and the European Common Market. The United States was the main supplier of agricultural imports. It provided about half, while Malaysia came in second with 22 percent.

CHANGES IN FOOD CONSUMPTION PATTERN. Since the early 1950s the population of Taiwan has increased at an annual rate of 2.5 percent and agricultural production at a rate of 4.3 percent. Daily per capita calorie intake has risen from 2,078 to 3,017 and protein intake from 49 to 90 grams. By all accounts, agriculture in Taiwan has been able to provide adequate food at reasonable prices to meet the rising per capita demand. That demand has shown some interesting trends.

Since 1970, there has been a significant decrease in the per capita consumption of sweet potatoes and rice, and a remarkable increase in the consumption of meat, sugar, vegetables, fruits, and milk (table 2.3). This change was mainly due to increased per capita income. The increase in meat consumption provided a market for the local livestock industry and pushed up the demand for imports of feedstuff. In turn, the higher production of vegetables and fruits to

**TABLE 2.3** Per capita annual food consumption, selected years (kilograms)

Food	1952	1960	1970	1980	1988
Cereals					
Total	138.1	159.7	164.1	138.8	110.6
Polished rice	126.1	137.7	134.5	105.5	73.6
Wheat flour	11.3	20.0	25.4	23.6	32.1
Sweet potatoes	59.9	65.4	18.4	4.1	0.9
Sugar	9.4	9.4	15.0	24.0	25.2
Pulses, nuts, and seeds	9.9	11.4	18.3	18.8	23.1
Vegetables	61.7	61.1	84.8	129.6	122.1
Fruits	16.8	22.1	45.8	70.2	104.3
Meat	16.8	16.2	25.3	39.6	57.8
Eggs	1.6	1.6	4.1	8.0	10.9
Fish	15.1	21.7	34.2	38.7	45.8
Milk	1.2	3.2	11.0	27.6	41.1
Oil and fats	3.5	4.7	7.7	10.8	18.9

SOURCE: Taiwan (1989b).

meet the growing consumer demand greatly increased the intensity of agricultural production and farmers' income.

Significant changes in the level and pattern of food consumption and the slower growth in agricultural production have made Taiwan less self-sufficient in food in recent years. Before 1968 domestic food production was about equal to domestic requirements. But the food self-sufficiency rate dropped to 93 in 1988, as is evident from Taiwan's dependence on imports to satisfy the domestic demand for wheat, corn, soybeans, other feedgrains, and dairy products.

#### *Institutional Framework for Agricultural Development*

Many institutions, both public and private, contributed to the successful development of agriculture in Taiwan (Mao 1984, 1985). The government played a particularly important role because it got development going. Among the more influential institutions was the Sino-American Joint Commission on Rural Reconstruction (JCRR), established in Nanking in 1948, which served as a nonpermanent agency for the postwar rural reconstruction of China. With the transfer of the JCRR to Taiwan after the fall of the mainland to the Communists in 1949 and the reactivation of U.S. economic aid in 1951, the JCRR became the agricultural arm of the U.S. Mission to Taiwan. From 1951 to 1965 the United States provided a total of \$1.465 billion in aid. Approximately one-third went to agriculture and was used to build infrastructure and foster agriculture and human resources. Industrial development was left by and large to private enterprise. The main source of funds was the local counterpart funds generated through aid-financed imports. Many financial experts consider Taiwan an out-

standing example of the efficient use of U.S. aid for economic development (Jacoby 1966).

From the beginning, the JCRR was allowed to work with any level of government to carry out its projects. Thus bureaucratic red tape was reduced to a minimum and assistance extended directly to end users. This system made it possible for government agencies to be of real service to the people. The JCRR's role in agricultural development was that of a catalytic agent. By providing technical and some financial assistance, it was able to give direction to agricultural policies, promote new technologies and complex projects, and, most important, generate a spirit of self-help among local agencies. It supported the upgrading of agriculture in Taiwan; supplied conceptual leadership in identifying problem areas and in planning remedial measures; provided support for facilities, equipment and personnel; furnished support and coordination for nationwide research projects; and also coordinated research, education, and extension activities.

The JCRR was the only agency that attempted to combine the planning and implementation of research, extension, and irrigation through the revitalization and strengthening of farmers' associations. It is no exaggeration to say that the JCRR was promoting "integrated rural development" long before the concept was discussed in the literature and espoused by such development agencies as the World Bank (Thorbecke 1979). From the outset, planners and actors interacted in identifying general objectives, specific targets, and the best means of achieving them at the local level without the interference of a cumbersome central bureaucracy. With local farmers involved in planning and implementation, objectives could more easily be translated into specific local actions.

Taiwan's agricultural planning targets were more than mere projections. Annual production goals in each four-year plan were adjusted annually to meet the changing market conditions. Regional goals were also established by provincial and county agricultural production conferences held at the beginning of each year. Consultations between the provincial and county levels enabled farm leaders as well as officials at all levels to participate in the development process. At such meetings, farmers' representatives could express opinions and make suggestions regarding the annual plans and regional goals and indicate the support they needed from the government.

**LAND REFORM PROGRAM.** In the immediate postwar years, the farm population in Taiwan was more than half of the total, but many farmers did not own their own land. Tenant farmers paid high rents—at least 50 percent of the crop harvest—and social unrest was widespread in the rural areas. Consequently, it was difficult to motivate farmers to improve their farming techniques. The land reform program initiated in 1949 and completed in 1953 was the first measure taken by the government to remedy this situation and promote rural development.

This program was geared toward reducing rents, selling public lands, and

giving land to the tiller. The program was carried out gradually and focused first on rent reduction. The farm rental rate was set at 37.5 percent of the annual yield of the main crop, and the lease was to cover a period of six years, but could be extended after it expired. The next step was to sell off a large area of public lands. The government thought it was unfair to ask landlords to sell their holdings to tenants while the government itself held large estates. To set an example, the government sold public lands to the incumbent cultivators. The price was fixed at 2.5 times the annual yield of the main crop, to be paid in 20 semiannual installments.

In the third, land-to-tiller phase of the program, each landlord was allowed to keep three chia (about 2.91 hectares) of medium-grade paddy field or six chia of dry land. Holdings in excess of these amounts were purchased by the government and resold to incumbent tenant farmers. Again, the price was set at 2.5 times the annual yield of the main crop. The landlord was paid 70 percent of the land price with land bonds and the rest with shares of government-owned industries. This arrangement forced some landlords to shift their investment from land to industry.

Nevertheless, farmers benefited greatly under the program. Families owning all or part of the land they farmed increased from 61 percent to 88 percent of the total, and farmers were motivated to work longer and harder and to adopt various agricultural improvements. As a result, the index of multiple cropping shot up from 170 in 1953 to 190 in 1964. Farmers became better fed and clothed, and many started to repair their houses or build new ones. The income redistribution resulting from the land reform brought social justice to the rural areas. Equally important, farmers began to participate in community activities, and many ran for public office at the local level.

**AGRICULTURAL ADAPTIVE RESEARCH.** From the outset, the authorities recognized that Taiwan would not be able to increase agricultural production without using new technologies and modern farm inputs, whether introduced from abroad or developed locally (see Schultz 1964). Thus they hastened to establish a number of agricultural research institutes in Taiwan. At the national level is the Botanical Institute of the Academia Sinica, which concentrates on basic scientific research. At the provincial level is the Provincial Agricultural Research Institute, which also engages in basic research, and six district agricultural improvement stations, which carry out regional adaptive experiments. In addition, Taiwan has various research institutes specializing in tobacco, sugar, tea, forestry, fisheries, livestock, sericulture, bananas, and food processing. As a result of the efforts of these institutes, Taiwan has successfully produced hybrid hogs, reduced the incidence of livestock disease, and developed many high-yielding varieties of rice, sugarcane, corn, and sweet potatoes. The successful breeding of fast-maturing varieties crops contributed to Taiwan's multiple-cropping system and gained worldwide attention in the early stages of its development. To facilitate the spread of these new technologies,

experimental results are made known to farmers through demonstrations conducted by the district agricultural improvement stations and by the extension network of farmers' associations.

**FARMERS' ORGANIZATIONS.** Taiwan relied not only on technological progress to solve its rural problems but also on rural organizations. These were carefully designed to implement rural development policies and had the support of political and administrative leaders. Four main types of rural organizations were established: farmers' associations, irrigation associations, fishermen's associations, and agricultural cooperatives (primarily fruit-marketing cooperatives).

*Farmers' associations.* The most important organization in rural Taiwan is the farmers' association, which is a multipurpose cooperative. Its primary goal is to help members solve their farming, financial, and marketing problems. It also serves as a bridge between farmers and the government. At present, Taiwan has 291 farmers' associations at three levels: provincial (1), city (20), and township (270). Their total membership in 1988 was 1,094,000. Of this number 80 percent were regular members and 20 percent associates. The former are bona fide farmers with the right to elect and to be elected to any office of the association, and the latter are residents in rural areas who are not engaged in full-time farming. Associates have no right to vote but can be elected to the post of supervisor.

*Irrigation associations.* Paddy rice is the most important food crop in Taiwan and a reliable water supply is essential to its production. The irrigation association was formed to operate irrigation facilities, maintain orderly water distribution, and assist the government in planning and implementing new irrigation projects. There are now 16 irrigation associations in Taiwan.

*Fishermen's associations.* The fishermen's association is a cooperative patterned on the farmers' association. There are 37 district and 1 provincial fishermen's associations in Taiwan with a total membership of 185,000. Revenue comes from membership fees, service charges, contributions, and government subsidies for the improvement of fishing techniques, storage and marketing, and social welfare.

*Fruit-marketing cooperatives.* The principal activity of fruit-marketing cooperatives is the export of bananas, the most important fruit crop in the south, and oranges, the main crop in the north. Only growers of these fruits are eligible for membership. The cooperatives also supply production inputs, credit, and technical services.

**METHODS OF DELIVERING SUPPORT SERVICES.** New techniques developed through agricultural research are disseminated to farmers primarily by extension agents affiliated with farmers' associations. Each association has an average of six agents. These are experienced people who have been working closely with the district agricultural improvement stations since 1952. They transmit

information to farmers through study groups, audiovisual aids, reference materials, training courses, demonstrations, and farm and home visits.

Farmer credit is another important support service. Before the land reform program, landlords were the main source of high-cost, short-term loans in rural areas. Afterward, the landlords withdrew from the rural financial markets, and the farmers' associations began providing loans for production and marketing, using the deposits of members as the main source of loanable funds. The rest comes from the government and banks. Most of the loans do not require collateral but must have two or more guarantors. The ceiling rates for lending are based on central bank interest rates. The Taiwan Cooperative Bank, Land Bank of Taiwan, and Farmers' Bank of China and their branches also provide loans for rural areas. But farmers usually feel more at ease in dealing with their associations than with banks. As a result, some bank loans are channeled through the associations.

**RURAL INFRASTRUCTURE INVESTMENT.** The investment in rural infrastructure has focused on irrigation and rural roads. Irrigation has received considerable attention because an abundant water supply is indispensable for the production of paddy rice, particularly the high-yielding varieties. In Taiwan, the yield of the year's first rice crop is always higher than the second, because the first is for the most part irrigated while the second depends more on rainfall.<sup>2</sup> More than 60 percent of Taiwan's farm land is irrigated by means of 1,200 structures for transporting river water and by 30,000 kilometers of canals, laterals, and ditches. These various facilities are managed by irrigation associations, and the projects financed with government subsidies, long-term and low-interest loans, and the assessments collected from farmers.

Rural development has also depended on roads to connect farms to major highways and railway stations for the transport of farm products and inputs. The construction of farm roads is coordinated with irrigation and land consolidation programs. Except in mountain areas, it is rare to see a village without paved roads.

### *Macroeconomic Policies*

Two aspects of Taiwan's macroeconomic policy in the postwar years had a profound effect on agriculture: the move to stabilize prices and the taxation of farmers.

**PRICE STABILIZATION.** Prices in Taiwan rose about fivefold from 1946 to 1948 and then jumped about thirtyfold in early 1949. At the same time, two million soldiers and civilians were added to the population, and there was a continuing threat of a communist invasion. The urgent need for price stabiliza-

2. A regression analysis indicates a high relationship between average rice yield and area irrigated during 1922-38 and 1950-60. The correlation is similar to that of Thailand and the Philippines.

tion led to the new Taiwan dollar reform in mid-1949. The old currency was devalued by a factor of 40,000, and a highly conservative full-reserve system was established.

To further fight inflation the government introduced a high-interest policy for preferential interest savings deposits. At the beginning, the interest rate was set at 7 percent per month, which was equivalent to 125 percent per year. This rate was lowered later when prices came down. In the next nine years this policy absorbed an enormous amount of idle capital and thus contributed greatly to price stabilization. The policy also helped promote savings and investment.

In addition, the government made determined efforts to curtail public expenditures and increase tax revenue. The timely arrival of U.S. economic aid in 1951 greatly facilitated postwar rehabilitation and fiscal management. Aid-financed imports in the 15 years before 1965 accounted for about 30 percent of total imports. Equally important, the local currency generated by the sale of U.S. aid-financed commodity imports reduced inflationary pressures and helped offset government budget deficits before the budget was balanced in the early 1960s.

Substantial imports of U.S. aid-financed commodities and increases in domestic production, especially of food, helped relieve the pressure on demand. Rice was frequently used as a wage good to hedge against inflation. Financial transactions were made in terms of, or in relation to, rice. Under such circumstances, fluctuations in the price of rice could have had an adverse effect on the prices of other commodities and services. For example, it was argued that a rise in rice prices would increase labor costs and thereby raise the cost of production, which would in turn weaken the international competitiveness of many industries. To maintain stable rice prices, the government collected and stocked large amounts of rice and continued to do so right up to 1973. Collections were made through paddy land taxes in kind, compulsory purchases of paddy from landowners, rent on government-owned farmland, proceeds in kind from the sale of public farmland, the barter of fertilizers for rice, sales proceeds collected from former tenants who received land under the land reform program, and the repayment of rice production loans provided by the government. These policies were implemented under the slogan of "more food for the people and the military" and thus met with little challenge (Chen, Hsu, and Mao 1975).

The government's regulation of rice marketing has kept rice prices in Taiwan very stable, except for brief surges in 1953, 1960, and 1974, when supplies dwindled because of bad weather. In addition, the price spread between producers' prices and consumers' prices has been narrow. Seasonal rice price variations in normal years were also small.

Under Taiwan's stabilization and fiscal policies, inflation dropped from an average of 8.8 percent in the period 1952-60 to only 3 percent in 1961. This

success in fighting inflation during most of the 1950s was the foundation for the development of a labor-intensive industry and for the sustained and rapid growth in the years that followed.

**TAXATION OF FARMERS.** Two important taxes imposed on Taiwan's farmers are the farm land tax and the hidden rice tax carried out through compulsory purchases and the rice-fertilizer barter system. The land-tax unit (Y) is determined on the basis of the productivity of the land and ranges from Y1.2 to Y49.0 for each of the 26 grades produced. Land-tax collections were adjusted seven times between 1946 and 1947, and in this period the amount of paddy collected per tax unit increased from 8.85 kilograms to 22 kilograms.

The compulsory purchase of paddy from landowners at official prices is another source of government-provided rice. Any parcel of paddy land was subject to the paddy land tax plus compulsory purchase of rice. Collections made on top of the paddy land tax were calculated on the basis of the tax unit, which, as just mentioned, depends on the productivity of the land. In 1974 the amount to be purchased was increased from 12 to 35 kilograms per unit to offset the decrease in government-collected rice after the bartering of fertilizer for rice was discontinued. The government typically paid only 70–80 percent of the prevailing market price for compulsory purchases. The difference between the official and market prices thus constituted an additional, but hidden, tax on the paddy landowners. The difference, however, was abolished in 1973 in order to increase farm incomes.

The bartering of fertilizer for rice began in 1948. About 40 percent of the fertilizer was obtained through spot barter, while the remaining 60 percent was loaned to the rice growers, to be repaid in rice after harvest. On the whole, farmers found the exchange unfavorable. In 1950, for instance, the amount of rice required for 1 kilogram of ammonium sulphate was 1.2 kilograms for the first crop of 1950, but by 1972 it had fallen to 0.53 kilogram. This policy never won the full support of rice growers, yet rice collected by the government through this system constituted the bulk of government-controlled rice until the system was abolished in 1973.

Under the land reform program, payment for the land was made in paddy if the land produced paddy. Rice collected under the land-to-the-tiller program amounted to 50,000 metric tons in the peak year of 1959 but has decreased since then. Rice collected under the public land sale and leasing program amounted to 38,000 metric tons in the peak years of 1964 and 1965. In addition, the government provided rice production loans to needy rice growers in order to encourage rice production. Rice farmers were overcharged under the rice production loan program, and it has never been popular with them.

The government's rice collection by all of these methods averaged 50 to 60 percent of the total amount of rice marketed off the farm during 1950–70. By 1973, however, this share had declined to 20 percent. In subsequent years it increased again because of the guaranteed rice price policy. The total hidden

rice tax was greater than Taiwan's total income tax in the entire period before 1963 and was more than twice the farm land tax every year before 1961, except in 1954. After 1969, the hidden rice tax decreased rapidly. The ratio of the hidden rice tax to the total income tax dropped to only 8.5 percent in 1971 (Kuo 1975).

### **Industrialization and Export-led Growth, 1952–1988**

In the 1950s and 1960s Taiwan's industrial sector performed better than the agricultural sector. In 1968 it generated more gross domestic product (GDP) than the agricultural sector for the first time and has continued to do so ever since.

#### *Industrial Development: Growth and Structural Change*

Taiwan's modern economic development began in 1953. By then, economic output had recovered to prewar levels in most sectors, and the government was about to implement its first four-year economic development plan. Over the next two decades, Taiwan changed from an agricultural to an industrial-based economy. Between 1952 and 1972 agriculture's share of NDP dropped from 36 to 14 percent, while manufacturing's share increased from 11 percent to 32 percent (table 2.4). The labor force in the agricultural sector fell to only 33 percent in 1972, while that in manufacturing rose to 25 percent. This decline in agriculture continued through the 1970s and 1980s, but the transformation of Taiwan's economy from an agrarian to an industrialized one was essentially complete by the early 1970s.

The traditional economic structure and trading patterns of the colonial era had already begun shifting during the postwar reconstruction, when Taiwan came under the Chinese Nationalist government and its trading relations with Japan were interrupted. Up to then, Taiwan's economy had been based largely on exporting agricultural products to Japan, in exchange for manufactured goods. This pattern altered somewhat in the 1930s when Japanese manufacturers set up factories in Taiwan, mainly in food processing, cement, paper, and some chemical fertilizers. Industrialization proceeded slowly, however, and by 1950 manufacturing still accounted for less than 8 percent of total employment; moreover, the majority of industry's technical and managerial staff were Japanese (Chang 1980, table 5).

After 1945, mainland China provided a market for Taiwan's exports and became a source of manufactures, but this pattern was disrupted after the Communist takeover of the mainland in 1949. After the end of World War II, the production of nondurable consumer goods, processed food, and textiles all increased rather quickly, as did bricks, paper, and cement. In the early 1950s food processing was the fastest-growing industry: it accounted for about 40 percent of the increase in manufacturing and nearly a fourth of total manufactur-

TABLE 2.4 Net domestic product and employment by kind of activity, 1952-1988 (percent)

Year	Total	Industries					Services				
		Agriculture	Subtotal	Manufacturing	Construction	Electricity, Gas, and Water	Subtotal	Commerce	Transport, Storage, and Communication	Government	Finance, Insurance, and Business
Net domestic product											
1952	100.0	36.0	18.0	10.8	4.4	0.6	46.0	18.7	3.9	10.9	9.0
1956	100.0	31.9	22.4	14.5	4.9	0.8	46.0	17.0	4.0	12.7	9.8
1960	100.0	32.9	24.9	16.8	4.5	1.3	42.2	14.3	4.1	12.6	9.0
1964	100.0	28.3	28.9	20.9	4.4	1.8	42.8	15.1	4.4	12.4	9.1
1968	100.0	22.1	32.6	24.0	5.1	1.7	45.4	15.1	5.7	13.5	9.4
1972	100.0	14.2	40.3	32.3	4.6	2.1	45.5	14.9	6.1	12.6	9.6
1980	100.0	9.2	44.7	34.0	7.3	2.3	46.1	14.6	6.2	11.6	11.6
1988	100.0	6.1	46.2	38.1	4.9	2.6	47.7	15.7	5.5	11.3	11.2
Year	Total	Industries					Services				
		Agriculture	Subtotal	Manufacturing	Construction	Utilities	Subtotal	Commerce	Transportation	Other	
Employment											
1952	100.0	56.1	16.9	12.4	2.4	0.2	27.0	10.6	3.4	13.0	
1956	100.0	53.2	18.3	13.2	2.8	0.3	28.5	10.0	4.1	14.4	
1960	100.0	50.2	20.5	14.8	3.1	0.3	29.3	10.0	4.4	14.9	
1964	100.0	49.5	21.3	15.4	3.3	0.4	29.2	9.6	4.6	15.0	
1968	100.0	40.8	25.4	18.6	4.4	0.4	33.8	13.0	4.8	16.0	
1972	100.0	33.0	31.8	24.6	5.6	0.4	35.2	14.0	5.2	16.0	
1980	100.0	19.5	42.4	32.6	8.5	0.4	38.1	16.0	5.9	16.2	
1988	100.0	13.7	42.6	34.5	7.3	0.4	43.7	19.0	5.3	19.4	

**TABLE 2.5** Distribution of industrial production by ownership 1952–1988 (percent)

Year	Total		Mining		Manufacturing		Construction of Building	Electricity, Gas, and Water
	Private	Public	Private	Public	Private	Public	Private	Public
1952	43.4	56.6	71.7	28.3	43.8	56.2	100.0	100.0
1956	49.0	21.0	73.5	26.5	51.7	48.3	100.0	100.0
1960	52.1	47.9	75.8	24.2	56.2	13.8	100.0	100.0
1964	46.3	43.7	79.5	20.5	31.3	28.9	100.0	100.0
1968	68.9	31.1	76.9	23.1	75.3	24.7	100.0	100.0
1972	78.7	21.3	84.2	15.8	86.0	14.0	100.0	100.0
1980	79.1	20.9	52.0	48.0	85.5	14.5	100.0	100.0
1988	81.9	18.0	48.5	51.5	88.9	11.1	100.0	100.0

SOURCE: Taiwan (1989b).

NOTE: Based on value added at 1981 prices.

ing production. The textile industry also demonstrated high growth (16 percent), particularly after the introduction of export promotion measures. Other strong performers were wood and furniture (7 percent), cement and bricks (8 percent), and paper (7 percent). In the late 1960s the product mix of manufactures changed significantly as metals, machine tools, and electronic consumer products began to take advantage of export opportunities and the expanding domestic market. The domestic market accounted for more than 60 percent of growth from 1956 to 1966, when export expansion became increasingly important.

#### *Transition from Inward-looking to Export-oriented Development*

Taiwan's success in industrialization can be attributed in part to its large, fairly well-educated, rural labor force. Rural workers began moving into industry under the impetus of the import-substitution policies of the 1950s and the export-promotion strategy of the 1960s, which enabled Taiwan to make the best use of its comparative advantage through trade. As a result, manufacturing's share of employment increased from one-quarter in the period 1940–66 to one-half in 1966–74.

**IMPORT SUBSTITUTION.** Taiwan sought self-sufficiency through import-substitution strategies for a number of reasons: the loss of its traditional trading partners in the late 1940s, its unfamiliarity with other foreign markets, a shortage of foreign exchange, and the government's desire to strengthen Taiwan's economy so it could be a base for the recovery of the mainland. To this end, the government decided to develop three important industries: electric power, fertilizer, and textiles. The first two were vital to the continued expansion of industry and agriculture, while textiles were the largest import item at the time.

Because of the high investment they required, the electric power and fertilizer industries were run by the government, whereas textiles were left to private investors. In large part, transportation and other public infrastructure were also developed by the government.

The measures introduced to encourage the domestic development of import-substitution industries in the early 1950s focused on nondurable consumer goods for which demand in Taiwan was strong, notably textiles, apparel, wheat flour, wood, and leather products. Import-substitution was quickly achieved in industries that used rather simple technology. Textile production, for example, surpassed its prewar peak of 2.5 million meters and by 1953 was effectively satisfying domestic demand. Although the growth in exports caused a rapid expansion of output from the mid-1950s on, import substitution did less well in this respect. The main reason was that imports shifted to capital goods in the 1950s and the growth of the export industries in the 1960s offset the effect of import substitution, (see Schive 1987; Schive and Majumdar 1990).

EXPORT ORIENTATION. It did not take long for Taiwan's import-substitution policies to saturate the small domestic market with consumer products. Production exceeded capacity in the other industries as well, both because of the lack of demand and a multiple foreign exchange rate, which created a barrier to export. Furthermore, policy reforms implemented by the government gave industries more incentive to produce exports of light industry products. Virtually all manufacturing industries increased their exports after these reforms. Textiles, wood and wood products, and nonmetallic mineral products were especially successful. Foreign firms, attracted by the improved environment of the mid-1960s, invested in electronics, mainly for export. This prompted investment by local entrepreneurs, which precipitated a change in the structure of Taiwan's manufacturing sector, as explained in the next section.

### *The Engine of Growth: Trade Development*

Taiwan's dependence on trade has fluctuated somewhat over the past fifty years, although trade was already an important component of the economy in the colonial period (Lee 1971a).

GROWTH INDICATORS AND PATTERNS OF TRADE. Between 1951 and 1953 Taiwan concentrated on its import-substitution policy, with the result that trade declined to 23 percent of GNP. It rose modestly to 30 percent in 1960, but then doubled during the next 10 years and surpassed 100 percent by 1980. The composition of trade also changed significantly. In 1956, 82 percent of all Taiwan's exports were primary products or processed foods, and only 17 percent consisted of industrial products. After the export-orientation policies were implemented in the late 1950s and early 1960s, agriculture's share of exports fell to 67 percent and that of industrial products rose to 32 percent. As traditional agricultural exports declined, new export-oriented agricultural products, such as canned mushrooms and asparagus, took their place. At the same time,

the share of manufactures continued to increase, reaching 68 percent in 1968 and 83 percent in 1972. Whereas textiles had been the leading exports in the 1960s, electrical equipment and electronics gained in importance in the 1970s. These changes reflected a fundamental change in the structure of Taiwan's economy.

The composition of imports also changed significantly. In 1952 two-thirds of all imports were agricultural and industrial raw materials, such as raw cotton. Under the import-substitution policies, the share of consumer goods in total imports dropped from 20 percent in 1952 to 7 percent in 1956. In addition, the demand for capital goods was still low since rapid industrialization was still some years away (Ho 1978, 133) and the savings rate was low and foreign exchange limited at this time. By the mid-1960s, however, these restraints were largely gone, and in 1968 imports of capital goods increased to a third of the total.

Exports have made vital contributions to Taiwan's development in different periods. During the 1950s and early 1960s, agricultural exports, primarily rice and sugar, provided the foreign exchange for at least half of Taiwan's imports. The remainder was financed primarily by U.S. aid. These imports consisted largely of raw materials and capital goods necessary for development. The export-oriented policies that followed greatly boosted economic growth: in the early 1970s export expansion accounted for nearly two-thirds of all economic growth.

**COMPARATIVE ADVANTAGE.** These trade promotion policies greatly benefited Taiwan's industries because they emphasized its comparative advantage in labor-intensive products, which quickly became competitive in international markets. These included radios, bicycles, sewing machines, and machine tools. Taiwan's experience demonstrates that foreign firms tend to use a much more labor-intensive technology in producing for export than for the domestic market. This was the case for all industries in Taiwan except textiles, for which a few large industries exporting artificial fiber dominated the result. Thus market orientation appears to be a crucial factor in determining the "appropriate" technology used by foreign firms (Liang and Liang 1988; Schive 1990b).

Taiwan's strategy was to increase exports of inexpensive manufactured products to developed countries in the West where labor costs were rising and to also export both capital- and skill-intensive goods to less-developed countries with few technical skills. In this way, Taiwan made full use of its comparative advantages in different export markets (Lin 1973). However, the exports of labor-intensive products were far more important to Taiwan's economy.

Export-led development eventually exhausted Taiwan's surplus agricultural labor. The wage rate of workers had been fairly stable in the 1960s, although there was a slight rise in industrial wages in response to the boost in agricultural real wages related to rising agricultural productivity (Ranis 1979, 255). By the late 1960s wages had begun to rise more steeply, and agricultural labor to decline in absolute terms. Higher wages for unskilled labor gradually

led to a more capital- and skill-intensive industrial output in the 1970s. This phenomenon, known as secondary import substitution, is a further indication that the economy is responding to continuing changes in factor endowments and demand patterns (Schive 1987, 1990c).

### *Organization of Taiwan's Manufacturing Sector*

In the early 1950s most of Taiwan's larger firms were under government control. Many of them were former Japanese enterprises.<sup>3</sup>

**EXPANSION OF THE PRIVATE SECTOR.** Private ownership gradually expanded, however. In 1952 public industries produced 57 percent of total manufacturing output. The government's basic policy toward the ownership of industry was to retain direct control of utilities; natural monopoly industries that were considered vital to the country's defense (such as the railroad and highway buses); and industries held for revenue purposes, such as the Monopoly Bureau of Wine and Tobacco. Others were left in private hands. This policy reflected in part the government's lack of capital to finance large-scale investment, and in part the support of some government officials and the U.S. economic advisory group for the development of the private sector (Commonwealth 1984, 26). As a result, the private sector gained strength in the 1950s and thus was in a position to expand at full steam in the 1960s, when the export market boomed.

The total share of the public sector in manufacturing was at its peak in 1952 but two decades later was down to 14 percent (table 2.5). Some industries, such as electrical products and wood and wood products, were dominated by the private sector from the very beginning. The government saw its share in food processing decline, but retained tight control over much of the sugar sector. Government ownership in petroleum and coal products remained high throughout the period.

**GROWTH OF SMALL AND MEDIUM ENTERPRISES.** Small and medium enterprises (SMEs) played an important role in Taiwan's economic development. In 1961 nearly all manufacturing firms were SMEs (defined as having fewer than 100 employees) and their average size was 8 persons. They contributed 61 percent of total manufacturing employment. By 1971 their average size had increased to 28, but it has gone down slightly since the mid-1970s. However, the percentage share of SMEs in total manufacturing firms has increased. As table 2.6 shows, the contribution of SMEs to manufacturing employment has dropped well below the 1961 peak, but the value has risen.<sup>4</sup>

3. In 1932, up to 90 percent of Taiwan's industrial capital was in the hands of Japanese enterprises. Capital participation by local business was allowed only in mining, tea-making, and sugar industries (Chang 1980).

4. According to Bruch and Hiemenz (1984, table 2.1), 1971 SME data for country comparisons did not indicate an unusually large share for Taiwan's SMEs. If data from a much later period had been used, the concentration of SMEs in Taiwan's manufacturing sector would have been similar to that of Japan and Norway.

**TABLE 2.6** Share of small and medium enterprises in the manufacturing sector, 1954–1986

Year	Average Size of Firms (number of persons)	Share of SMEs (1–99 employment)		
		Total Number of Firms (percent)	Employment (percent)	Value Added (percent)
1954	—	99.4	—	—
1961	8.4	99.1	61.0	—
1966	21.3	97.2	42.7	—
1971	28.2	95.4	35.6	21.6
1976	27.4	95.3	38.6	28.2
1981	24.3	95.9	41.3	31.8
1986	24.2	96.0	47.9	39.9

SOURCE: *Census Report of Taiwan District, Republic of China*, Directorate General of Budget, Accounting and Statistics, Executive Yuan, various years.

NOTE: Value-added figures for 1986 are based on gross value added.

Structural changes have occurred in both SMEs and large firms. For instance, in the 1960s employment in the largest firms (those employing more than 500 persons) grew fastest. Larger SME firms (employing 50 to 99 persons) also increased their share. The rapidly growing shares of large firms coincided with the export market boom and the inflow of the export-oriented direct foreign investment. No doubt the smallest also grew bigger but were reclassified into larger size groups. When the labor surplus dwindled in the 1970s, employment in the largest firms declined, while the employment shares of the smallest firms and firms employing 100 to 499 persons stabilized. The medium SMEs employing 10 to 99 persons became increasingly competitive in the labor market.

In the early 1950s government leaders preferred to see larger companies developed because they believed smaller ones were unable to take advantage of economies of scale and modern production and management methods (Yin 1954, 1). Consequently, the government granted most of its low-cost loans and other resources to firms attempting to develop fertilizer, cement, and sugar industries, none of which were SMEs. Small companies were tolerated, however, because they provided employment and goods for local people. Although the JCRP provides some financial and technical assistance to rural enterprise, the SMEs rely primarily on the informal money market for finance and make no demands on the government. Some government officials believe that competition would force out the least efficient firms, and that many of the remaining smaller enterprises would combine to form larger conglomerates.

Despite this lack of attention, the SMEs thrived since they were flexible enough to adjust to rapidly changing circumstances. During the 1960s and 1970s, the SMEs benefited from policies that encouraged exports. They were

able to manufacture products that made use of Taiwan's abundant labor supply and of simple technologies that absorbed excess labor. Because of the small size of these firms, other small entrepreneurs could enter the various industries rather easily. As a result, competition remained keen. Some SMEs became subcontractors of large export-oriented foreign firms. The share of SMEs in total production of manufactures grew from 27 percent in 1971 to 48 percent in 1984, and SME exports as a share of their total products also grew, from 55.7 percent in 1972 to 66.7 percent in 1980, 75.9 percent in 1982, and 71.8 percent in 1984 (Chou 1989). SMEs dominated the manufacture of textiles, apparel, leather goods, wood and bamboo products, metal products, machinery equipment, and miscellaneous industrial products for which export demand was strong.

SMEs also contributed to equitable income distribution. Since many such enterprises were outside the main urban areas, they gave rural families an opportunity to supplement their incomes with nonagricultural employment. This was especially the case for lower-income farm families that relied heavily on nonagricultural income. By locating in rural areas, SMEs also helped prevent overurbanization, which has been a problem in many developing countries. Most prevalent among the SMEs were food-processing enterprises and those that produce rubber, leather and fur products, electronics and related equipment, and metal products. As the terms of trade grew increasingly in favor of manufacturing in the late 1960s, the government encouraged the establishment of local handicraft industries and other industries in rural areas. By 1966 the government had invested in 17 rural industrial districts covering an area of almost 1,600 hectares (Ranis 1979, 226). JCRR provided financial and technical support for some projects, especially food processing. The SMEs have certainly had a far-reaching and multifaceted impact on Taiwan's economy.

### *Economic Policies*

Taiwan's policymakers endeavored to strengthen the economy in the post-war years through protectionist measures, export promotion, direct foreign investment, an export processing zone, and improvements to the infrastructure.

**PROTECTION AND EXPORT PROMOTION.** In the late 1940s the government placed restrictions on imports and the use of foreign exchange with a view to improving the balance of payments and promoting import substitution. The package included tariffs, import controls, quotas, and multiple exchange rates. These policies stimulated domestic production, although efficiency probably suffered. By 1954 domestic industry was supplying about 83 percent of the domestic market for manufactured goods. The share for textiles and apparel was 94 percent, although in some more sophisticated industries (such as machinery and electrical equipment), more than half of the available supply was

still imported (Lin 1973, 66).<sup>5</sup> These policies put a dampener on the export of Taiwan's industrial goods. In addition, the overvalued NT dollar encouraged capital-intensive production and thus prevented Taiwan from making the best use of its comparative advantage (Ho 1978; Lee and Liang 1982).

At the same time, the protectionist policies enabled Taiwan's industries to meet basic needs in short order. By the late 1950s, however, Taiwan's market was becoming saturated with light industrial products, mostly consumer goods, and in some enterprises capacity and prices had begun to fall (Ho 1978, 222). Rather than attempt to develop heavy industry (which was to be the second phase of import substitution), the government decided to promote exports for which light industry enjoys comparative advantage. Initially, some were hesitant to take such a step for fear that Taiwan's textiles and other manufactured goods would not be able to compete with Japanese manufactures. Also, the Taiwanese were unfamiliar with foreign markets. But the low rates of economic growth in the late 1950s and, most important, the knowledge that U.S. economic aid was not unlimited persuaded officials to change their strategy.<sup>6</sup> They recognized that foreign exchange was essential for continued economic expansion, but that they could no longer rely on sugar exports, which had suffered a setback in 1958 as a result of a drop in sugar prices.

To further promote exports, Taiwan simplified the multiple exchange rate in 1958 and finally unified it in 1961, relaxed controls on imported manufacturing inputs, and introduced the landmark 19-Point Program to improve the investment climate, liberalize controls on industry (such as the restrictions on the establishment of new factories), and encourage exports. It is doubtful that Taiwan would have liberalized so early and so thoroughly without the support and encouragement of the U.S. aid mission (Jacoby 1966). Subsequent measures provided low-interest loans for exporters, a rebate of indirect taxes and tariffs on imported inputs for exports, and partial exemption from corporate income tax on export earnings of some products (Galenson 1979; Scitovsky 1986).

5. In the mid-1950s, imports of certain chemical fertilizers, wheat, flour, plywood, leather and leather products, cement, paper, rubber products, sewing machines, bicycles, soap, cotton, woolens, and man-made yarn and fabrics were suspended or controlled. Also, tariffs were high on many consumer goods. The nominal rate of protection for import-substitution industries was measured by comparing domestic prices for commodities with international prices, weighted by domestic sales. The nominal rate was 0.535 in 1961 but dropped to 0.300 in 1971 (Kuo, Ranis, and Fei 1985, 52). These tariff and nontariff protection schemes combined with foreign-exchange controls caused a widening of the differentials between the prices of imports or import substitutes and the CIF costs of comparable imports. In 1953 these differentials ranged from 41 to 48 percent for wheat flour, powdered milk, peanut oil, cotton yarns, and steel plate; but rates rose more than 300 percent for woolen yarn (Lin 1973, 50). As a result, it is not difficult to estimate the loss of efficiency from protection (Lee et al. 1975).

6. Large trade deficits in the 1950s were financed primarily through U.S. aid, which was equivalent to about 35 percent of all imports in 1958.

Beginning in the early 1960s, the government required a certain percentage of production to be exported, which in the case of new cement factories amounted to their entire output. It also removed all restrictions on textiles after they had successfully entered foreign markets. These restrictions included suspensions on production licenses, limits to the expansion of production, specific export requirements, and required ratios of local content (Hsing 1970, 202-4). In addition, industry trade associations were allowed to regulate output, prices, and sales of products. Also, limits were placed on the amount firms could sell in the domestic market; to further expand, they were obliged to export. The environment for export grew even more favorable as the price differentials between domestic and foreign markets helped subsidize exports from domestic sales (Lin 1973, 109-110), and incentives such as preferential loans were introduced (Lee and Liang 1982).

Regulations pertaining to the local content of inputs were first aimed at foreign firms but then in 1963 were also applied to local producers. Under these regulations, producers were required to increase their local content by ten percentage points a year, from an initial 40 percent to a maximum of 70 percent of product value. The aim was to further stimulate domestic-related industry, but exceptions were made so as to safeguard exports. More important, the strong backward linkages created by the quickly expanding export sector fostered the development of secondary import-substitution industries (Schive 1987, 1990b).

**DIRECT FOREIGN INVESTMENT AND ESTABLISHMENT OF AN EXPORT PROCESSING ZONE.** Direct foreign investment in Taiwan began in 1952, but did not reach significant levels until the mid-1960s. Since then, its contribution to gross capital formation has remained below 5 percent, although it did rise to 7 percent of the total investment in manufacturing during 1969-72. From 1974 to 1982 foreign firms accounted for about 20 percent of the country's total exports and generated 15 to 17 percent of the total employment in manufacturing (Schive 1990a).

Because they were concentrated in the labor-intensive exporting industries, foreign firms in Taiwan used more labor-intensive technology than national firms and thus helped improve the allocation of resources. Foreign parent firms also provided export-marketing assistance to their local subsidiaries. By 1972 about four-fifths of these subsidiaries were using their parent companies' international marketing network. Far more important, this marketing assistance abroad allowed local firms to start off with a large scale of production (Schive 1990a).

With the aid of foreign investment, firms were also able to introduce new products, modern marketing techniques, and new technology. Local managers, technicians, and workers trained at foreign firms gained new skills, which they subsequently put to use in starting their own firms or in hiring on

at domestic firms. In this way, the new technology or skills spread to the domestic industry. Another important development was that foreign firms were now purchasing domestically produced inputs (Schive 1990a; Schive and Majumdar 1990). Econometric analysis indicates that the inflow of direct foreign investment in Taiwan was positively related to capital formation, with a significant coefficient of 2.84. In other words, every dollar of direct foreign investment from 1958 to 1987 induced \$1.84 in capital formation. Although the impact is difficult to calculate precisely, these figures clearly suggest that this investment has stimulated capital formation in Taiwan (Schive and Tu 1991).

Because many foreign investors were unfamiliar with the government's procedures and thus were hesitant to open factories, the authorities decided to establish an export processing zone in Kaohsiung, Taiwan's largest port. It opened in 1965, and two more such zones were set up in 1969. Government regulations were simplified and coordinated to make it easier for foreigners to take advantage of Taiwan's favorable policies. These zones provided industrial sites, standard factory buildings, plentiful energy, and storage and transportation facilities at reasonable prices. Between 1966 and 1970 the zones attracted \$33 million in direct foreign investment, which amounted to 23 percent of total investment of this kind. By the late 1970s almost 80,000 people were employed in the three zones, about 80 percent of whom were women.

In the mid-1960s the government also established policies for bonded factories. Factories established for the production of exports enjoyed the same tax benefits as those in the export processing zones but were not restricted to any particular location. Foreign firms were therefore allowed to take advantage of the labor supply available in many areas and to avoid undue competition for labor around the zones.

**INFRASTRUCTURE.** In the 1950s the republican government began to improve and expand the infrastructure that had already been built by the Japanese. In preparation for economic development, Taiwan invested large amounts in irrigation, land development, road construction, communication, and the electric power industry. It continued the expansion and modernization of paved roads, communications, and postal establishments into the 1980s. In addition, it modernized and improved the efficiency of its railways.

Throughout the past four decades the electric power industry has played a particularly important role in Taiwan's development. By introducing standard urban and rural power rates, the Taiwan Power Company, a government enterprise, has not only raised rural living standards but also facilitated the growth of industries in rural villages. These enterprises absorbed labor from agriculture and helped maintain greater equality between rural and urban incomes and development. As a result, regional development of industry was well balanced between 1951 and 1971. This would not have happened without adequate investment in the rural regions.

## **Contributions of Agriculture to Nonagricultural Sectors**

As mentioned throughout this volume, agriculture contributes to the growth of other sectors by providing labor, capital, agricultural goods, and a market for nonfarm goods and services. As nonfarm sectors expand, the demand for agricultural products increases, job opportunities open up for farm families, and excess agricultural labor becomes absorbed by the job market. These interrelationships were particularly important during 1950–60, when newly developed import-substitution industries precipitated a structural change in Taiwan's economy.

### *Labor Flows*

From 1952 to 1964 agricultural labor increased from 1.64 million to 1.81 million, although its growth rate was much lower than that of the total labor force. During this period, more than 200,000 agricultural workers migrated to nonagricultural sectors, at the rate of about 19,000 a year. The annual rate of outflow ranged from 0.3 to 2.3 percent, which was low compared with that in later periods. Thus agriculture still absorbed a large portion of the increased rural labor at this time. After 1965 agricultural labor migration accelerated owing to rapid industrialization in the nonagricultural sector. Between 1965 and 1973 an average of 93,522 persons a year migrated from agriculture to nonagricultural sectors, which was five times the 1953–63 average. In the early period the most important forces behind this migration were push factors, such as the rising per capita income and industrial wage. Pull factors, such as employment opportunities and urbanization, became significant later. The migration continued in the 1970s, in response to Taiwan's growing economic prosperity, but then slowed as economic growth moderated, only to surge upward again in 1987 and 1988, when the economy regained its vitality.

There were only three years of negative migration during the 1952–88 period. The first occurred in 1964 but was insignificant.<sup>7</sup> The second and third occurred in 1974 and 1982, when the oil crises hit. Thus during the economically depressed years, agriculture was a buffer for unemployed nonagricultural labor and contributed greatly to social stability. The cushion effect was much less pronounced in 1982, however, owing to the shrinkage of the agricultural sector.

Farm labor also contributed to Taiwan's economic development indirectly in that the children raised on farms were educated in schools subsidized by farm taxes. The nonfarm sector did not pay for the rearing of those who migrated to cities after finishing school. An adequate and basically balanced elementary system in the countryside helped improve the quality of migrants absorbed in the nonfarm sector.

7. The growth rates of GNP, agricultural production, and industrial production in 1964 were 12.3 percent, 9.5 percent, and 21.1 percent, respectively.

### *Capital Flows*

According to studies on the flow of resources and funds from agriculture to nonagricultural sectors in Taiwan (Lee 1971a, 1971b), the net sectoral outflow of real capital from agriculture was positive throughout the period 1895 to 1969 and contributed significantly to capital formation of the nonagricultural sector (see table 2.7). This outflow was determined from both net real agricultural surplus (or visible net capital outflow) and changes in the sectoral terms of trade.

The net intersectoral capital flow was unfavorable to agriculture throughout the period under review. The outflow from agriculture trended upward in the prewar period, declined in the early postwar period, but picked up again in 1961-69. An invisible outflow caused by the terms of trade against agriculture accounted for more than 50 percent of the total outflow in the postwar period. Financially, land-rent payment and government taxing accounted for the lion's share of agricultural surplus transferred to nonagriculture in the prewar period, and the direct transfer of farmers' savings became a significant factor in 1966-69. The magnitude of the intersectoral capital flows was influenced by government policy and the stage of development.

### *Market for Nonfarm Products*

The agricultural sector had a fairly large population and income share at the beginning of industrialization and had the potential of being a good customer for industrial goods. From 1950 to 1970 Taiwan's agricultural production grew 5.3 percent annually, which was reflected in increased agricultural incomes. As a result, the agricultural sector's effective demand for industrial goods rose significantly. In addition, a series of land reform programs helped improve the purchasing power of farm families through income redistribution.

The relative importance of agriculture in stimulating the industrial development can be verified in two ways. First, the domestic market accounted for more than 60 percent of the growth of the manufacturing sector from 1956 to 1966. After 1966 export expansion became increasingly important. Second, from 1950 to 1955, 58 percent of the agricultural production was sold to the nonagricultural sector. In the same period, farmers' purchases from the nonagricultural sector amounted to NT\$1.1 billion of working capital goods, NT\$0.1 billion of fixed capital goods, and NT\$2.1 billion of consumer goods.

From 1956 to 1960, 60.3 percent of the agricultural production was sold to the nonagricultural sector. Farmers in return spent NT\$8.7 billion to purchase the nonagricultural products. A similar pattern occurred during 1961-65 and 1966-69, although the share of consumer goods declined while the shares of working capital and fixed capital goods steadily increased. Thus the prosperous agricultural sector clearly provided an attractive local market for the manufacturing sector during the crucial initial period of industrial development.

**TABLE 2.7** Intersectoral capital flows between the agricultural and the nonagricultural sectors (five-year average), 1931–1969 (NT\$, 1935–37 constant prices)

Item	1931–35	1936–40	1950–55	1956–60	1961–65	1966–69
Total agricultural production	290,597	507,819	7,210,674	16,028,408	30,701,164	42,224,656
Total sale of agricultural products	208,470	362,474	4,183,722	9,664,662	18,606,946	26,138,740
Total sale ratio	71.70	71.40	58.00	60.30	60.61	61.90
Total outflow of agricultural products to	208,470	362,474	4,183,722	9,664,662	18,606,946	26,138,740
Nonagricultural production	88,287	163,606	2,013,044	4,925,649	9,681,331	12,872,047
Nonagricultural household	48,356	81,858	1,941,976	4,177,284	7,554,053	11,114,156
Foreign countries	71,827	117,010	228,702	561,729	1,371,562	2,152,537
Total inflow of nonagricultural products	145,886	260,692	3,267,665	8,716,325	17,260,910	24,059,808
Working capital goods	47,053	82,407	1,052,583	2,594,395	5,636,389	8,569,460
Fixed capital goods	8,201	9,462	107,100	1,196,321	1,1789,079	3,757,021
Consumer goods	90,632	168,823	2,107,982	4,925,609	9,835,442	11,733,327
Net commodity outflow	62,584	101,782	916,057	948,337	1,346,036	2,078,932
Gross outflow of fund	75,853	134,818	1,337,180	2,616,115	6,270,108	10,600,574
Land rent and interest	55,828	98,299	531,969	738,790	591,937	1,042,141
Taxes and fees	16,985	30,141	711,555	1,452,694	1,894,607	2,348,434
Transfer of funds through financial institutions	3,040	6,375	93,656	424,631	3,783,564	7,209,999
Gross inflow of funds	13,269	33,036	421,123	1,667,777	4,924,072	8,521,642
Public investment and subsidy	1,026	2,147	26,154	71,432	919,590	1,362,657
Investment by nonagricultural sector in agriculture	3,101	5,343	11,625	44,171	—	—

TABLE 2.7 (continued)

Item	1931-35	1936-40	1950-55	1956-60	1961-65	1966-69
Income received from the non-agricultural sector	9,142	25,546	383,344	1,552,174	4,004,482	7,158,985
Net outflow of fund	62,584	101,782	916,075	948,338	1,346,036	2,078,932
Terms of trade	106.90	102.10	125.70	119.80	119.03	118.51
Agricultural price index (1935-37 = 100)	80.40	120.20	1,404.90	2,483.50	3,830.00	4,041.00
Nonagricultural price index (1935-37 = 100)	85.90	122.70	1,766.00	2,974.90	4,559.00	4,789.00
Visible net real capital outflow	77,841	84,677	65,204	38,136	35,145	51,446
Invisible net real capital outflow	11,618	4,519	47,559	58,003	72,064	92,995
Net real capital outflow	89,459	89,196	112,763	96,189	107,209	144,441

SOURCE: Lee (1971b).

In summary, during Taiwan's early postwar industrialization agriculture played an important role in providing labor, capital, and a reliable and expanding market for the nonagricultural sector. An important lesson from Taiwan's experience is that the resource flows between agriculture and the non-agricultural sector were an active two-way transfer. In 1966–69, for instance, annual sales by the agriculture to nonagriculture were 2.2 times the 1950–55 level after price adjustment, while sales in the opposite direction were 2.7 times the 1950–55 level. In the meantime, the financial outflow of capital from agriculture was NT\$10.6 billion, and the inflow from nonagriculture was NT\$8.5 billion (see table 2.7). The intersectoral capital flows were significant only when the relations between agriculture and nonagriculture were close.

### **Social Impact of Agriculture-led Growth**

Taiwan's economic expansion was notable not only for its rapid industrialization but also for its improved income distribution and more balanced industrial growth among regions. With the development of many labor-intensive foreign firms and SMEs, Taiwan was able to make use of its comparative advantage and provide geographic diffusion for industry. In addition, the government's effort to maintain a rough parity of incomes between the agricultural and industrial sectors helped prevent the urban flight common in many industrializing countries.

#### *Urbanization*

Although the population of Taiwan's larger cities increased, the rate was slow in relation to the rate of industrialization. In 1951–72 the population of the five largest cities rose from 18 percent to 27 percent of total population (Ho 1968, 139). However, the proportion of industrial establishments in these cities was only slightly more than one-third in both 1951 and 1971. Between 1956 and 1966 the percentage share of industrial employment in the cities fell from 43 percent to 37 percent. This pattern is distinctly different from that of most developing countries (Ranis 1979, 222).

Taiwan's relatively slow urbanization reflected the diffused patterns of industrialization. Although substantial intersectoral migration took place from agriculture to the industrial sector, this was often not accompanied by a corresponding geographic migration. Other factors affecting Taiwan's slow polarization of population were its well-developed transportation and communication systems, which, along with Taiwan's small size, reduced transportation costs and facilitated growth in rural and semirural areas. Enterprises producing labor-intensive, light industrial goods often did not need large plants and were able to take advantage of less expensive land and surplus labor in rural areas. The increase in demand for light industrial goods was abetted by export-oriented policies that allowed these enterprises to expand rapidly. In 1971, 61 percent of

all consumer goods were produced outside of the five largest cities, in comparison with only 39 percent of producer goods (Ranis 1979, 229).

With this expansion, nonagricultural income became increasingly important to farmers: it accounted for 34 percent of total farm family income in 1966, for example, and 54 percent in 1975 (Fei, Kuo, and Ranis 1979). As industries spread in rural areas, farm people were able to take advantage of the higher wages in manufacturing without leaving home, and a large number (57 percent) did so on a seasonal basis. Slightly more than half commuted to work, but only 17 percent actually left the rural area. By 1968 about one-fourth were engaged in long-term employment elsewhere (Thorbecke 1979, 189–90), but most of them probably had found jobs in the large foreign companies established in the late 1960s.

Many of those who switched from agricultural to nonagricultural activity were young (two-thirds of the laborers in manufacturing between 1966 and 1972 were under the age of 24), and 79 percent were female (Kuo, Ranis, and Fei 1985, 105). It was said that “the flow of relatively cheap labor that attracted foreign investors to Taiwan would have ended much sooner had women decided to remain at home” (Galenson 1979, 395). They were able to enter the manufacturing work force so readily because industry was widely diffused and transportation facilities were well developed.

### *Income Distribution*

Between 1952 and 1972 real income for all population groups in Taiwan rose and was distributed more equally. The Gini coefficient declined from 0.56 in 1953 to 0.32 in 1964 and 0.29 by 1972. The rapidly expanding, labor-intensive manufacturing industries provided wage income to large numbers of surplus rural laborers. By 1979 wage income had risen to 61 percent of total income, while income from property had decreased. Without doubt, the greater increase in wage income helped reduce income inequality in Taiwan (Fei, Kuo, and Ranis 1979, 314–16).

The land reforms immediately after the war, which reduced the rents of tenant farmers by 37.5 percent, also created a shift in the relative position of landlords. This move stimulated agricultural productivity. The combination of lower rents and increased production boosted the average income of tenant farmers 81 percent from 1949 to 1952 (Kuo, Ranis, and Fei 1985, 50). In addition, farmers benefited from the redistribution of wealth from higher-income landlords to the lower-income tenants, which in 1952 amounted to about 13 percent of GDP (Ho 1968, 166). Income equity improved even further under the government’s policies of promoting labor-intensive industries together with universal education (Ranis and Schive 1985).

Despite the change in income distribution, the gap between the income of farm families and nonfarm families increased between 1964 and 1972, because the former rose more slowly than the latter (Fei, Kuo, and Ranis 1979, 203).

Although decreases in the terms of trade for agriculture have been mitigated somewhat by the promotion of higher-priced agricultural goods, on the whole agricultural growth rate has lagged behind that of industry. Moreover, the productivity of agricultural labor increased by 79 percent between 1952 and 1970, whereas that of industrial labor increased by 132 percent. This difference and the continued expansion of the industrial sector have prompted more and more agricultural workers to move into other sectors. To help equalize farm income with that of the industrial sector, the government offered loans and subsidies in aid of further mechanization of farms, which it hoped would raise farmer productivity.

Farm family income was also boosted by farm women entering the formal work force in large numbers in the 1960s. While the absolute numbers in agriculture between 1965 and 1975 remained stable, the women entering the manufacturing sector increased by 400,000. The number of women employed in the service sector also increased, but the relative share remained fairly stable (Galenson 1979, 33). Since most of the women entering the manufacturing sector were probably paid higher wages than they had been receiving, the movement of female labor contributed to a more equitable distribution of income.

### **Postindustrialization Adjustment of the Agricultural Sector**

The turning point in agricultural development occurred in the mid-1960s, when industrial production overtook agriculture in its contribution both to net domestic product and to exports.

#### *Difficulties in Agricultural Development*

One of the difficulties for agriculture at this time was that the growth rate of production had begun to slow down in response to a changing emphasis on livestock and fishery products and high-value export crops. As already mentioned, industrial employment had also begun pushing up the costs of labor and other production inputs, labor productivity in agriculture was lagging behind that in the industrial sector, and the gap between farm and nonfarm per capita incomes was increasing. These and the other ensuing problems in the agricultural sector were similar to those that many other industrial countries have experienced at a comparable development stage.

**LOSS OF FARMLAND AND LABOR.** Farm labor reached a record level of 1.8 million persons in 1964 but by 1988 was down to 1.1 million. In other words, 0.7 million young laborers had left agriculture. This aging of farm labor is expected to become an even more serious concern in the future.

Another concern is that little unused farmland is left on the island yet the demand for land is growing in the face of rapid industrialization, population growth, and rising incomes. Since nonagricultural use generally produces more

income than farming, the conversion of farmland to nonfarm purposes is inevitable. Indeed, the process is already in full swing: from 1952 to 1988, the total area of paddy fields decreased by 50,129 hectares; and the use of land for buildings increased 77,300 hectares, for roads and irrigation facilities 57,215 hectares, and for fishponds 15,670 hectares. A large portion of this conversion involved farmland in the fertile plain. Only 69,000 hectares were added to dry farmland by reclamation and development of slope and wild land. It should also be pointed out, however, that rural industries can only be established in the planned industrial zones or in locations exempt from agricultural use.

**RIGID FARMLAND SYSTEM.** Under the constraints imposed on the land tenure system by Taiwan's land reforms, many part-time farmers left their land to overseers working on their behalf rather than leasing it to other farmers for fear that the government might force them to give up their landownership. Consequently, it is now almost impossible for a full-time farmer to rent additional land, and the system originally designed to prevent land concentration actually prevents more productive use. This has created a serious bottleneck to Taiwan's agricultural development. Since 1960, the government has encouraged group farming, along with mechanization, to improve the efficiency of small units and to realize economies of scale and eliminate labor shortages. Small landowners have been urged to take full-time nonfarm jobs. Unfortunately, there is no legal basis for implementing this measure, and the results have been unsatisfactory.

To address the problem, the Council of Agriculture is drafting a law to provide more flexibility in farmland transactions and the tenancy system. Under existing land laws, only the bona fide farmers are qualified to purchase farmland. The proposed new law would allow agricultural school graduates and other young people with training in farming, agribusiness, and agricultural production cooperatives to buy farmland. The proposed law would also free all tenancy contracts, except those signed under the 37.5 percent Rent Reduction Act. In addition, the proposal would put more restrictions on conversions of farmland to nonagricultural uses after a master plan of land use has been formulated. This measure is expected to prevent land speculation in rural areas and to enlarge the size of farms.

**DETERIORATION OF RURAL ENVIRONMENT.** Because rural industrialization has raised the income and standard of living of rural labor, it has received widespread support in Taiwan. However, industry has become the major source of pollution in rural areas and has affected agricultural production. Rivers and streams in western Taiwan have been polluted by industrial wastes in various degrees, and industrial wastewater has been discharged into rural irrigation and drainage canals without treatment. In a few cases, industrial wastes have contaminated the soil to such an extent that farmland has had to be abandoned.

Some responsibility for the deteriorating environment also falls on the agricultural sector, whose overuse of fertilizers and chemicals has polluted both

surface and groundwater. Wastes from livestock farms have caused water and air pollution, and the extensive use of groundwater on aquacultural farms has produced heavy sedimentation along the southern coast. As a result, aquacultural farms have been encouraged to raise fish that tolerate brackish water, and livestock farms are not allowed to discharge the animal wastes freely. These measures are expected to improve the rural environment in the near future.

**RAPID CHANGES IN FOOD DEMAND.** The increase in per capita income has had a marked effect on food consumption patterns. The challenge for Taiwanese farmers has been to adjust production to the changing domestic demand while also competing with foreign producers in both the domestic and foreign markets. If Taiwan is to meet this challenge, agricultural policy must focus on the income and welfare of full-time farmers while improving their production and management practices. Part-time small farmers should either maintain their small-scale farming through group farming or participate in large-scale operations under new institutions. Either option would, of course, need strong support from the government.

**SMALL-SCALE FARM OPERATION.** The small farm system is likely to prevail in a country where cultivated land is limited and population density is high. The average size of a farm in Taiwan fell from 1.29 hectares in 1952 to 0.97 hectare in 1972, but then went up to 1.21 hectares in 1988 following the loss of farm households. The latest agricultural census in 1985 indicates that 73 percent of all farm households owned less than 1 hectare. In the early days, small farms were able to compete because labor-intensive farming did not provide an opportunity for significant scale economies. However, a 1-hectare farm is too small to operate efficiently when farm machinery substitutes for manual work. As the steady decline in Taiwan's multiple-cropping index indicates, land use has become less intensive.

**LOW FARMERS' INCOME.** Until the mid-1960s the real income of farm and nonfarm families rose at about the same steady rate. In 1970, however, the per capita income of farm families dropped to 60 percent of nonfarm income and to 70 percent of that of workers' families. Although various government support policies boosted farm income in the late 1980s, many farmers were still forced to take part-time work off the farm. The proportion of farm family income that came from net agricultural income ranged from two-thirds in 1966 to less than one-third in 1980.

**INCREASE IN PART-TIME FARMING.** Since the average farm size has remained small, it has become increasingly difficult for farmers to raise their income from agriculture. Many farms have therefore become sideline operations in which one or more family members have taken a job outside agriculture. In 1980 such operations accounted for 55.5 percent of total farm households, in comparison with 9 percent for full-time farms and 35.3 percent for part-time farms. Subsequently, several measures were introduced to reverse this trend, including nucleus farm projects and the creation of new farm busi-

ness for rural youth. By 1985 the number of part-time farm households had dropped to 21.6 percent and full-time farm households had increased to 21.6 percent, but the sideline farm households had changed little at 63.6 percent. At present, the majority of rice farms are either sideline or part-time operations. Most full-time farms produce horticultural or livestock products.

**DECLINING INTERNATIONAL COMPETITIVENESS.** Largely because of the surge in wages and other farm production costs, many Taiwanese farm products have lost their competitive edge in the world market, and imports have risen. Imported corn, for example, has replaced sweet potatoes as the major feedstuff. Rice and sugar are no longer profitable for export. And Taiwan's large share of canned mushrooms, asparagus, and pineapple has been lost to other countries.

### *Policy Changes and Challenges*

In November 1969, in response to the mounting pressure for change in agriculture, the government issued policy guidelines designed primarily to accelerate agricultural modernization and maintain a balance between the agricultural sector and the rest of the economy. Several action programs were then developed to reduce the price of fertilizer, establish the Agricultural Finance Coordinating Committee, improve the agricultural marketing system, promote farm mechanization, and reduce the tax burden on farmers. Unfortunately, funds were not provided to implement these policies, except for the reductions in the price of fertilizer and tax burden on farmers.

Under the Accelerated Rural Development Program announced September 27, 1972, the government moved to abolish the rice-fertilizer barter system, abolish the educational surtax on farm land tax, ease the terms of agricultural credit, improve agricultural marketing, strengthen the rural infrastructure, accelerate the improvement of cultivated techniques, establish specialized agricultural production areas, strengthen agricultural research and extension, and promote industrial parks in rural areas.

In the next two years the government appropriated NT\$2 billion to implement these measures. From that time on, agriculture played a "supported," as opposed to "supportive," role in development. The program was originally designed to terminate at the end of 1974 but was extended to 1978 with regular financial support. From 1973 to 1978 a total of NT\$22.9 billion (including NT\$13.6 billion of the Food Stabilization Fund) was committed to the program.

In 1973 and 1974, in the face of a world food shortage and a dwindling rice surplus in Taiwan, the government made self-sufficiency in rice a national policy. To increase rice production and improve farmers' income, it also adopted a rice price guarantee and established a food stabilization fund. This represented a sharp switch in policy. In principle, the floor-support price for rice provided for a 20 percent profit margin above production costs. Rice production reached a record 2.7 million metric tons in 1976. From 1974 to 1977 no limit was set on the quantity purchased from rice growers. Because of its heavy

financial burdens, however, the government later limited its purchases to a maximum of 970 kilograms per hectare per crop. When rice prices were falling, the government also purchased it at a price a little above the market price.

The rice-support price program created problems in the long run. Per capita consumption fell from 140 kilograms per year in 1968 to 74 kilograms in 1988. As expected, rice stockpiling became a serious problem. In order to reduce production, farm extension workers encouraged farmers to shift rice fields to other crops, but no economic incentive was provided and the program failed. A six-year rice-crop substitution plan implemented in 1984 gave direct subsidies of 1 metric ton of paddy rice per hectare to farmers who shifted their rice fields to corn or sorghum, or 1.5 metric tons of paddy rice per hectare to farmers who shifted to crops other than corn and sorghum. In addition, corn and sorghum were to be purchased by the government at guaranteed prices. Under the program, rice production declined to 1.84 million metric tons in 1988, which was 0.9 million metric ton below the 1976 peak. The paid-in-kind subsidy was changed to a cash payment in 1988 to improve management of the program. Starting in 1989, rice purchased at the guaranteed price was increased to 1,400 kilograms per hectare, and the quantity purchased at higher-than-market prices was set at 1,000 kilograms per hectare. The purpose of the new policy was to increase the income of rice growers.

The new policy had some inconsistencies, however, as a result of which the Food Stabilization Fund lost NT\$81 billion in the buying and selling of rice in the period from 1974 and 1989. For one thing, the guaranteed price encouraged overproduction even though the purpose of shifting from rice to other crops was to reduce rice production. For political considerations, however, the government was reluctant to make any immediate change. Policymakers are now giving some attention to a direct payment scheme linked to farmers' income and land use.

After the Accelerated Rural Development Program came to an end, the government launched two new programs: one to enhance farm income and strengthen rural reconstruction, and the other to develop basic infrastructure. The two were merged in 1982 in an effort to coordinate and integrate long-term rural development projects. A six-year program to adjust crop production by substituting higher-value crops for rice, enlarging farming operation, improving agricultural marketing, and strengthening agricultural research and extension was begun in 1985. From fiscal 1979 to 1989, a total of NT\$125.7 billion (including NT\$39.8 billion of the food stabilization fund) was spent on these programs. For an area the size of Taiwan, an investment of this size over an 11-year period was no small achievement. By 1988 Taiwan had 895,000 hectares of cultivated land, 739,000 farm families, and a farm population of 3,819,000. The average expenditure of public funds on the farm economy over this period was NT\$140,447 per hectare of cultivated land, NT\$170,095 per farm family, and NT\$32,914 per farm person. Public spending in the agricultural sector is

expected to grow as the economy expands. The challenge at present is how to make the best use of public resources to develop new technology, increase the scale of farming, and improve the efficiency of agricultural production.

### **Conclusions and Policy Implications**

During the colonial period from 1921 to 1937, Taiwan made great strides in agricultural development as output expanded and resources flowed into the sector. In the period of recovery after World War II, agriculture experienced sustained growth but with significant structural changes. The second half of the 1960s can be considered the turning point of Taiwan's agricultural development.

Several institutions contributed to this rapid development, particularly the Sino-American Joint Commission on Rural Reconstruction. Its agents worked with the government and various organizations in identifying problems and developing policy recommendations, and in providing technical and financial assistance. By merging planning and implementation and striving for "integrated rural development," the JCRR helped generate a spirit of self-help among local agencies.

The land reforms of 1949–53 produced further changes. Immediately after the war, most Taiwanese farmers were tenants and received less than half of their crop harvests. Under the land reform program, rents were reduced, public lands were sold off, and land was given to the tillers. These measures redistributed assets, provided incentives for land improvement, raised the social status of farmers, released land capital for nonagricultural purposes, and helped create small and medium enterprises. In short, the land reform program supplied an indispensable social infrastructure for the successful development of the agricultural and industrial sectors. Last but not least, research institutes and associations in Taiwan introduced, developed, and diffused agricultural technologies. Farmers' and fishermen's associations also engaged in market promotion and provided financial services to their members. These associations helped implement government policies.

Greater economic stability in the 1950s facilitated agricultural and industrial development. The rampant inflation between 1946 and 1949 was gradually brought under control by introducing the new Taiwan dollar with full reserves in 1949, along with preferential interest savings deposits and tight government budgets. The timely arrival of U.S. economic aid provided much-needed financial support. In addition, several steps were taken to stabilize rice prices as a hedge against inflation. These prices in turn helped stabilize wages, production costs, and commodity prices. In order to keep the market stable and the rice stockpile at a safe level, the government collected rice by all means, including paddy land taxes in kind, the compulsory purchase of paddy rice from paddy landowners, rent on government-owned farmland, and the bartering of fertil-

izers for rice. The means used in collecting rice often did not reflect the market price and hence became a hidden tax on rice growers, which by 1963 was in excess of the total income tax.

From 1952 to 1972 Taiwan changed from a primarily agricultural to an industrialized economy. This was largely due to government policies of import substitution in the early 1950s and export promotion in the late 1950s and 1960s. At the beginning of this period, Taiwan had an inward-looking economy with a heavily protected domestic market. By the early 1970s, however, Taiwan had become heavily dependent on the world's economy. To promote exports, it relaxed industrial regulations, provided various tax incentives for exports and investment, and established export processing zones and bonded factories. As part of this strategy, the government provided an adequate supply of power, land for industry, and transportation facilities. Direct foreign investment was encouraged. The key to the success of the export scheme, however, was Taiwan's ability to make the best use of its abundant labor. Because of the labor-intensive nature of small and medium enterprises and their ability to make a quick response to external changes, they exported 56 percent of their total production in 1972. Foreign companies also engaged actively in export and created a significant number of jobs.

Agriculture contributed to Taiwan's industrialization and economic growth by providing labor, capital, agricultural goods, and a sizable market for nonfarm products. Higher industrial wages and nonfarm job opportunities led to outflows of farm labor. Moreover, farm taxes paid for the education of migrant farm laborers, which constituted a subsidy for the nonfarm economy.

Between 1931 and the outbreak of war, capital outflows from agriculture increased. They declined in 1950-60 but then picked up again in 1961-69. Changes in the terms of trade against agriculture accounted for more than half of the total net real capital outflow in the postwar period. This was a considerably higher share than before the war, when land-rent payment and government taxes accounted for the lion's share of the agricultural surplus transferred to nonagriculture. Government policies clearly have played an important role in determining the speed of flow and the means of transferring farm capital.

The relatively large and booming agricultural sector provided an important market for consumer goods, farm machinery and various intermediate inputs such as fertilizer and chemicals. Purchases of nonagricultural products by farmers accounted for about 55 percent of the total value of agricultural production, or about 90 percent of the total sales of agricultural products. This sizable and easily accessible market facilitated Taiwan's industrialization, especially in the 1950s but also in the 1960s.

Despite rapid industrialization from the 1950s through the 1970s, Taiwan's population was slow to pursue urbanization, in large part because of the balanced development of the agricultural and nonagricultural sectors and the pattern of industrial development. A prosperous agricultural sector can slow

down outmigration of farm labor by providing a competitive wage. Good transportation, widely spread industrial sites, and relatively small-scale operations with low capital intensity all helped to keep farm labor employed in rural areas.

Almost every factor favorable to more balanced regional development also helped equalize income distribution. When family income from agriculture lagged, that from nonagriculture made up part of the loss and slowed the widening income gap between farm and nonfarm households. A significant increase in female labor in nonfarm jobs also benefited low-income farm families.

After the surplus labor became absorbed, however, agriculture began experiencing numerous difficulties. In 1965 the number of farm laborers started declining, and wages in rural areas then went up. As a result, farm labor developed an aging problem. Furthermore, the farm sector was unable to compete with nonfarm sectors for land. Meanwhile, the supply of fertile land was shrinking, and the land regulations originally designed to prevent land concentration stood in the way of more productive land use by increasing farm size. Farms thus became smaller, and the number of part-time farmers increased because farming income had become inadequate and abundant job opportunities were available elsewhere. In addition, rural areas have suffered environmental problems because of the pollution caused by both industry and farming. Finally, rising incomes have changed food consumption patterns, and thereby the structure of domestic farm production. At the same time, agricultural imports have provided strong competition for domestic products.

In order to cope with structural changes in agriculture, the government initiated a series of policies to alleviate the burden of taxes, reduce fertilizer prices, and eventually abolish the rice-fertilizer barter system. These policies promoted new investment in agricultural infrastructure and research and development. They also encouraged institutional arrangements for zoning and marketing. After the first oil crisis, a rice price support policy was adopted to encourage rice production for food self-sufficiency and to improve farmers' incomes. As expected, this policy caused an overproduction of rice and caused a heavy drain on the government's budget. The policy was modified to limit the amount of rice purchased and provided subsidies to encourage a shift from rice to other crops.

As this chapter has explained, Taiwan's successful economic development over the past four decades has been due to many factors, beginning with a strong and growing agricultural sector. It provided savings, foreign exchange, and labor for nonagricultural development and a large market for industrial products. Agriculture shared the heavy cost of import protection beneficial to industry. Resources supplied by agriculture enabled the industrial sector to expand quickly, and agricultural growth helped maintain a balanced develop-

ment between agriculture and nonagriculture and among regions. This, in turn, led to a more equitable distribution of income.

The growth of the agricultural sector depended on investment both in "hardware" and in "software." Land reform in Taiwan in the early 1950s created a social infrastructure favorable for development. The JCRR and other civil organizations then played a decisive role in policymaking and implementation. The manner in which these institutions have functioned provides a valuable lesson for those seeking to integrate agricultural and industrial development. A stable price level also seems crucial for the effective reallocation and mobilization of resources. In the case of Taiwan, a stable price for rice helped maintain price stability in general. Without doubt, a properly designed taxation system can transfer agricultural resources to nonagriculture along with changes in the terms of trade between these sectors. Nonetheless, an expanding agricultural sector with continuous investment is essential for releasing its resources in the long term.

As far as industrialization is concerned, a limited role for public enterprises in selected areas, fewer regulations on entry, certain export promotion measures, and an open policy toward foreign investment can all contribute to a more efficient use of resources and an expansion of trade. The great problem in a small economy such as Taiwan's is that a growing industrial sector will quickly emerge as a strong competitor for resources and create pollution and farm income problems. It will take both academic wisdom and practical experience to resolve these problems.

## References

- Bruch, M., and U. Hiemenz. 1984. *Small- and Medium-scale Industries in the ASEAN Countries*. Boulder, Colo.: Westview Press.
- Chang, Chung-han. 1980. *Taiwan's Industrialization during the Colonial Period*. Taipei: United Press.
- Chen, H. Y., W. F. Hsu, and Y. K. Mao. 1975. "Rice Policies of Taiwan." *Food Research Institute Studies* 14 (4).
- Chen, Y. E. 1986. *Agricultural Productivity of the Republic of China*. Taipei: Council of Agriculture.
- Chen, Y. E., and Y. T. Wang. 1980. "Secular Trend of Output, Inputs, and Productivity—A Quantitative Analysis of Agricultural Development in Taiwan." In *Proceedings of the Conference on Agricultural Development in China, Japan, and Korea*. Taipei: Institute of Economics, Academia Sinica, Republic of China.
- Chou, T. C. 1989. "Assisting the Development of Small and Medium Enterprises." Report of the conference on national development strategy on commerce and industry (Chinese). Taipei: Ministry of Economic Affairs.

- Fei, John C. H., Shirley W. Y. Kuo, and Gustav Ranis. 1979. *Growth with Equity: The Taiwan Case*. England: Oxford University Press.
- Galenson, Walter. 1979. "The Labor Force, Wages, and Living Standards." In *Economic Growth and Structural Change in Taiwan*, ed. Walter Galenson. Ithaca, N.Y.: Cornell University Press.
- Gold, Thomas B. 1986. *State and Society in the Taiwan Miracle*. Armonk, N.Y.: M. E. Sharpe.
- Ho, Samuel P. S. 1968. "Agricultural Transformation under Colonialism: The Case of Taiwan." *Journal of Economic History* (September).
- . 1978. *Economic Development of Taiwan, 1968–1970*. New Haven: Yale University Press.
- Hsing, Mo-huan. 1970. "Taiwan Industrialization and Trade Policies." In *Taiwan and the Philippines, Industrialization, and Trade Policies*, ed. John H. Power, Geraldo P. Sacan, and Mo-huan Hsing. London: Oxford University Press.
- Jacoby, Neil H. 1966. *U.S. Aid to Taiwan*. New York: Praeger.
- Klein, L. R. 1986. "Introduction." In *Models of Development*, ed. L. J. Lau. San Francisco, Calif.: Institute for Contemporary Studies.
- Kuo, Shirley W. Y. 1975. "Effects of Land Reform, Agricultural Pricing Policy, and Economic Growth on Multiple Crop Diversification in Taiwan." *Philippine Economic Journal* 14 (1 and 2).
- Kuo, Shirley W. Y., Gustav Ranis, and John C. H. Fei. 1985. "Causes and Roles of Export Expansion in the Republic of China." In *Foreign Trade and Investment: Economic Development in the Newly Industrializing Countries*, ed. Walter Galenson. Madison: University of Wisconsin Press.
- Lee, T. H. 1971a. *Intersectoral Capital Flows in the Economic Development of Taiwan, 1895–1960*. Ithaca, N.Y.: Cornell University Press.
- . 1971b. "Strategies for Transferring Agricultural Surplus under Agricultural Situations in Taiwan." Report of the Sino-American Joint Commission on Rural Reconstruction (July).
- . 1972. "Wage Differential, Labor Mobility, and Employment in Taiwan's Agriculture." Proceedings of the Sino-American conference on manpower in Taiwan.
- . 1974. "Agricultural Contributions to Economic Growth in Taiwan." JCRR Report.
- Lee, T. H., and Y. E. Chen. 1975. "Growth Rates of Taiwan Agriculture, 1911–1972." JCRR Economic Digest Series No. 21 (January).
- Lee, T. H., and Kuo-shu Liang. 1982. "Development Strategies in Taiwan." In *Development Strategies in Semi-industrial Economics*, ed. B. Balassa et al. Baltimore, Md.: Johns Hopkins University Press.
- . 1973. "Process and Pattern of Economic Development." *Economic Essays* 4.
- . 1974. "Process and Pattern of Economic Development." In *The Development of East and Southeast Asia*, ed. Shinichi Ichimura. Honolulu: University Press of Hawaii, pp. 296–299.
- Lec, T. H., K. S. Liang, C. Schive, Ryh-song Yeh. 1975. "The Structure of Effective Protection and Subsidy in Taiwan." *Economic Essays* 6 (November).
- Li, K. T. 1976. *The Experience of Dynamic Economic Growth on Taiwan*. Taipei: Mei Ya Publications.

- Liang, Kuo-shu, and Ching-ing Hou Liang. 1988. "Development Policy Formation and Future Policy Priorities in the Republic of China." *Economic Development and Cultural Change* 36 (April).
- Lin, Ching-yuan. 1973. *Industrialization in Taiwan, 1946-1972*. New York: Praeger.
- Mao, Y. K. 1984. "Agricultural Development Policy and Performance in Taiwan, R.O.C." In *Industry of Free China* (November).
- . 1985. "Agricultural Development Policy and Performance in Taiwan, R.O.C." In *Industry of Free China* (January).
- . 1987. "Current Land Problems and Policies of Taiwan, The Republic of China." *Industry of Free China* (June).
- . 1987. "Role of Agriculture in the Economic Development in Taiwan, R.O.C." Proceedings of Economic Development in the Republic of China on Taiwan.
- . 1988. "Analysis of Changes in the Type of Farm Households under Rapid Economic Growth in Taiwan, R.O.C." Proceedings of the conference on directions and strategies of agricultural development in the Asia-Pacific Region. Taiwan: The Institute of Economics, Academic Sinica.
- Mellor, John W. 1966. *The Economics of Agricultural Development*. Ithaca: Cornell University Press.
- Myers, Ramon H. 1986. "The Economic Development of the Republic of China on Taiwan, 1965-1981." In *Models of Development*, ed. Lawrence J. Lau. San Francisco: Institute for Contemporary Studies.
- Ong, Shao-Er. 1984. "Development of the Small Farm Economy in Taiwan, A Program of World Significance." Taiwan: The Council of Agriculture, Executive Yuan.
- Rada, E. L., and T. H. Lee. 1963. "Irrigation Investment in Taiwan." *Economic Digest Series No. 15*. JCRR (February).
- Ranis, Gustav. 1979. "Industrial Development." In *Economic Growth and Structural Change in Taiwan*, ed. Walter Galenson. Ithaca, N.Y.: Cornell University Press.
- Ranis, Gustav, and Chi Schive. 1985. "Direct Foreign Investment in Taiwan's Development." In *Foreign Trade and Investment: Economic Development in the Newly Industrializing Countries*, ed. Walter Galenson. Madison: University of Wisconsin Press.
- Schive, Chi. 1987. "Trade Patterns and Trends of Taiwan." In *Trade and Structural Change in Pacific Asia*, ed. Colin I. Bradford and William H. Branson. Chicago, Ill.: University of Chicago Press.
- . 1990a. "Linkage: Do Foreign Firms Buy Locally?" *Asian Economic Journal* 4 (March).
- . 1990b. *The Foreign Factor: The Multinational Corporation's Contribution to the Economic Modernization of the Republic of China*. Stanford, Calif.: Hoover Press.
- . 1990c. "The Next Stage of Industrialization in Taiwan and Korea." In *Development Strategy between Latin America and East Asia*, ed. D. K. Wyman and G. Gereffi. Princeton, N.J.: Princeton University Press.
- Schive, Chi, and Badiul Majumdar. 1990. "A Direct Foreign Investment and Linkage Effects: The Experience of Taiwan." *Canadian Journal of Development Studies* 11 (2).
- Schive, Chi, and Cheng-hwa Tu. 1991. "Foreign Firms and Structural Changes in

- Taiwan." In *Direct Foreign Investment in Developing Economics and Structural Change in the Asia-Pacific Region*, ed. Seiji Naya and Eric D. Ramstetter. Boulder: Westview Press.
- Schultz, T. W. 1964. *Transforming Traditional Agriculture*. New Haven, Conn.: Yale University Press.
- Scitovsky, Tibor. 1986. "Economic Development in Taiwan and South Korea, 1965–1981." In *Models of Development*, ed. Lawrence J. Lau. San Francisco, Calif.: Institute for Contemporary Studies.
- Scott, Maurice. 1979. "Foreign Trade." In *Economic Growth and Structural Change in Taiwan*, ed. Walter Galenson. Ithaca: Cornell University Press.
- Shei, S. Y. 1988. "Agricultural Foundation for Industrial Development." Proceedings of the conference on economic development experiences of Taiwan and its new role in an emerging Asia-Pacific area. Taiwan: The Institute of Economics, Academia Sinica.
- Shen, T. H., ed. 1974. *Agriculture's Place in the Strategy of Development: The Taiwan Experience*. JCRR (July).
- Taiwan, Council of Agriculture. 1989a. *Agricultural Production Statistics Abstract, Taiwan District, the Republic of China*. Taipei.
- . 1989b. *Taiwan Statistical Data Book*. Taipei: Council for Economic Planning and Development, Executive Yuan.
- Thorbecke, Erik. 1979. "Agricultural Development." In *Economic Growth and Structural Change in Taiwan*, ed. Walter Galenson. Ithaca, N.Y.: Cornell University Press.
- Wang, Y. T., and H. H. Chen. 1981. "Strategies of Technological Progress in Taiwan's Agricultural Development." Proceedings of the conference on experiences and lessons of economic development in Taiwan. Taiwan: The Institute of Economics, Academia Sinica.
- Wu, R. I., and C. F. Wanglian. 1988. "Economic Evaluation of Rice Policy in Taiwan." Proceedings of the conference on directions and strategies of agricultural development in the Asia-Pacific region. Taiwan: The Institute of Economics, Academic Sinica.
- Wu, T. C. 1988. "Directions and Strategies of Agricultural Development in Taiwan." Proceedings of the conference on directions and strategies of agricultural development in the Asia-Pacific region. Taiwan: The Institute of Economics, Academic Sinica.
- Yin, K. Y. 1954. "A Discussion on Industrial Policy for Taiwan." *Industry of Free China* 1 (5).
- Yu, Y. H. 1978. "The Accelerated Rural Development Program in Taiwan." Agricultural Economic Research Papers, Economic Digest Series No. 23. Taiwan: JCRR, October.