THE ROLE OF THE AGRICULTURAL SECTOR IN TAIWAN'S ECONOMIC DEVELOPMENT

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ABSTRACT

THE ROLE OF THE AGRICULTURAL SECTOR IN

TAIWAN'S ECONOMIC DEVELOPMENT

by Charles Hsi-chung Kao

The role of the agricultural sector in Taiwan's economic development was examined, following Kuznets, in three aspects, i.e., product, market and factor, with special reference to the post-war period.

The product aspect of the agricultural sector was analyzed in two periods: 1901-40 and 1945-62. It was concluded that the means used in increasing the crop yields in 1901-40 provides "an example of the Japanese approaches applied in a different setting." But this achievement was not attained by merely employing resources that had low opportunity costs as Professor Bruce Johnston claims. Two modern inputs: fertilizers and irrigation, were used at quite high costs.

Further progress was made in agriculture during the post-war period. The total agricultural production increased at an average growth rate of 4.9 percent per year in 1953-60, well exceeding the high population growth of 3.5 percent per year. Such a rapid increase is not accidental. The government's "balanced growth" policy embedded in the three Four-Year Development Plans, with the cooperation of Joint Commission on Rural Reconstruction, Farmers' Associations, and last but not least, farmers, seem to be key factors. Within this framework the factors responsible for the increased agricultural output include irrigation, fertilizers, seed improvement, agricultural extension service, agricultural credit, diseases and pest control, land reform, and U.S. economic aid. By using regression

analysis, it was found that there was a significant relationship between irrigation, fertilizers and the unit yield of rice at the 99 percent level of confidence.

The market aspect of the agricultural sector was analyzed in terms of selling agricultural products to the domestic and international markets, and purchasing farm inputs and consumer goods from the non-agricultural sector. The discussion on this aspect was closely related to the changing structure of the economy as a whole.

The factor aspect of the agricultural sector essentially involves a transfer of capital and labor. The items of capital transfer include the low government purchasing price of rice, the high government exchange price of fertilizers to rice, the land tax, agriculture's share in domestic capital formation and in earning foreign exchange. The second type of transfer is labor migration. The estimated out-migrants from agriculture were about 350,000 persons during 1951-60. If the past investment in each out-migrant is assumed to be NT $5,000, then the contribution made by the agricultural sector during this period amounted to NT$ 1.75 billion.

The three aspects (contributions) of agriculture to economic development were also measured by using Kuznets' formulas. These estimations confirm Kuzents' conclusion that agriculture, strategic in the early phase, diminishes in relative weight in the economy as a whole in the process of development.

Two important policy implications drawn from this thesis are (1) Taiwan's empirical success in following a "balanced growth" approach in economic development, and (2) the existence of large potentials for improving agricultural productivity either by applying known methods or by the introduction of the non-conventional inputs.

THE ROLE OF THE AGRICULTURAL SECTOR IN TAIWAN'S ECONOMIC DEVELOPMENT

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CHAPTER I

INTRODUCTION

The Problem

The role of the agricultural sector in the process of economic development has been a controversial issue in the post-war development literature, as well as in the policy field. It is argued, on the one hand, by Kuznets, Nicholls, Rostow, etc. that the increase in agricultural productivity is a pre-condition for economic development. On the other hand, Leibenstein, Hirschman and others "almost exclusively emphasize the importance from the outset of the heaviest possible commitments to industrial development."[1] Such arguments cannot be settled or reconciled unless the role of the agricultural sector in the process of economic development in one or more specific countries is analyzed.

Up to now, much has been debated but too little has been devoted to analyzing the role of the agricultural sector in the process of economic development for a developing country. Thus to fill an empirical void, an analysis of the Taiwan (Formosa) experience is selected. It is selected because Taiwan has achieved considerable success, both in agricultural and general development, despite limited resources

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[1]William H. Nicholls, "The Importance of an Agricultural Surplus in Underdeveloped Countries," Presented as the J. S. McLean Memorial Lecture at Ontario Agricultural College, (January 1962), p. 3.

and high population pressure. As Parker and Hendrix point out,[2]

> In many ways, Taiwan is of larger interest than Japan as an example of modern agricultural progress. For in contrast to Japan's more temperate climate, Taiwan has subtropical monsoon climate much more like that of the Philippines, Thailand, and other South Asian countries. Taiwan also started much later than did Japan to improve its agriculture. Too, like most of the newly developing countries, it still has mainly an agrarian economy with agriculture accounting for about two-thirds of its national income[3] and 90 percent of its exports and providing employment of more than half of its people.

In addition, Johnston's study shows that the historical experience of Taiwan demonstrates the substantial potential that exists for raising farm output and productivity by techniques that rely mainly on the use of resources that have low opportunity cost.[4] The choice of Taiwan is also dictated by the availability of relatively reliable statistical data and the author's own background in that area.

As of 1959, Taiwan ranked 30th among 95 lesser-developed nations in terms of gross national income, and 50th in terms of per capita income. In recent years, from 1953 to 1960, agricultural production expanded at an average rate of 4.3 percent per year. It surpassed the high annual growth rate of population at about 3.5 per cent. During the same period the production of rice, the major agricultural product, increased by 16

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[2]Frank W. Parker and W. E. Hendrix, "Foundations for Agrarian Development," Prepared for delivery before the Rural Development Symposium, Central Treaty Organization Countries, Tehran, Iran, (September 1963), p. 9.

[3]It is not correct to say that agriculture still accounted for two-thirds of its national income. It has constituted 40-30 percent of national income since 1950.

[4]Bruce F. Johnston, "Agricultural Development and Economic Transformation: A Comparative Study of the Japanese Experience," Food Research Institute Studies, Vol. 3, (November 1962), pp. 223-274.

percent while the yield per hectare (1 hectare = 2.47 acres) rose by 18 percent. The annual value of exports of agricultural and processed agricultural products represented 93 percent and 68 percent of total export value in 1953 and 1960, respectively. Also in 1960, 33 percent of national income originated in agriculture and a little less than half of the total population was engaged in agriculture. These figures illustrate that agriculture has been an important sector in the over-all economy. Taiwan's agriculture, however, has also encountered numerous difficulties--small size of farm, large size of farm family, unstable prices of agricultural exports and limited employment opportunities outside the agricultural sector, to name a few.

Thus the problem in the present study is to assess the role of the agricultural sector--not only in terms of its contributions but also in terms of the problems encountered. The present empirical study then will be able to throw some light on the currently debated issue of the role of the agricultural sector in developing countries. It may also prove useful in suggesting agricultural policies for other developing nations.

Objectives

The over-all objective is to examine the changes in the role of agriculture as it relates to development in Taiwan, primarily during the post-war period: 1946-62. However, wherever the data permit or long-run analysis is warranted, earlier periods will also be analyzed. More specific objectives are to:

1. Analyze the product aspect of the agricultural sector and factors affecting the increased agricultural output, in the period 1901-40 and 1946-62.

2. Examine the market aspect of the agricultural sector as it

relates to the structural changes of the economy.

3. Investigate the factor aspect of the agricultural sector.

4. Draw some policy implications for other developing countries.

The terms: "product, market, and factor aspects" will be explained in the section on "methodological issues."

Sources of Data

The present study is based on secondary data at the macro level. Most of the basic information was obtained from various publications--yearbooks, research reports, manuscripts, articles, etc.--published mostly by the Joint Commission on Rural Reconstruction (JCRR hereafter), Industry of Free China (a monthly Journal) and the Department of Agriculture and Forestry, Taiwan Provincial Government. Data are generally adequate, but there are still some statistical problems. The national income data are not available before 1950. The labor force data before 1950 are fragmentary. Production data of the pre-war period might be subject to some biases. Other economic and financial data are often fragmentary and the periods covered are not always long enough to show real trends. All these problems make it difficult to apply any sophisticated approaches. Despite these shortcomings, Taiwan probably has better data than other developing nations.

Currently, there are four important publications which deal with various aspects of Taiwan's economic development during various periods of time. Johnston studies the agricultural development in Taiwan (1901-40) in summary fashion and in contrast to Japanese agricultural development.[5] Hsieh and Lee's study concentrates on the production side of

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[5] Ibid.

agriculture during the period 1910-56.[6] Liu's unpublished Ph.D. dissertation examines certain aspects of agriculture with special emphasis on the sugar industry since 1950.[7] A more recent study by the United Nations analyzes the interrelationships between agricultural and industrial development in the period 1953-60.[8] None of them, however, examines explicitly the role of the agricultural sector in terms of the three interrelated product, market and factor aspects. This is another main reason why the present study emphasizes these aspects, which have not been fully explored in the past.

Methodological Issue

The essential methodological question raised in this thesis is: How can the role of the agricultural sector be adequately understood in the process of economic development? This is indeed a broad question to tackle. In actual empirical studies, due to the limitation of data and timing, this question often becomes more specific but still meaningful: What contributions has the agricultural sector made during a given period of time in a given country? The term "agricultural sector" is usually used in a limited sense referring mainly to farm crops. We will use this definition throughout the study. A number of economists have discussed the

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[6] S. C. Hsieh and T. H. Lee, An Analytical Review of Agricultural Development in Taiwan--An Input-Output and Productivity Approach, JCRR, Economic Digest Series, No. 12, (1958).

[7] W. P. Liu, An Economic Analysis of Taiwanian Agricultural Development Since 1950, Unpublished Ph.D. Dissertation, University of Minn., (July 1961).

[8] "Relationship Between Agricultural and Industrial Development: A Case Study in Taiwan, China, 1953-60," Economic Bulletin for Asia and The Far East, Vol. XIV, No. 1, (June 1963).

contributions of the agricultural sector to economic development theoretically. More commonly used are the Kuznets and Johnston-Mellor analyses.[9] Kuznets points out that agriculture can make three contributions, i.e., product, market and factor. These three contributions, if simply stated, mean that "if agriculture itself grows, it makes a product contribution; if it trades with others, it makes a market contribution; if it transfers resources to other sectors, these resources being productive factors, it makes a factor contribution."[10] Johnston and Mellor list five contributions: (1) providing food supply; (2) enlarging agricultural exports; (3) transferring manpower from the agricultural to non-agricultural sector; (4) increasing capital formation; and (5) increasing rural net cash income as a stimulus to industrialization.

In a recent paper, Witt discusses these two approaches and states, "Johnston-Mellor concentrates on the cross-sectoral transactions, including factors, products and money," and "Kuznets points to three rather than five contributions and considers them more in relation to economic development in general than to other sectors."[11] In addition, more emphasis is given to the structural changes in Kuznets' framework than in Johnston-Mellor's. For these two reasons, Kuznets' approach will be

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[9]Simon Kuznets, "Economic Growth and the Contribution of Agriculture: Notes on Measurements," reprinted in Carl Eicher and Lawrence Witt, Agriculture in Economic Development, McGraw-Hill, (1964), pp. 102-119; Bruce F. Johnston and John W. Mellor, "The Role of Agriculture in Economic Development," American Economic Review, Vol. 51, (September 1961), pp. 556-593.

[10]Kuznets, op. cit., p. 114.

[11]Lawrence Witt, "Role of Agriculture in Economic Development," paper presented at a seminar with the same title at Purdue University, (May 14, 1964), pp. 9-10.

adopted. However, in considering the contribution of agriculture, we should recognize an element of ambiguity. As Kuznets warns us,

> "Since any sector is part of an inter-dependent system represented by the country's economy, what a sector does is not fully attributable or credited to it but is contingent upon what happens in the other sector, (and perhaps also outside the economy.)" But Kuznets also reminds us, "so long as we keep the semantic caution in mind, and remember that the capacity of a sector to 'contribute' depends not upon the sector alone, no harm is done by retaining this familiar expression."[12]

This may be further supplemented by saying that it takes two to make a contribution--the contributor (say, the agricultural sector) and the recipient (say, the non-agricultural sector). For unless the recipient can use the transfer (say, farm labor), no contribution is being made. Our primary attention is given to the contributor. For the purpose of keeping the thesis in a more general scope, in some cases the word "aspect" is used to substitute for "contribution." Thus Kuznets' three contributions often become product, market and factor aspects. It is believed that the role of the agricultural sector will be adequately understood by examining these three aspects.

It will be noted later that rice is often chosen as a prime example to illustrate the role of agriculture. This is because in many respects, rice production is strategic for Taiwan's agriculture. Eighty percent of farmers are rice farmers. Being the basic crop, it takes up the best land and is central in crop patterning. It absorbs most of the time of the farm family. The utilization of land and labor is focused on rice-growing, and the production of other crops is subordinated to that of the main staple.

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[12] Kuznets, op. cit., pp. 104-105.

Procedure

Since economists are far from unanimous as to the role of the agricultural sector, this results in conflicting policy prescriptions on economic development strategy. Chapter II reviews the modern economists' position on the issue of agricultural vs. industrial developement. Economists who have expressed their opinion on this issue are, at the risk of some over-simplification, classified into three groups.

The first group includes those who emphasize that priority should be given to the agricultural sector in the early stage of development, or that agriculture is not inherently inferior to industry.

The second group, often called the "big-push" group, includes those who, while recognizing the need for raising agricultural productivities, seem to argue that industrialization should receive top priority. But each of them provides different justifications.

The third group emphasizes the simultaneous development between agriculture and industry. A familiar but often misleading term of this concept is called "balanced growth."

The diversified as well as conflicting points of view on the role of the agricultural sector in a developing country among economists illustrates the urgent need for more empirical studies in this area.

As Johnston points out, "The Taiwanese experience is interesting as an example of the Japanese approach to agricultural development in a different setting,"[13] a brief review of the Japanese case, therefore, is made in Chapter II with special emphasis on the means of achieving and sustaining agricultural development.

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[13]Johnston, op. cit., p. 252.

Chapter III presents a general background of Taiwan's economy. Chapters IV, V, and VI are the main body of the thesis. Three aspects of the agricultural sector are analyzed in these three chapters, respectively.

Chapter IV provides an historical review of the product aspect of the agricultural sector in Taiwan. It covers two distinct periods: the pre-war period, 1901-40, or the period under the Japanese occupation; and the post-war period, 1946-62. An analysis is then made to examine those factors which affected the increased agricultural output. After examining these factors, the crucial variables which are most responsible for the increase in agricultural output are expected to be identified. Regression analysis will be used to test the significant relationship between fertilizers and irrigation and unit yield of rice. An effort is also made to measure the product contribution of agriculture to the growth of total output by using Kuznets' formula.

Chapter V analyzes the market aspect of the role of the agricultural sector. This includes an analysis of selling agricultural products at home and abroad, and of purchasing farm inputs and consumer goods from the non-agricultural sector, and an estimation of the magnitude of agricultural marketization.

In the next chapter, the factor aspect of the agricultural sector is analyzed, which includes two factors: capital and labor.

The last chapter summarizes the main findings of the thesis and suggests some policy implications for other developing nations.

CHAPTER II

REVIEW OF LITERATURE

Our review of literature will focus on two issues: First, the modern economists' position on the issue of agricultural vs. industrial development. Second, the relevancy of the methods used in Japanese agricultural development to underdeveloped countries, particularly to Asian countries. Both issues are crucial to the present study. The first one will enable us to recognize the complex nature of this issue. It thus helps prevent us from being biased in any one direction in the discussion of the role of the agricultural sector. The second one will provide for the developing nations a "workable" and "relevant" model, as some economists argue, either to imitate or compare, or both.

Modern Economists' Position on the Issue of Agriculture vs. Industrialization

In discussing the role of agriculture in underdeveloped countries, economists are far from unanimous as to its role in the early process of economic development. Some economists give the top priority to the agricultural sector; others argue that the industrial sector should proceed first; and still others advocate the principle of simultaneous growth. The issues surrounding this subject often have been discussed in terms of the dichotomy of agricultural versus industrial development. It is pointed out by Johnston and Mellor that such a dichotomy is false

because it is their contention that "balanced growth" is needed.[1] Nicholls realizes that "rising agricultural productivity and industrial development clearly have much to contribute to each other" and "some consideration of 'balance' is unavoidable." Nevertheless, he indicates that[2]

> It is easy to say that the answer lies in the balanced agricultural and industrial development. In practice, however, the underdeveloped country faces the dilemma that, because its economic resources are by definition severely limited, their allocation according to the criterion of balance may spread them so thin that they are below certain crucial minimum levels which must be exceeded if productivity and income are to be raised in any direction. Under such difficult circumstances, it is not possible to avoid policies which seek to promote, in the short run at least, rather different rates of development in (say) the agricultural and industrial sectors.

As suggested earlier, economists who have expressed their opinion on this issue are classified into three groups. The first group stress that priority should be given to the agricultural sector in the early stage of development or that agriculture is not inherently inferior to industry. The second group argues that industrial development should receive more emphasis than agriculture. The third group advocates the simultaneous growth between the agricultural and industrial sector. Such classification, needless to say, is not a matter of black and white but of different shades of gray. In what follows, we will let each speak for himself; the contrasts will stand out sharply and will lead us to a clear recognition of the diversified point of view involved in assessing the

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[1]Bruce Johnston and John W. Mellor, "The Role of Agriculture in Economic Development," op. cit., pp. 556-590.

[2]William H. Nicholls, "The Role of Agriculture in Economic Development," reprinted in Carl Eicher and Lawrence Witt, Agriculture in Economic Development, McGraw-Hill, (1964), p. 14.

role of agriculture in the process of development.

The First Group

An increasing number of economists falls into this group. They are Viner, Rostow, Coale, Hoover, Kuznets, Nicholls, and Oshima. (The list follows the order of the date of their publications.) As early as in 1952, Viner points out:[3]

> In many countries, the most promising field for rapid economic development lies in agriculture...There are no inherent advantages of manufacturing over agriculture, or for that matter, of agriculture over manufacturing...

He tries to destroy the notion that agriculture is necessarily associated with poverty and industrialization is necessarily associated with prosperity. Thus he reaches the conclusion:[4]

> As long as a country has a comparative advantage in the expansion of agriculture over the expansion of manufacturing the investment in their own estates of their savings by rural landowners may be the most productive and the most efficient investment under way in the national economy.

Rostow recognizes three distinct major roles that agriculture must play in the transitional process between a traditional society and a successful take-off. First, agriculture must supply more food. Second, agriculture must finance the government's economic development plan and third, agriculture must yield up a substantial part of its surplus income to the modern sector.[5] In a recent paper, Rostow makes his point even

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[3]Jacob Viner, International Trade and Economic Development, Free Press, (1952), p. 72.

[4]Ibid., p. 135

[5]W. W. Rostow, The Stages of Economic Growth, A Non-Communist Manifesto, Cambridge University Press, (1960), p. 30.

stronger:[6]

> Radical improvement of agriculture in Asia, Africa, and Latin American is, I am convinced, a fundamental condition for the maintenance of a high rate of development in those regions, especially their industrial development.

Next, judging from the Indian experience, Coale and Hoover conclude that "Very substantial progress in that most backward part of the economy (agriculture) was a prerequisite to successful development of the Indian economy as a whole." They further point out:[7]

> Structural interrelations between agriculture and the rest of the Indian economy are likely to be such that if one sector limits the growth of the other, it is more likely to be a case of agricultural growth limiting non-agriculture than vice versa. The relationship between these rates of growth is, however, a flexible one.

In 1959, based on his comprehensive studies on industrial structure of labor force and national product both in developed and underdeveloped countries, Kuznets reaches the now widely-quoted conclusion:[8]

> It is a pre-condition of industrialization as a world-wide phenomena that productivity of labor in agriculture increases sufficiently to feed, at higher per capita levels, a larger proportion of the labor force than could be fed before. And as our estimates have shown, in most of the developed countries, product per worker in the agricultural sector increased more than product per worker in the rest of the economy combined. At the danger of stressing the obvious, one may claim that an agricultural revolution -- a marked rise in productivity per worker in agriculture -- is a pre-condition of the industrial revolution for any sizable region in the world.

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[6]W. W. Rostow, "Agriculture's Role in Economic Development," Foreign Agriculture, Vol. 1, No. 35, (September 1963).

[7]Ansley J. Coale and Edgar M. Hoover, Population Growth and Economic Development in Low-Income Countries: A Case Study of India's Prospects, Princeton University Press, (1958), pp. 120-139.

[8]Simon Kuznets, Six Lectures on Economic Growth, Glencoe, Illinois, (1959), pp. 59-60.

It was not until 1960 that a coherent thesis of the importance of agriculture in the early stages of development was presented by Nicholls. He strongly states:[9]

> Until underdeveloped countries succeed in achieving and sustaining (either through domestic production or imports) a reliable food surplus, they have not fulfilled the fundamental precondition for economic development.

He also draws some lessons from the Western countries. First, the existence of a substantial agricultural surplus is a precondition for industrial development. Second, neglecting agriculture may have serious repercussions on the rate of general economic progress. Third, "too rapid a restructuring of a small-scale peasant agriculture into large scale, mechanized farm units is likely to create a surplus labor force not easily absorbed into non-agricultural employment."[10]

Oshima, in 1962, argues that an "agriculture-first" policy is needed in view of the present situation in Asia. He suggests the following policy prescription:[11]

> An economic development program should meet many-sided needs. It cannot focus only on growth rates of national income or external economies or "balance" or food requirements. Problems of overpopulation and unemployment, very low incomes, excessive urbanization, "unproductive" investment patterns, food supply, and international trade, as well as certain social and political implications, must all be taken into account. In view of all these problems besetting Asian countries at their present stage of development, it is premature to adopt a policy favoring industrialization. For the present period, a plan to develop the rural sectors, especially to overcome the stagnation in agriculture, should be the prime objective of public policy, leaving industrialization to private capital. Such a program should be

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[9]Nicholls, op. cit., p. 40.

[10]Ibid., pp. 24-26.

[11]Harry T. Oshima, "A Strategy for Asian Development," Economic Development and Cultural Changes, Vol. 10, (April 1962), pp. 302-308.

> continued for a decade or so, until such time as full employment is reached, and the rural sector has "taken-off." After this, there can be a switch to a policy of speeding up industrialization and urbanization.
>
> In the long run, an "agriculture-first" policy may be the key to the "take-off" of first the agricultural sector, and then in the next stage the non-agricultural sector, as was the case in the West.

The Second Group

Economists included in this group are Leibenstein, Higgins, Hirschman, Prebisch, and Singer. They, while recognizing the need for raising agricultural productivities, seem to argue that industrialization should receive top priority but each of them provides different justifications.

Leibenstein's position is that the agricultural environment is generally not conducive to economic development. It is not conducive to the creation or expansion of an entrepreneurial class, the creation of new skills and techniques or the expansion of such skills, and the spread of knowledge and the creation of an intellectual atmosphere that leads to technical innovation and inventions. He concludes:[12]

> In sum, the growth agents are more likely to be stimulated in an urban, industrial setting rather than in an agricultural environment.
>
> The mere fact that it often appears that the initial marginal productivity is greater in agriculture than elsewhere does not necessarily imply that the correct investment policy is to concentrate on agricultural investment.

Higgins is generally classified into this group. At one point he argues that the only means to a "cumulative improvement in agricultural

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[12]Harvey Leibenstein, Economic Backwardness, and Economic Growth, John Wiley, N.Y., (1957), pp. 263-264.

productivity" is a public policy "designed to make labor relatively scarce in agriculture by simultaneously shifting to a more mechanized and large-scale agriculture encouraging a rapid rate of industrialization." Nicholls interprets his position and concludes "the logic of Higgins' position necessitates emphasis on industrialization since, without it, land consolidation and farm mechanization could hardly increase the scarcity of labor."[13] However, with a sympathetic interpretation of his statements elsewhere, he may not be as strong a proponent of the "big-push" as may at first appear. In his own words:[14]

> Neither agricultural improvements on the present holdings nor industrialization will, by itself, break through the particular vicious circle.
>
> In short, economic development is tantamount to getting people out of peasant agriculture. Cumulative growth comes spontaneously only when labor becomes scarce in agriculture ... Industrialization is unlikely to produce the desired results.
>
> So far as industry versus agriculture is concerned, it is not a question of balanced growth or unbalanced growth, but one of balanced growth or no growth at all.

Hirschman applies the concept of linkage effect to favor industrialization in the early stage of development. He indicates that industries with the greatest linkage effect (i.e., linked to other industries either in the purchase of input or sale of outputs measured in input-output tables) should be developed first. Since agriculture is low in linkage effect, and since the industries of complex chemical, machine tool, steel, etc. are highest, then it follows that such industries of high

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[13]Nicholls, op. cit., p. 16.

[14]Benjamin Higgins, Economic Development, W. W. Norton and Co., New York, (1959), pp. 343 and 455.

linkage effect should be given high priority. It is Hirschman's position that the linkage effect argument is much more powerful than the argument of comparative productivity. He writes:[15]

> The case for inferiority of agriculture to manufacturing has most frequently been argued on grounds of comparative productivity. While this case has been shown not to be entirely convincing, agriculture certainly stands convicted on the count of its lack of direct stimulus to the setting up of new activities through linkage effects; the superiority of manufacturing in this respect is crushing. This may yet be the most important reason militating against any complete specialization of underdeveloped countries in primary production.

Oshima recently comments on the linkage effect and states, "this argument is only plausible if one grants the validity of his assumption that 'entrepreneurship is not lacking,' that 'industrial skills can be learned by any people,' and that savings are not insufficient."[16] Witt also points out that Hirschman does not adequately consider the food and food processing and marketing linkages in the agricultural sector, thus underestimates the linkage effect of agriculture.

Another supporter of the idea of the genetic inferiority of primary production compared to industry is Prebisch.[17] His argument runs as follows: Improvements in agriculture lead to greater outputs and therefore relatively lower prices. Improvements in industry, where labor is more easily organized and producers can combine more easily to administer prices, lead rather to higher wages and profits while prices are maintained or increased. Therefore a country which specializes along

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[15]Albert O. Hirschman, The Strategy of Economic Development, Yale University Press, New Haven, (1960), pp. 109-110.

[16]Oshima, op. cit., p. 315.

[17]Raul Prebisch, "The Role of Commercial Policies in Underdeveloped Countries," American Economic Review Papers and Proceedings, (May 1959); see also The Economic Development of Latin American and Some of its Problems, N.Y., (1949).

agricultural lines finds the prices of its exports falling relatively to those of its imports. In other words, the terms of trade move unfavorably to the primary-producing countries.

Thus Prebisch suggests the policy of import substitution and industrialization for Latin American countries. As a result of this deliberate policy, agriculture is neglected in some Latin American countries. Prebisch insists that the industrialization of Latin American is not incompatible with the efficient development of primary production. The mere fact, as Meier puts it, however, is that "although aggregate agricultural production has increased since the pre-war period, the rate of growth has not kept pace with the industrial expansion or population growth."[18] The result is "on the side of foreign trade, the retardation in the agricultural sector has resulted in a substantial increase in food imports and a restraint on the expansion of some exports."[19]

A very similar argument was advanced at about the same time by Hans Singer of the UN Department of Economic Affairs.[20] Their argument is often termed as Prebisch-Singer thesis. The policy prescriptions provided by Prebisch and Singer have been critically refuted by Meier,

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[18]Gerald M. Meier, "Export Stimulation, Import Substitution, and Latin American Development," Social and Economic Studies, Univ. College of West Indies, Vol. 10, No. 1, (March 1961), p. 58.

[19]Ibid., p. 59.

[20]Hans Singer, "The Distribution of Gains Between Investing and Borrowing Countries," AER Papers and Proceeding, (May 1950), pp. 473-485.

Harberler, Baer, and many others.[21]

The Third Group

Nurkse, Lewis, Witt, Johnston and Mellor fall into this group who emphasize the simultaneous development between agriculture and industry. A familiar but often misleading statement of this concept is called "balanced growth."

A now-considered classical book in development literature was written by Nurkse in 1953. He advocates "a frontal attack...a wave of capital investments in a number of different industries," which he called "balanced growth."[22] To escape the "vicious circle," he suggests the only way out of the dilemma is "more or less synchronized application of capital to a wide range of different industries. Here is an escape from the deadlock; here the result is an over-all enlargement of the market... The case for "balanced growth" rests on the need for a "balanced diet." This is the essence of the argument of balanced growth. He also points out "improved farm productivity is the basic need in the early stage of development."[23] However, in comparing two cases: an under-populated and over-populated countries Nurkse provides different policy prescriptions.

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[21]Gottfield Harberler, International Trade and Economic Development, National Bank of Egypt, Cairo, (1959); Werner Baer, "The Economics of Prebisch and ECLA," Economic Development and Cultural Change, Vol. X, No. 2, (January 1962), pp. 169-182.

[22]Ragnar Nurkse, Problems of Capital Formation in Underdeveloped Countries, Oxford: Basil Blackwell and Mott, Ltd., (1953), p. 5.

[23]Ibid., p. 141.

It seems to Nurkse that in an underpopulated country an increase in agricultural productivity is particularly important. It should have priority over everything else.[24] For an overpopulated country, he states:[25]

> In overpopulated peasant countries agricultural improvements are not, in my view, a logically primary condition of economic advance. They should not be neglected; they are extremely important in practice...and yet it seems plausible to mention that drastic improvements in farming methods are not the first crucial prerequisite in the initial stages of economic progress in a society endowed with large reserves of surplus labor on the land.

Thus, Witt comments, "for the former he could be categorized as industry first, for the latter as agriculture first. This certainly is one type of balance but it is not the type considered here."[26]

In his well-known article,[27] Lewis concludes that countries with inadequate agricultural resources relative to their population (India, Japan, Egypt, the United Kingdom) should export manufactures and import agricultural products. It is impossible to imagine India as a truly efficient agricultural country, but it is easy to see India as an efficient producer of steel and textiles. This kind of misallocation of resources occurs in many underdeveloped countries.[28] Lewis' position, however,

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[24] Ibid., p. 52.

[25] Ibid., p. 54.

[26] Witt, "Role of Agriculture in Economic Development," op. cit., p. 5.

[27] Arthur Lewis, "Economic Development with Unlimited Surplus of Labor," The Manchester School, Vol. XXII, (May 1954), pp. 139-191.

[28] Cf. Higgins, op. cit., p. 357

cannot be just simply interpretated as favoring industrialization at the expanse of the agricultural development. In his book,[29] published one year later, he recognizes that the increase in agricultural productivity is one of the conditions for economic growth. He further states the interrelationship between agriculture and industry:[30]

> If agriculture stagnates, the capitalist profits remain a small part of the national income, and saving and investment are correspondingly small. Smooth economic development requires that industry and agriculture should grow together... Innovation in one sector of the economy is checked unless other sectors expand appropriately.

In accordance with the belief that adequate food supply is essential in the process of economic development, Witt becomes one of the pioneers in studying the new facet of "surplus farm product disposals" in recent years. He argues that American surplus farm commodities have made and can make a contribution to economic development and a higher level of consumption and welfare in the recipient countries.[31]

In a recent paper, Witt explicitly points out that agriculture is an intimately inter-related sector in the development process. "It (agriculture) has a role to play, but so do other sectors. A 'balance' of effort is needed, whatever that may be."[32]

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[29]W. Arthur Lewis, The Theory of Economic Growth, George Allen and Unwin, (1955).

[30]Ibid., p. 277.

[31]Lawrence Witt and Carl Eicher, "The Effects of United States Agricultural Surplus Disposal Programs on Recipient Countries," Research Bulletin 2, Agricultural Experiment Station, Michigan State University, (1964), p. 63.

[32]Lawrence Witt, "Role of Agriculture in Economic Development," op. cit., p. 4.

The names of Johnston and Mellor are often associated with their writing on the role of the agricultural sector. Nevertheless, they do not advocate the policy of "agriculture-first" as one may expect. The following statement made by them summarizes their position clearly:[33]

> Although this paper has stressed the importance of agriculture's role in development, we part company with those who draw the inference that agricultural development should precede or take priority over industrial expansion... It is our contention that 'balanced growth' is needed in the sense of simultaneous efforts to promote agricultural and industrial development.

The foregoing review of recent literature reflects the conflicting and diversified views of economists as to the role of the agricultural sector in the early stage of development. It is hoped, however, that experience learned from the present study will contribute to resolving some of the differences.

A Comparable Case: Japan[34]

A survey of the literature of Asian development indicates that no systematical empirical studies on the role of the agricultural sector are available. The only exception probably is Japan. Fortunately enough,

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[33]Johnston and Mellor, op. cit., p. 590.

[34]In writing this section, the author relied heavily on the following sources: Kazushi Ohkawa and Henry Rosovsky, "The Role of Agriculture in Modern Japanese Economic Development," Economic Development and Cultural Change, Vol. XI, No. 1, Part II, (October 1960), pp. 43-68; Bruce F. Johnston, "Agricultural Productivity and Economic Development in Japan," JPE, Vol. LIX, No. 6, (December 1951), pp. 498-513; Johnston, op. cit., Martin Bronfenbrenner, "Some Lessons of Japanese Economic Development, 1853-1938." Unpublished paper, (1960), pp. 1-31; and Nicholls, "The Place of Agriculture in Economic Development," op. cit. Lengthy footnotes are avoided.

for the present purpose, Japan is the most relevant case to examine. As cited earlier, "The Taiwanese experience is interesting as an example of the Japanese approach to agricultural development in a different setting."[35] In recent years increasing attention has been given to the process of the Japanese agricultural development. In what follows, the role of Japanese agriculture is reviewed in more summary fashion, with emphasis on her means of achieving significant agricultural development and the relevancy of this experience to the contemporary developing countries. Detailed figures of the Japanese achievements are omitted.

In the period of 1860 to 1940's, there took place a decline in the relative share of income produced and labor employed in the Japanese agriculture. The percentage of national income produced in the primary sector dropped from 64 in 1878-82 to 17 in 1938-42. The percentage of the labor force engaged in agriculture was 76 and 44, respectively, in the same periods. Both of these measures indicate the rapid transformation of the structure of the economy as an outstanding feature of the Japanese development.

As to the source of financing economic development, from the Meiji Revolution (1868) onwards, the land tax was the major financial resource for the Meiji Government: in the period from 1888-1892 the land tax accounted for 86 percent of total government revenue. The agricultural land tax formed 80 to 90 percent of the general land tax, and thus the main source of revenue had to be the net product of the farms. This contribution was made possible mainly because of the increase of productivity.

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[35]Johnston, "Agricultural Development and Economic Transformation: A Comparable Study of the Japanese Experience," op. cit., p. 252.

The land tax remained the major source of the government revenue until 1913-17. The land tax then declined to 10 percent to the period 1933-37.

During the period 1878 to 1960, about a 80-year span, total agricultural production in Japan increased almost three-fold and yields more than doubled. Production increased at a rate of 2.3 percent per year from 1880 to the first World War and dropped to 1.0 percent the inter-war period. These rates are about the same as those of the United States for the same period. After World War II the rate increased tremendously to 5.3 percent per year. Moreover, relying on Johnston's study, Nicholls concludes that the rising Japanese agricultural productivity contributed to her development in other important ways. First, it minimized the need for using foreign exchange for food imports. Second, by holding down food prices, it reduced the inflationary pressures generated by industrialization and kept wage rates favorably low relative to profits, thereby encouraging industrial production and exports. Finally, it released increasing numbers of workers who were needed in the expanding non-agricultural industries.[36]

Most economists attribute the increase in agricultural productivity and output in Japanese agriculture (1880-1940) primarily to the expanded use of commercial fertilizers, selective breeding, improved methods of water, pest control and of cultivating, transplanting, and weeding the growing plants. The reasons for the rapid increase in the rate of agricultural production after World War II, according to Ohkawa, are: an increase in the initiative, incentive and capacity of the Japanese

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[36]Nicholls, "The Place of Agriculture in Economic Development," op. cit., p. 16.

farmers; technical progress through the greater use of fertilizers and seed improvement; changes in the combination of enterprises, notably in the rapid increase of dairy cattle and other livestock enterprises; further mechanization of auxiliary operations; government programs to support land reclamation, irrigation and drainage; a government price support program; and creation of a more effective agricultural extension organization.[37]

To summarize the role of agriculture in Japan, her agricultural development was characterized by: (1) a very unfavorable man-land ratio and (2) a relatively low level of labor productivity in her early stage of development. Another characteristic is that the Japanese experience demonstrates that agricultural development made only minimal demands on three critically scarce resources--investible funds, foreign exchange, and the high calibre entrepreneurial talent which are indispensible for industrial development. In addition, Ohkawa and Rosovsky observe:[38]

> It would have to emphasize several key relations observed in Japan: an increasing trend in the subsistence level of the peasantry, increasing real wages in the industrial sector, almost balanced growth of output in agriculture and industry, high rates of saving and investment, and low capital coefficients.

Now the crucial question is: How relevant is Japanese experience for other developing countries, especially those in Asia? The answer is not unanimous. To Bronfenbrenner, "Japanese development has come to be

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[37]Kazushi Ohkawa, "Significant Changes in Japanese Agriculture Since 1945," Journal of Farm Economics, Vol. XLIII, No. 5 (December 1961), pp. 1103-1108.

[38]Op. cit., p. 66.

regarded as something of a freak which it would be useless and perhaps even injurious to emulate."[39] He gives four reasons to support his argument. First, there was a long period of the maintenance of peace and order. Second, Japan's reservoir of labor, primarily agricultural, not only was cheap but also was highly skilled along lines adaptable to modern industry. Third, Japan had a good opportunity in external trade with low tariff and less competition in the international market. Fourth, the gap separating Japanese and Western levels of living in the Meiji Era was substantially less than the existing disparity between the Western and underdeveloped countries. It is true that some of the underdeveloped countries today may not have all the advantages which Japan once enjoyed. It should also be realized, however, that the underdeveloped countries enjoy some advantages (or privileges) which Japan did not have then. For instance, the availability of more know- how, international economic aid and borrowings, international technical assistance and international commodity agreements; deliberate government economic planning; people's "development-consciousness," to name a few in common. Johnston also points out, "The advances in scientific understanding, particularly during the past century, represents a possible windfall gain for a country launching a program of agricultural program today."[40] It seems that these advantages enjoyed by the developing countries today may be greater than those once enjoyed by Japan as indicated by Bronfenbrenner. The author is inclined to accept Johnston's conclusion that "The whole

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[39] Op. cit., p. 29.

[40] Johnston, "Agricultural Development and Transformation," op. cit., p. 271.

analysis suggests that the Japanese model is particularly appropriate to Far Eastern Countries."[41] Nicholls also reaches the similar conclusion:[42]

> In my opinion, in the entire annals of world economic development, Japan's achievements are without question the most remarkable and impressive in terms of its initial handicaps and, as such still offer the best model for Asian economic development generally.

Johnston and Nicholls' conclusion becomes more convincing if we realize that the means of achieving such a remarkable record in agriculture was obtained with small direct capital outlay, with a minimum of social dislocation and government efforts in the social overhead of agricultural research and extension services. It is hoped that the analysis of Taiwan's agriculture made in the remaining chapters of this thesis will throw some light on the "Japanese approach to agricultural development in a different setting."

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[41] Johnston, "Agricultural Productivity and Economic Development in Japan," op. cit., p. 512.

[42] "The Place of Agriculture in Economic Development," op. cit., p. 14.

CHAPTER III

GENERAL BACKGROUND OF TAIWAN'S ECONOMY

Natural Environment

Taiwan is a sub-tropical island located 120 miles east of mainland China. From north to south the island resembles a tobacco-leaf. It is about 240 miles long and 98 miles wide at its broadest point. In area it totals 13,855 square miles. The size is about equal to America's Massachusetts, Connecticut and Rhode Island combined. Taiwan has one of the highest population densities in the world today, averaging 770 per square mile and 3,000 per square mile of the cultivated land in 1960.

A sub-tropical climate prevails over the greater part of Taiwan, but in the southern section the climate is tropical. It is particularly suitable for rice, sugarcane -- two major crops on the island--and also well suited to sweet potatoes, tea, pineapple and many other crops. Rainfall is abundant but its distribution is not even. Earthquakes, typhoons and floods are natural hazards which often cause heavy losses of life and damage to property.

Of the natural resources, the cultivated land is 24 percent of the total land area and the soils are relatively poor. The soil fertility is diminishing because of intensive land use. Hydro-electric power is an important resource, with an estimated total of about 3.5 million Kw. Taiwan is also well-endowed with forest resources, estimated at about 240 million cubic metres. The island has a coastline of 16,000 kilometres. However, the rich fishery resources of the island's coastal waters have already been heavily exploited. Mineral resources are

poor except for coal, of which there is an estimated deposit of 200 million tons. But the cost of mining is relatively high due to the thinness of the coal seams. Other known mineral deposits include petroleum, natural gas, pyrite, gold and copper. But the quantity is insignificant and the grade is low.

Early in the present century, Taiwan was one of the Japanese colonies. With the conclusion of the first Sino-Japanese War in 1895, Taiwan was ceded to Japan. The island was restored to China in 1945, ending the half-century of Japanese occupation.

Selected Characteristics of Taiwan's Agriculture

Taiwan's agriculture is an important sector in the economy, with some common and some special characteristics. Some of them, e.g., the small size of farm and the large size of the farm family, are shared by most of the other developing Asian countries. These characteristics impose some limitations on agricultural development. Some of the other characteristics provide a great deal of stimulus to agriculture, e.g., the active role of government and farmers' associations, and the intensive use of fertilizers and land, which may not all be shared by other developing countries. This mixed type of agriculture presents both an opportunity and a challenge in the effort to speed up the rate of economic development in Taiwan. A brief review of the selected characteristics of agriculture is discussed below.

(1) Small Farm Size: The average farm size per farm family in 1960 was 1.11 hectares, which is equal to 2.74 acres. (One hectare = 2.47 acres.) The size of farm is roughly determined by the number of farm families and total acres cultivated. For the 1900-60 period,

the number of farm families increased by 100 percent against a 60 percent increase in land in farms. As shown in column 3 of Table 3.1, since 1940 there has been a declining tendency in the average size of farms due to a more rapid increase in the number of farm families than the increase of land in farms.

Table 3.1. Average size of farm and farm families, Taiwan, 1900-1960

Period	Farm families (no.) (1)	Area (ha) (2)	Average size of farm (ha) (3)	Average size of farm families (persons) (4)
1900-09	368,787	554,481	1.50	5.32
1910-19	373,164	704,248	1.89	5.95
1920-29	395,715	774,110	1.96	5.40
1930-39	417,685	833,369	2.00	6.56
1940-49	507,472	843,944	1.66	6.69
1950-59	718,628	875,070	1.22	6.29
1960	785,592	869,223	1.11	6.84

Source: E. L. Rada and T. H. Lee, Irrigation Investment in Taiwan, JCRR, Economic Digest Series, No. 15, (February), p. 18.

(2) Large Farm Family: The average size of farm family has been increasing during the period 1900 to 1960, except during the decades of the 1920's and 1950's, as shown in column 4 of Table 3.1. In 1960, the average size of the farm family was 6.84. The average man-equivalent labor force of a farm family is estimated as 3.54.[1]

[1] Report on an Investigation of Farm Economy, Department of Agriculture and Forestry, Taiwan Provincial Government, (1958), p. 9.

This illustrates that there is a high proportion of young children on the farm.

(3) Intensive Use of Land: Small farm size and large farm families necessarily lead to intensive use of land. An increase or even maintenance of level of living requires an increase in intensiveness of cultivation. The measure of the intensive use of land is reflected in column 3 of Table 3.2. The multiple cropping index steadily increased from 146 in 1946 to 196 in 1952. Then it changed a little in the range of 190 to 196 in the period 1953-58. A recent report indicates that the average double cropping index was 225 among farm record-keeping families in 1961.[2]

(4) An Active Farmers' Organization: Farmers' associations are organized on three levels: 317 township associations, 22 county and municipality associations, and 1 provincial association. In addition, five mountain district farmers' associations were added in fiscal year 1961-62. Farm families of every village in a township are organized into small agricultural units. There are 4,854 such small units, composed of 782,322 farm families. Of the total membership, 527,585 or 67.4 percent, are regular members, and 254,737 or 32.6 percent, are associate members. It has enabled the farmers, with characteristically small individual holdings, to pool their efforts and resources. This organization serves farmers in the area of credit facilities, wholesale purchasing, cooperative marketing, warehousing, agricultural extension and education. In carrying out these activities, JCRR has assisted farmers' associations in rebuilding warehouses and processing facilities, in training

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[2] Report of Farm Record-keeping Families in Taiwan, 1961, Department of Agriculture and Forestry, Provincial Government of Taiwan, Taiwan, (August 1962), p. 11.

Table 3.2 Multiple cropping index, Taiwan, 1946-1958.

Year	Cultivated area (ha) (1)	Crop area[A] (ha) (2)	Multiple cropping index (3) = $\frac{(2)}{(1)}$ x 100	Year	Cultivated area (ha) (1)	Crop area (ha) (2)	Multiple cropping index (3) = $\frac{(2)}{(1)}$ x 100
1946	831,951	1,210,914	146	54	874,097	1,694,942	194
47	833,952	1,372,904	165	55	873,002	1,659,552	190
48	863,157	1,552,120	180	56	875,791	1,707,047	195
49	864,864	1,654,409	191	57	873,263	1,706,409	195
50	870,633	1,682,201	193	58	883,466	1,730,865	196
51	873,871	1,685,946	193				
52	876,100	1,713,679	196				
53	872,738	1,700,059	195				

[A]Crop area includes the green manure and mulberry field.

Source: Annual issues of Taiwan Agricultural Yearbook, Dept. of Agr. and Forestry, Taipei.

personnel, and in service improvements. JCRR also provided technical and financial assistance to various farmers' associations in developing 4-H club program, home economics program and adult extension program. JCRR also made loans to 118 associations for implementation of a unified credit programs.

(5) Active Role of Government: Two Four-Year Agricultural Development Plans were launched by the government in 1953 and 1957, respectively, and the third one is still under way. Government at every level is devoted to the effort of improving agriculture. The most significant measures carried out by the government include land reform, irrigation, guaranteed prices for sugarcane, jute, pineapple and tobacco, agricultural extension and education, pest control, credit facilities and others. The JCRR plays an important part in rendering assistance in nearly every area and aspect of the development plans.

The Growth of the Economy in the Post-war Period

Agriculture is a part of the whole economy. There is an intimate relationship between agriculture and the general economy. Before concentrating on the agricultural sector in the later chapters, some knowledge about the general economy is needed. For this reason, some key macro variables, i.e., population and labor force, national income, national consumption, capital formation and savings -- sometimes they can be called the "indicators of economic growth" -- are selected for brief discussion

Population and Labor Force

In the beginning of this century, the total population was a little over 3 million. When Taiwan was restored to China in 1945, the total

population went up to about six million. In 1950, total population increased up to about 7.5 million. Of the increase, it was estimated about two million came from the mainland during the period 1948-50.

The average annual growth rate of population for the past decade was 3.6 percent, which is among the highest rates in the world. The data on the natural increase of the agricultural population and non-agricultural population are not available. The data in Table 3.3 indicate that the agricultural population--increased at a much slower pace than non-agricultural population and total population. During this period, the annual growth rate of the agricultural population averaged 2.5 percent as against 4.9 percent for the non-agricultural population. It is certain that much rural to urban migration has occurred.

The available information on the labor force is presented in Table 3.4. Labor is referred to as persons gainfully occupied or able and willing to work. Due to the shortage of data, the variations in gainful occupation during the year are not known.

The agricultural labor force declined from 71 percent in 1905 to 56 percent in 1960. However, the total labor force expanded considerably during the whole period from 1.4 million in 1905 to 3.3 million in 1960. The two figures together mean that the increase of the national labor force during this period was mainly contributed by the faster increase of non-agricultural labor force.

It should be pointed out that during the past decade an interesting phenomena was recorded: the absolute number of agricultural population was less than the non-agricultural population from 1957 on (Table 3.3). But the absolute amount of the labor force engaged in agriculture was still slowly increasing in the past decade except for a slight decrease

Table 3.3. Total and agricultural population for selected years, Taiwan.

(in thousands)

Year	Total	Agricultural	Percent of agricultural population to total population
1905	3,123	1,962	62.80
10	3,299	2,2087	63.25
15	3,570	2,280	63.86
20	3,758	2,227	59.25
25	4,147	2,340	56.41
30	4,679	2,534	54.16
35	5,316	2,790	54.29
40	6,077	2,984	49.10
45	-	3,366	-
50	7,554	3,998	52.93
55	9,078	4,603	50.71
56	9,390	4,699	50.04
57	9,690	4,790	49.43
58	10,039	4,881	48.62
59	10,431	4,975	47.69
60	10,792	-	-
Average annual growth rate			
1950-59	3.7	2.5	
1950-60	3.6		

Source: Data preceding 1950 were from Taiwan Agricultural Statistics: 1901-1955, JCRR, (December 1956), p. 7; data on and after 1950 were from Economic Bulletin For Asia and the Far East, Vol. 1, No. 35, (June 1963), p. 30.

in 1956 (column 2 of Table 3.4).

In this connection, Dovring's analysis of long-term changes in the composition of the labor force can be examined. He indicates that there has normally been an increase in the absolute numbers employed in agriculture during the early phase of industrialization, but a decline in absolute as well as relative numbers at a later stage.[3] Thus by using his criteria, Taiwan is still "in the early phase of industrialization." This seems to be a rather simplified conclusion.

Indicators of Economic Growth

Four key macro variables are selected for analysis, namely, national income, national consumption, captial formation, and domestic savings. Due to the lack of national income data preceding 1950, analysis is only applied to the period 1951-60.

Taiwan's real national income (i.e., at constant prices) increased from 100 in the base period 1951 to 195 in 1960 (column 2 of Table 3.5). It averaged 7.7 percent per year. Real per capita income, a more crucial indicator, increased from the base period 1951 to 145 in 1960, at an annual average rate of 4.2 percent (column 3 of Table 3.5). This means that, despite of high population growth, Taiwan still experienced a rapid increase in income per capita.

During the same period, national consumption increased at an even higher rate. It increased to about 203 in 1960 from the base period 1951, or an average of 9 percent per year (column 5 of Table 3.5).

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[3]Folke Dovring, "The Share of Agriculture in a Growing Population," reprinted in Carl Eicher and Lawrence Witt, Agriculture in Economic Development, McGraw-Hill, (1964), pp. 78-98.

Table 3.4. Labor force in Taiwan: total, agricultural, and non-agricultural, for selected years.

Year	Total labor force (1000)	Agricultural		Non-agricultural	
		(1000)	Percent of total	(1000)	Percent of total
1905	1,404	993	71	417	29
1915	1,643	1,165	71	478	29
1920	1,637	1,737	69	500	31
1930	1,790	1,212	68	578	32
1940	2,244	1,400	62	844	38
1950	2,849	1,788	62.8	1,061	37.2
1955	3,026	1,812	59.9	1,214	40.1
1956	3,015	1,806	59.9	1,209	40.1
1957	3,110	1,810	58.2	1,300	41.8
1958	3,178	1,813	57.0	1,365	43.0
1959	3,272	1,853	56.6	1,419	43.4
1960	3,344	1,877	56.1	1,467	43.9

Source: Data preceding 1950 were obtained from Bruce Johnston; "Agricultural Development and Economic Transformation: A Comparative Study of the Japanese Experience," Food Research Institute Studies, Vol. 3, (November 1962), p. 266; data on and after 1950 were cited from Economic Bulletin For Asia and the Far East, Vol. 1, No. 35, (June 1963), p. 56.

Table 3.5. Selected indicators of Taiwan's economic growth (base year 1951 = 100 and at its constant prices)

Period	GNP	National income	Per capita income	Disposable income	National consumption	Gross capital formation		Net savings	National consumption as % of disposable income	Gross capital formation as % of disposable income	Net capital formation as % of national income	Net savings as % of national income
						Total	Domestic sources					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Index: 1951 = 100									Percentage			
1951	100	100	100	100	100	100	100	100	83.8	16.2	12.0	9.1
1952	112.3	113.2	109.9	115.3	112.5	130.8	135.9	121.1	82.5	17.5	15.8	9.7
1953	124.4	130.3	122.3	130.7	125.9	157.5	144.2	110.8	84.3	15.7	14.6	7.7
1954	134.8	135.6	122.8	145.6	143.6	156.5	102.7	58.7	84.4	15.6	14.7	3.9
1955	144.9	144.0	125.4	148.6	152.2	128.9	135.2	126.8	85.3	14.7	12.7	8.0
1956	150.7	151.8	128.0	159.4	163.5	137.0	127.7	87.5	85.7	14.3	11.9	5.2
1957	161.2	162.0	132.5	175.2	177.9	160.4	141.0	88.9	84.5	15.5	13.0	5.0
1958	171.7	171.0	135.3	187.2	186.4	191.3	160.7	110.1	83.1	16.9	15.1	5.9
1959	184.5	182.8	140.1	207.3	202.9	231.7	177.7	140.2	81.6	18.4	17.1	6.9
1960[A]	196.0	195.2	144.9	-	-	-	-	-	-	-	-	-
1952-60 Average increase (%)	7.8	7.7	4.2	9.5	9.2	11.1	7.5	4.3	83.8	16.2	14.4	6.3

[A]Estimated

Source: K. Y. Yin, "Economic Development in Taiwan: Records and Prospects," Industry of Free China, Vol. XVII, No. 1, (January 1962), p. 14.

Capital formation and domestic saving, the major source of capital formation, also increased during this nine-year period. The total gross capital formation increased at an annual average of 11 percent. But domestic sources only increased at an annual rate of 7.5 percent. This indicates that foreign sources contributed about one third of the capital formation. Net savings increased at an annual average of 4.3 percent, as shown in column 8 of Table 3.5.

More insight can be gained if national consumption, capital formation and savings are all expressed as percentages of national income. They are shown in columns 10, 11 and 12 of Table 3.5. Expressed this way, national consumption comprised about 84 percent, net capital formation about 14 percent, and net savings about 6 percent, of national income, respectively. In this connection, a word can be said about Rostow's take-off. One of his three conditions required for the take-off is "a rise in the rate of productive investment from, say, 5% or less to over 10% of national income (or net national product [NNP])"[4] It is noted that the rate of Taiwan's net capital formation to national income averaged 14.4 percent during the period 1951-59. This rate was sufficient to fulfill one of Rostow's conditions on investment rate. As mentioned above, such a high rate of capital formation was, however, partly due to the large inflow of external capital in the form of U.S. aid.

A UN study based on 1953 prices indicates that the average annual growth rates of GNP and national income were 6.9 and 6.1 percent during

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[4] Rostow, The Stages of Economic Growth, op. cit., p. 39.

the period 1954-60. In the same period an average growth rate of national income per capita was 2.7. Among Asian countries, only Japan exceeded these rates of economic growth over the same period.[5]

Government Agricultural Policy

Wise government agricultural policy can influence the direction and the rate of its agricultural development. To examine the agricultural policy in Taiwan, emphasis is given to the three Four-Year Development Plans and agricultural price policy. The over-riding goal of these Development Plans has been to ensure a simultaneous growth between agriculture and industry. The former governor of Taiwan, Chen Cheng, now the Vice-President, first advocated this policy in the later 1940's and coined the now widely-quoted statement (loosely translated into English as follows): "Industrial development stimulates agricultural development and agricultural development, in turn, helps industrial development." This policy has been closely followed ever since. He symbolized the intimate relationship between agriculture and industry just like two wheels of a vehicle or two wings of a bird. They should go together. K. T. Li, one of the key policy-makers, repeatedly points out that the guiding principles in development planning is a balanced and coordinated development between agriculture and industry.[6] This idea is exactly what economists nowadays call the "balanced growth" theory. This "balanced growth" idea has been implanted in these development plans. "Balanced growth," of course, does not imply an even allocation of investment funds between agriculture and industry. In the case of Taiwan,

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[5] Economic Bulletin for Asia and the Far East, op. cit., p. 32.

[6] Li, "Industrial Development in Taiwan, Republic of China," Industry of Free China, Vol. XX, No. 3, (September 1963), p. 13.

it means that the Government puts efforts into both sectors in the sense that neither of them has a necessary or inherent priority over the other in the development plans.

The specific goals of these Four-Year Plans for the agricultural sector have been set to insure an adequate supply of goods for the growing population, expand the output of exportable crops, and provide the domestic processing industries with an adequate supply of agricultural raw materials. The rationale is to achieve, as the Third Four-Year Plan stressed, (a) self-sufficiency in food supply as well as better nutrition for a growing population, (b) coordination with U.S. aid programs to gradually achieve economic self-support through increased exports in quantities and varities of agricultural products, and (c) continuous support to Taiwan's industrialization by providing industries with requisite raw materials of agricultural origin.

For implementating the agricultural Four-Year Plan, the Government has been strengthening the farm extension services and providing investment, working capital and materials necessary for increasing farm production, such as irrigation, drainage, flood control, seedlings, fertilizers, pesticides, feed-stuffs, vaccines, etc.[7]

The financing of agricultural development has been largely contributed by the Government. In each fiscal year, the Provincial Government of Taiwan allocates about 15 percent of its total budgeted expenditures for agricultural development. The main portion of the

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[7] T. H. Shen, Agricultural Planning and Production, Committee D, Economic Stabilization Board, Executive Yuan, Taipei, (March 1958), p. 9.

agricultural budget is assigned for carrying out agricultural extension, education, administration and experimental purposes. Prefectual and municipal governments and township offices also finance a small portion of agricultural development expenditures. Their budget funds are mainly used for social overhead capital, such as flood control, reforestation and fishing harbor reconstruction.

The current Third Four-Year Agricultural Development Plan (1961-64) can illustrate how the Chinese Government deliberately takes measures to increase agricultural production.

In carrying out this Plan, the Government is devoting its efforts: (a) to increase farmers' income: through efforts to continue a vigorous farm credit program. The Government also attempts to finance 50 percent to 70 percent of the cost of irrigation development project. (b) To improve the marketing channels of agricultural products. Due to the seasonality of agricultural production the Government devotes efforts to strengthen marketing and transportation facilities and market management. As the Plan states, the Farmers' Associations, with a total membership of over 85 percent of the farmers on the island, are assigned a more active role in transportation, marketing, warehousing and processing of farm products on a cooperative basis. The Farmers' Association is given financial and technical assistance in all these undertakings. (c) To provide technical assistance. The Government is expanding the training program of agricultural technicians and strengthening the coordination of educational, research and extension programs. At present, Taiwan has about 2,800 junior and senior agricultural technicians, in addition to some 6,000 technical workers at lower levels. Provision is made in the

Plan to send about 50 of them each year to receive higher training abroad, so that an additional 200 technicians of high calibre may be available at the end of the Plan.

To implement these programs and many others not mentioned above, requires the total amount of NT $8 billion during this four-year period.[8] Approximately 44 percent of this outlay is expected to come from private sources, and the remaining portion, 56 percent, from Government sources and the U.S. Aid Fund.

Since price policy also plays an important part in affecting the agricultural production, a brief discussion of it is warranted. In recent years increasing attention has been given to price stabilization rather than to price support programs. Thus the achievement of price stability has become one of the main government policy goals. Such emphasis is easily understood because extensive support activities are not possible due to the limited funds available to the Government for carrying out such programs.

The methods used by the government to stabilize the prices of agricultural products and industrial products, as noted by a UN study,[9] differ. In the industries, the cost approach was used. For instance, since electric power is one of the big cost items to certain industries, the Government's efforts were to ensure a cheap supply of electric power to those industries. In agriculture, the cost approach was often neglected. For instance, the government kept the cost of commercial fertilizer

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[8]The foreign exchange rate of New Taiwan dollar (N.T.) to one American dollar was 15.7, 36.4 and 40.0 in 1953, 1958-60, and 1961-62 respectively.

[9]Economic Bulletin for Asia and the Far East, op. cit., p. 51.

above the level in foreign markets despite the fact that it is an important item of farmers' expenditure.

Historically, the rice price policy has been the main concern of the government because it is not only the major agricultural commodity in terms of the total value of agricultural products but also it is the most important single item of an average family's expenditure. To stabilize the price, a support price for rice was not used in Taiwan. Instead, a procurement schema was introduced. The schema enables the government to accumulate annually up to 30 percent of the rice crop through the collection of rice as payment in kind for the land tax and for the cost of fertilizers, and through the compulsory purchase of rice from the farmers. The government also controls rice exports and imports. Thus it can effectively regulate the market supply of rice, and in turn, the market price of rice. Thus it should not be surprising that on the one hand, the cost of fertilizers was kept above the market level, and on the other hand, the price of compulsory purchase of rice paid by the Government was kept lower than its market price.[10] The stabilizing program for rice, so far as the consumers are concerned, has been considered a success in recent years.

There also has been price stabilization program for the growers of sugarcane. Owing to the downward trend of sugar price in the world market, the purchase price paid by the Taiwan Sugar Corporation to the sugarcane farmers was not high enough to induce farmers to grow sugarcane. While the prices for rice and sugarcane were not favorable to farmers, there is no evidence that the economic position of the farmers in general has deteriorated. This is mainly due to the substantial improvements in the

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[10]Under these circumstances, rice farmers have made a tremendous contribution to the Government revenue. A detailed discussion will be presented in Chapter VI.

yields of crops per unit of cultivated land.[11]

There are other types of program for tobacco, jute, pineapple and mushrooms. Some of these programs are supported by Government, others are operated by the industry itself. There are still others, i.e., tea and citronella oil, which are not covered by any program.

The price policy for agricultural products, under the present circumstances, is, to a large extent, regulated by the Government. But the Government claims to aim at an eventual realization of a free market mechanism.

Finally, a word should be said about the general level of prices in Taiwan. A persistent and appreciable rise in the general level of prices is known as inflation. Economists differ as to the role of inflation in economic growth. It seems generally agreed, however, that hyperinflation will definitely impede economic growth. But creeping inflation, e.g., general price level rising at less than 4 percent per year, is often argued to be the cost which must be paid in order to accelerate development. For instance, Hansen contends that we need not worry about inflation if price level rises at no more than 2-4 percent annually.[12]

Table 3.6 presents the evidence of inflation in Taiwan. Using 1953 as the base period, the wholesale prices increased from 100 to 187 by 1961. This means that the average rate of price rise was about 10 percent per year during the nine-year period. With this high rate of

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[11] Economic Bulletin for Asia and the Far East, op. cit., p. 51.

[12] A. H. Hansen, The American Economy, New York, McGraw-Hill, (1957), p. 45.

Table 3.6. Index numbers of wholesale prices, in Taiwan, 1952-1961.

(1953 = 100)

Year	Wholesale prices
1952	92
1953	100
1954	102
1955	117
1956	132
1957	141
1958	143
1959	159
1960	181
1961	187

Source: Industry of Free China, Vol. XVIII, No. 3, (September 1962), p. 114.

inflation, Taiwan still experienced a high rate of development and provides another example of the coexistence of inflation and development.[13]

[13] In repudiating the concept of those "required preconditions" for development, Hirschman provides historical and recent experiences in Germany, Italy, Columbia and Brazil to show that the required preconditions might be skipped. He states that "Brazil experiences development in the absence of monetary stability." In this sense, the Taiwan experience seems to serve another example. See his article, "Reflections on Economic Development Policy," reprinted in Eicher and Witt, Agriculture in Economic Development, op. cit., p. 395.

CHAPTER IV

THE ROLE OF THE AGRICULTURAL SECTOR: PRODUCT ASPECT

The product aspect (contribution) of agriculture to the economic growth of a nation comes from a rise in farm production within the sector itself. As Kuznets clearly states, "An increase in the net output of agriculture, in and of itself, represents a rise in the product of the country--since the latter is the sum of the increases in the net products of the several sectors."[1] Thus this chapter presents first a brief historical review of the increase of agricultural output during the periods of 1901-40 and 1945-62. The period 1910-40 is the pre-war period, or period under the Japanese occupation; and the period 1946-62 is the post-war period, or period after the restoration of Taiwan to China. The War period, 1941-45, is omitted because of its abnormal situation. Analysis is also given to the factors which affect the increased agricultural output in each period.

Agricultural Output in the Pre-war Period: 1901-40

First, a few words need to be said about the general situation under the Japanese rule. Immediately after Taiwan was ceded to Japan in 1895, the Japanese launched a comprehensive land survey between 1898 and

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[1] Kuznets, op. cit., p. 105.

1905 and compiled the census of Taiwan in 1905 and 1915.[2] The main effort of their 50-year occupation, from 1895-1945, in Taiwan can be summarized in the following areas:[3]

(1) A well-developed system of land and ocean transportation, an abundant supply of electric power and a banking system were created. These constituted the very foundation for Taiwan's later development.

(2) Since Japan developed Taiwan as a colonial type economy--to supply food and raw materials to Japan and import industrial goods from her, natural resources were given special emphasis. Rice and sugar were the two major agricultural products and the most important exports. Industrial development lagged behind because of political reasons. Sugar manufacturing was the most important industry. Others, also related to agriculture, were fruit canning, vegetable oil, and tea processing. In the later years, as Japan's war preparations were stepped up, chemical industries (such as basic chemicals and fertilizers) and heavy industries (such as petroleum refining, aluminum, steel, machinery and shipbuilding) were inaugurated. Shortly before the end of World War II, textile and paper industries also were developed.

(3) During the whole period, technical and managerial skills were all supplied from Japan. For this very reason, immediately after the war, Taiwan's economic development ran into great difficulties as a result of the repatriation of the Japanese.

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[2] G. W. Barclay, Colonial Development and Population in Taiwan, (Princeton, 1954), p. 10.

[3] K. Y. Yin, "Economic Development in Taiwan: Record and Prospects," Industry of Free China, Vol. XVI, No. 6, (December 1961), pp. 5-11.

Now turn to the agricultural sector. In the pre-war period 1902-1940, the production contribution of agriculture to the whole economy is recorded in Table 4.1. Agriculture, except for the 1930's, accounted for more than 50 percent of the total production of the whole economy, shown in column 4 of Table 4.1. In this forty-year span, agricultural production increased eight-fold from the base period 1902 to 1936-40. Such a tremendous increase in agricultural output clearly is what Kuznets calls the product contribution of agriculture to the economy.

Table 4.1 Index of total production and agricultural production, Taiwan, 1902-40

Base period: 1902 = 100

Year (1)	Total production (2)	Agricultural production (3)	Ratio of agricultural to total production (4) = $\frac{(3) \times 78.3}{(2)}$
1902	100	100	78.3
1906-1910	132	118	70.0
1911-1915	197	158	62.8
1916-1920	444	302	53.3
1921-1925	612	406	52.0
1926-1930	752	505	52.6
1931-1935	864	491	44.5
1936-1940	1,361[A]	834	48.0

[A]The date on 1939 and 1940 were lacking. This figure was the average of 1936-1938.

Source: Computed from S. W. Chow, The History of Taiwan's Economy Under the Japanese Occupation, Bank of Taiwan, (September), pp. 15-16.

A fairly satisfactory picture of the changes in agricultural output can be obtained by focusing on three major crops, i.e., rice, sweet potatoes and sugarcane. They were of overwhelming importance within the agricultural sector. As of 1939, rice, sweet potatoes and sugarcane claimed 57, 12 and 10 percent, respectively, of the total planted area. Rice and sugar accounted for 50 and 20 percent of the total value of agricultural output respectively. Data in Table 4.2 show the area, yield and production for the three major crops.

Table 4.2. Taiwan: index numbers of area, yield, and production (in calorie equivalent) of rice, sweet potatoes, and sugar, 1901-1940.

(1901-10 = 100)

	Rice			Sweet potatoes			Sugar		
Period	Area	Yield	Production	Area	Yield	Production	Area	Yield	Production
1901-10	100	100	100	100	100	100	100	100	100
1911-20	112	104	117	124	103	128	323	95	306
1921-30	128	120	154	137	134	183	371	164	608
1931-40	152	145	220	149	168	251	387	298	1,155

Source: Based on data in Chinese-American Joint Commission on Rural Reconstruction, Taiwan Agricultural Statistics 1901-1955, pp. 6, 20, 32, 44.

During the period 1901-1940, rice production increased more than two-fold along with about a 52 percent increase in area cultivated. The production of sweet potatoes increased two-and-half-fold with about a 49 percent increase in area planted. There was close to a twelve-fold expansion in sugar output. Though there was a four-fold expansion in the

area cultivated, the yield of sugar per hectare of cane tripled between 1901-10 and 1931-40. Within this forty-year span, the increase in the output of these three major crops was more impressive than that achieved by Japan between the 1880's and the decade 1911-20.[4] As noted in Chapter II, the success of Japanese agricultural development was mainly due to the expanded use of commercial fertilizers, selective breeding, improved methods of water and pest control, etc. So was the case in Taiwan.

Factors Affecting the Increased Agricultural Output

It is generally agreed that the increase of crop yields and production of the major crops in Taiwan was mainly a result of the combined use of varietal improvement, commercial and family-supplied fertilizers, and improvement of farm techniques.

The large increase in sugarcane yields, for instance, resulted from improvement in cane breeding. "The early efforts at varietal improvement in Taiwan emphasized pure line selection of native varieties characterized by high yields... It is reported that this substitution of inferior native with superior native varieties raised yields by 10 to 30 percent, although the increase of yield indicated by the over-all crop statistics was small until 1920."[5] The improvement in rice seed also raised yield by 23 percent in the 1920's.[6] Introduction of the Ponlai varieties was a key factor in expanding rice exports to Japan. At the same time farmers were encouraged to use more green-manure and commercial fertilizers. Warehouses for rice storage were also built in various places in the island to reduce

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[4]Johnston, "Agricultural Development and Economic Transformation," op. cit., p. 253.

[5]Ibid, p. 256.

[6]S. W. Chow, The History of Taiwan's Economy Under the Japanese Occupation, Bank of Taiwan, (September 1958), p. 36.

losses caused by the previously poor storage facilities.

Increased use of composts and other farm-supplied manures was believed to have very favorable effects upon the rising crop yields, but no data are available concerning their quantitative importance. Imports of chemical fertilizers rose rapidly from negligible levels during the 1901-10 period to between three and eight million Taiwan dollars in the 1930's. Expressed in terms of the percentage share of the total value of imports, fertilizers increased from 1.3 in 1901-10 to 14.9 percent in 1931-40.[7]

Improvements in farm techniques also contributed to higher yields. It is reported that before the Japanese occupation rice was planted by broadcasting, whereas under Japanese influence it came to be almost entirely transplanted. The extension of irrigation facilities was another important factor. Large-scale irrigation projects were undertaken directly by the state government and small-scale irrigation works were constructed and maintained by the local water resource utilization associations. Public funds were made available to finance all or part of the projects. As a result of these various irrigation projects, the irrigated areas, expressed as a percentage of the total cultivated area, were increased steadily throughout the whole period from 28 in 1903 to 61 in 1940. The percentage increase in cultivated and irrigated areas was 60 and 252 percent, respectively, from the base period 1903 to 1940.[8] The increased irrigated areas were generally used for raising rice which was a

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[7] Ibid., pp. 154-155.

[8] Ibid., p. 30.

relatively labor intensive crop. It was expected that this would lead to an intensive use of labor and land. Since both of these factors had low opportunity costs outside the agricultural sector, an intensive use of them would be economically advantageous. Whether the expectation is true or not can well be examined by using the multiple cropping index. Unfortunately, the earliest data of multiple cropping index started in 1939. It was estimated that the multiple cropping index was 127, 130, and 132 in 1939, 40, and 41 respectively.[9] These data do not throw much light on the preceding period with which we are more concerned. Although there were no data available to verify our expectation, economic historians usually agree that multiple cropping did increase rapidly.

The increased output of sugarcane and rice was partly contributed by the expansion of irrigation facilities. Table 4.3 indicates the possible effects of irrigation on the unit yield of sugarcane and rice. Data in the table show that rice production per chia increased two-fold and sugarcane went up to 48-fold. There were probably some other reasons to explain such an unbelievably high increase in sugarcane production. But data at hand are not adequate to give any further analysis.

To what extent can the increase in crop yield be attributed to the use of fertilizers and irrigation? To attempt to answer this question, a regression analysis is used to test the significant relationship between the use of fertilizers, the expansion of irrigated land and unit yield of rice.

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[9] Taiwan Agricultural Statistics, 1901-1955, op. cit., pp. 14-15.

Table 4.3. Production of sugarcane and rice per chia[A] before and after irrigation in Chi-Nan area, Taiwan

Commodity	Before irrigation (1920) (1)	After irrigation (1930) (2)	Percentage increase (3) = $\frac{(2)}{(1)} \times 100$
Sugarcane	43.83 catty[B]	2140.49 catty	4,890%
Rice	8.1 picul[C]	16.55 picul	204%

[A] 1 chia = 2.397 acres

[B] 1 catty = 1.102 pound

[C] 1 picul = 2.64 U.S. gallon

Source: S. W. Chow, The History of Taiwan's Economy Under the Japanese Occupation, Bank of Taiwan, (September 1958), p. 28.

Equation 1: period 1922-38

$$Y = 59.096 + 0.0817\ F + 0.277\ I$$

$$(5.202)^{*}\quad (.486)^{*}\quad (3.861)^{*}$$

*Numbers in parentheses are t-values.

where Y: rice production per crop hectare (kg)
F: fertilizer applied to rice (kg)
I: expanded irrigated hectares

R^2 = .844 = the percent of total variation in rice production explained by the equation.

$t_{.99}$ = 2.977
degrees of freedom = 14
standard error of estimate = 3.819
partial correlation coefficient of F = .129
partial correlation coefficient of I = .718

The t test indicates that there is a significant relationship between Y and I at the 99 level of confidence. An increase in an irrigated hectare will cause a .28 kg increase in rice yield, given other factors constant. But there is no significant relationship between Y and F.

One should not conclude that fertilizers have no effects on rice yields. One reason for this "not significant relationship" could be that a high inter-correlation exists between fertilizers and irrigation. Or other factors such as improved crop varieties, cultivation methods, or pest control, also contribute to the increase in unit yields. Though both irrigation and technology have advanced over time, data do not permit a farmer by farmer comparison.

Other economic and social factors contributed to the increase of agricultural output. Especially noteworthy was the establishment of domestic peace, an effective political administration, and a well-defined land tenure system, and the investment in social overhead capital.[10]

The key factors discussed above which contributed to the increase of agricultural development in Taiwan were similar to those most responsible for Japanese agricultural development. In this sense, Johnston's conclusion that "Taiwanese experience is an example of the Japanese approach applied in a different setting" is understandable and justified. If the Japanese approach was successfully repeated in the pre-war Taiwan's case, with the additional advantages enjoyed by the developing nations today (these advantages were discussed in Chapter II), there is no reason to accept the Bronfenbrenner's pessimistic conclusion that the Japanese approach cannot be emulated by the developing nations.

Johnston further concludes that the historical experience of Taiwan demonstrates the substantial potential that exists for raising farm output and productivity by relying mainly on the use of resources having low opportunity costs. It seems to the author that this statement requires qualifications. It has been shown that the increased agricultural

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[10]Johnston, "Agricultural Development and Economic Transformation," op. cit., p. 253.

output in Taiwan was a result of a combination of factors. Among them, irrigation and chemical fertilizers seem to be the two main ones. As indicated earlier, chemical fertilizers imported from Japan accounted for about 15 percent of the total value of imports in the 1930's. No other single commodity exceeded the percentage share of fertilizers in the total value of imports in this period. The investment and outlays for irrigation was not small. Total investment and operational outlays amounted to 125 and 226 million at current prices, in the period 1921-30 and 1931-40 respectively, shown in Table 4.4.

Table 4.4. Investment and operational outlays for irrigation, by government and irrigation associations, and by decades, Taiwan, 1901-1910 to 1931-1940.

(current prices)

Decade	Investments			Operational outlays[A]	Total investment and operational outlays
	Government	Irrigation associations	Total		
1901-1910	2,873,986	240,900	3,114,886	4,708,541	7,823,427
1911-1920	7,699,866	798,200	8,498,066	16,143,890	24,641,956
1921-1930	30,562,910	56,530,798	87,093,708	138,952,179	226,045,887
1931-1940	8,193,228	18,006,443	26,199,671	98,885,852	125,055,523

[A]Including repair, maintenance and administration costs.

Source: E. L. Rada and T. H. Lee, Irrigation Investment in Taiwan, JCRR, Economic Digest Series, No. 15, (February 1963), p. 37.

The author is inclined to conclude that the rising farm output in this period was achieved not only by the expected intensive use of resources, i.e., labor and land, with low opportunity costs outside the agricultural

sector, but also by the introduction of modern inputs, i.e., fertilizers and irrigation, at quite high cost.

There are several aspects of economic transformation which deserve brief discussion. They include the change in the farm labor force and agricultural population. The farm labor force accounted for 71 percent of the total labor force in 1905 and 1915; it still remained 68 percent in 1930, and then declined to 62 percent in 1940 (Table 3.4). In other words, during the 35-year span, the percentage of the farm labor force to the total labor force dropped 11 percent. It was a slow decline, at about 0.3 percent per year.

The trend of the agricultural population shows about the same slow path of proportionate change as the farm labor force. Table 4.5 indicates that it averaged 63 percent in the decade of 1911-20 and declined to 53

Table 4.5. Ten-year average of agricultural population and its percentage share of total population, Taiwan, 1910-50.

Year (1)	Agricultural population (2)	% of agricultural population to total population (3)
1910-1920	2,258,681	63.1
1921-1930	2,361,561	56.0
1931-1940	2,782,940	51.5
1941-1950	3,535,844	52.8

Source: Taiwan Agricultural Statistics, JCRR, (1962), p. 7.

percent in the 1940's. In other words, the ratio of agricultural population to total population dropped 12 percent during the 30-year span (1915-45), also averaging only a bit over 0.3 percent per year. But as indicated in column 2 of Table 4.5, the absolute number of agricultural

population has been steadily increasing.

The slow path of economic transformation was also reflected in a slow urbanization. As late as 1940 there were only three cities with 100,000 population. The Japanese deliberate colonial policy appears to be the basic explanation for the lack of rapid structural transformation. But it should also be noted that the percentage share of industry to the total value of production in the whole economy went up steadily. It increased from 17 percent of the total value of production in 1902 to 35, 40, and 43 percent in 1927, 1932, and 1937, respectively.[11]

Three other effects resulting from the Japanese colonialization policy also deserve brief discussion.

(1) The lack of funds for investment in industries by Taiwanese: Table 4.6 shows that the source of investment in industries was overwhelmingly supplied by the Japanese.

In small corporations, Japanese provided 60-73 percent of the total investment compared to 39-26 percent supplied by the Taiwanese in the period 1934-41. In big corporations, Taiwanese only provided 3.6 to 2.8 percent in the same period shown in part (b) of Table 4.6. The investment in corporations provided by the Taiwanese in either case declined steadily. This, however, does not imply that foreign investment is undesirable. We merely try to point out that only a very small portion of investment in industries was provided by the Taiwanese.

(2) Limited educational opportunities for Taiwanese: This can be readily seen in the low rate of admitted students of the total eligible

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[11] S. W. Chow, op. cit., p. 62.

Table 4.6. Sources of investment by Japanese and Taiwanese, Taiwan, 1938-41

(a) Small corporations with investment 200,000 to 5,000,000 yuan

Year	Total Investment (1,000)	Source of investment: Japanese in Japan	Japanese in Taiwan	Japanese Total	Taiwanese	Other	%
1938	72,076	25.5%	34.1%	59.6%	38.5%	1.9%	100%
39	80,588	27.4	34.6	62.0	36.3	1.7	100
40	93,433	31.9	35.8	67.7	30.9	1.4	100
41	117,619	36.4	36.3	72.7	25.5	1.8	100

(b) Big corporations with investment over 5,000,000 yuan

1938	302,184	71.7	18.5	96.2	3.6	0.2	100
39	325,811	76.9	19.7	96.6	3.1	0.3	100
40	361,810	75.6	21.1	96.7	3.0	0.3	100
41	414,210	76.5	20.4	96.9	2.8	0.3	100

Source: S. W. Chow, The History of Taiwan Economy Under the Japanese Occupation, Bank of Taiwan, (September 1958), p. 76.

students and extremely low number of students in junior college, shown in columns 2 and 4.

(3) The dominant position of the Japanese: Politically, the Japanese held every key position at every level of the government. Economically, the Japanese also monopolized industries and banking.

As a result of these combined effects, Taiwan, under Japanese rule, appears to have obtained substantial progress in agriculture but without the same development in other sectors.

Table 4.7. Number of Japanese and Taiwanese students, 1926.

Nationality	Primary education		High school (7th-11th grade)	Junior college (12th-14th grade)	Professional school
	No. of students	Rate of admitted students to the total eligible students			
Japanese (person)	23,711	98.2%	6,856	220	477
Taiwanese (person)	210,727	28.4	4,642	28	251

Source: S. W. Chow, The History of Taiwan Economy Under the Japanese Occupation, Bank of Taiwan, (September 1958), p. 308.

Agricultural Output in the Post-war Period: 1946-62

In turning to the post-war agricultural development, the general economic situation since 1946 is examined in a summary fashion. This short span of years is usually divided into three periods. The first period covers 1946 through 1952. It was a period of recovery and rehabilitation after the war. No great improvement of the economy was immediately expected. In the period 1949-52, there were shortages of goods, distorted production, budget deficits and vicious inflation. This was partly due to the sudden inflow of people evacuated from mainland China. Under such circumstances, the immediate goal of the Government was to stabilize the economy. The main effort during this period thus was not given to long-range economic development, but to an all-out increase of output in order to combat inflation.

The second period covers the years of 1953 to 1956, or the First Four-Year Economic Development Plan. An improvement of the economy became evident. Inflation was not as serious as in the first period. Still, problems such as budget deficits, shortages of foreign exchange and goods remained. On the other hand, rehabilitation efforts made in the first period began to have their effect. People had more confidence in investing their money in new industries, i.e., petroleum refining, fertilizer, glass, etc. A new tendency to operate businesses on a long-run basis was in the making.

The main objective of the First Four-Year Plan was to raise the level of production. The Plan was divided into two parts: industry and agriculture. The main emphasis in agriculture was given to the improvement of seeds and production methods to increase both output and unit yield. The industrial development concentrated on mining, manufacturing, electric power, transportation and communications. Seventy percent of the total investment outlay of the Plan was used in industry and thirty percent in agriculture.

The achievements of the Plan were evident but not impressive. All the major projects were carried out, but some lagged behind schedule. Substantial progress was witnessed in the production of agriculture and industry. Agricultural output rose by 22 percent and industrial output by 55 percent, from the 1953 base. The main area in which actual performance fell far behind the target was in the balance of payments.

The third period includes 1957 to 1960, or the Second Four-Year Plan period. Inflation in this period was further mitigated. As the general public gained a growing confidence in the New Taiwan Dollar,

the volume of saving deposits rose steadily and the hoarding of goods, gold and U.S. currency lost their attractiveness. However, two unexpected events interrupted the smooth pace of development. First, the events following the tension and artillery bombardments of the Quemoy Island led to a sudden increase in government expenditures, which in turn led to a wide inflation of market prices in the following Winter and Spring. Second, devastating floods in August, 1959 caused severe damage to cultivated land, private properties and production facilities. As a result of this flood, the economy faced the problem of an immediate shortage of goods and large expenditures for rehabilitation.

During this period also a drastic change took place in Government policy toward foreign trade and investment. Three important changes were: (1) unifying foreign exchange rates -- abolishing multiple foreign exchange rates -- and relaxing foreign exchange and trade controls, (2) relaxing a number of temporary controls over business such as restriction on the entry of new factories and price ceilings, and (3) further revision of laws and regulations pertaining to investment. It can be said that a more favorable "social climate" for entrepreneurs was created.

The Second Four-Year Plan attempted to continue to develop natural resources, increase agricultural and industrial production, and expand exports in order to raise national income, create employment opportunities, and reduce the deficit in the balance of payments. The achievement of the Second Plan again was not as significant as was expected, though progress has made in many areas. For instance, the actual increase in national income within the four-year period was 29 percent against the planned 33 percent over the four-year period but

still a substantial rise. Agricultural output met the target of a planned increase of 20 percent, but industrial output fell short of the target even though it showed an increase of 58 percent. Exports in 1960 amounted to U.S. $170 million, a little below the target. Imports reached U.S. $250 million, far surpassing the projected amount.[12]

Now let us examine the post-war agricultural development by focusing on the changes in agricultural output. The over-all changes in Taiwan's agriculture for the 17-year period since the end of WWII are shown in Table 4.8. The year 1953 was selected as a base year because it was the starting year of the First Four-Year Economic Development Plan, also a year with a stable price level, and judgment indicates that by this year the residuals of the war had been fairly well overcome.[13] Our main concern lies in the recent period 1953-62. The period 1945-52 were dominated by war-recovery measures, so are of less interest to this study.

Agricultural production increased 44 percent during the period 1953-62, as shown in Table 4.8. This is the production contribution of agriculture within 10-year span. The annual average growth rate was as high as 4.9 percent.[14*] Table 4.8 shows that group indexes of crops increased

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[12]Yin, op. cit., p. 13.

[13]Other economists prefer to select 1938 as a base period which was the peak year under the Japanese occupation. For historical comparison 1938 is a useful base period. For the present purpose, we are more concerned with what happened in agriculture since the Second World War so we pick up 1953 as a base period. The different results of using these two different years are hard to generalize depending upon individual cases. For instance, if 1938 is used as a base period, rice production and yield increased 51 and 19 percent respectively in 1962, whereas using 1953 as a base period, rice production and yield increased 29 and 26 percent, respectively, by 1962.

[14*]This is the average of the change in each year compared with the previous year.

Table 4.8. Indices of agricultural production, Taiwan, 1946-1962.

Base: 1953 = 100
Formula: weighted aggregates of value

Period	General index	Crop	Forestry products	Fishery products	Livestock products
		Group index			
1946	39.8	42.3	24.4	38.9	33.0
1947	50.2	52.9	32.7	47.0	44.9
1948	62.5	64.8	65.0	64.0	49.1
1949	74.0	80.1	53.6	63.4	58.6
1950	78.6	85.0	70.7	64.5	60.1
1951	82.2	80.8	79.8	73.1	96.6
1952	91.2	88.3	97.1	91.6	103.3
1953	100.0	100.0	100.0	100.0	100.0
1954	101.4	98.9	103.1	116.2	102.1
1955	103.5	98.3	104.0	137.1	103.7
1956	110.8	105.0	110.9	146.1	112.7
1957	121.4	115.4	124.8	157.5	122.6
1958	128.8	120.9	155.3	173.5	125.3
1959	131.4	123.0	170.8	185.2	118.5
1960	131.7	122.1	171.7	194.8	117.6
1961	144.3	132.0	187.1	234.8	120.7
1962	144.3	132.4	188.9	243.9	110.6

Source: Industry of Free China, Vol. XX, No. 41 (October 1963), pp. 44-45.

from 100 in the base period 1953 to 132.4 in 1962. Fishery and forestry products registered a larger expansion than crops. The forestry and fishery products increased from the base period to 188.9 and 243.9, respectively, in 1962. But fishery and forestry products are of minor

importance in Taiwan's economy. For instance, in 1958-60, only 10 and seven percent of the total value of agricultural production comes from fishery and forestry respectively. Livestock products accounted for about 21 percent of the total value of agricultural production in 1958-60.

Within the category of crops (Table 4.9), the indexes of rice and vegetables showed a steady but relatively slower expansion at about 29 and 42 percent respectively, while the common and horticultural crops reached remarkable increases of 60 and 127 percent during the period under review. Special crops showed the smallest increase in this period. It should be noted that the fluctuation in the production of special crops was primarily due to the variation in sugarcane production in response to the changing condition of the world sugar market.

For the post-war period, our analysis of total agricultural production still concentrates on three major crops, i.e., rice, sweet potatoes and sugarcane because they are the major sources of domestic food and foreign exchange. The overwhelming importance of these three crops is indicated in Table 4.10 which shows that rice is the most important single crop in terms of its value of total agricultural products, followed by sweet potatoes and sugarcane. Together they accounted for 59 percent of the total value of agricultural output for 1961, in contrast to 79 percent in 1939. It is, however, possible to obtain a general picture of the changes in agricultural output by examining these three crops. Table 4.11 summarizes the area, production and yield for the three crops during the period 1945-62. Taking 1953 as a base period, it is found that rice production rose by 29 percent with only a two percent increase in planted area. This means, of course, that a rapid rise in yield per

Table 4.9. Indices of crops, Taiwan, 1946-62.

Period	Group index	Rice	Common crop[A]	Special crop[B]	Horticultural crop[C]	Vegetable[D]
No. of commodities	55	1	9	15	5	25
1946	42.3	54.4	55.6	18.2	46.7	54.6
47	59.9	60.8	72.4	22.5	106.4	79.9
48	64.8	65.1	85.2	48.8	105.9	78.2
49	80.1	74.0	94.4	81.1	95.7	82.7
50	85.0	86.5	93.5	75.9	100.0	94.0
51	80.8	90.4	88.3	59.1	100.9	97.5
52	88.3	95.7	89.9	73.9	102.1	98.9
53	100.0	100.0	100.0	100.0	100.0	100.0
54	98.9	103.3	113.3	87.8	95.5	102.8
55	98.3	98.4	113.2	90.0	108.9	105.8
56	105.0	109.0	121.1	92.8	108.1	108.8
57	115.4	112.0	131.3	107.3	131.3	116.5
58	120.9	115.4	146.5	113.0	161.4	122.2
59	123.0	112.9	147.2	121.7	164.6	124.5
60	122.1	116.5	155.0	106.4	188.6	133.3
61	132.0	122.8	165.7	121.8	202.9	135.8
62	132.4	128.6	159.5	112.6	226.9	142.1

[A]Including sweet potatoes, barley, wheat, soybean, etc.
[B]Including sugarcane, tea, tobacco, peanut, etc.
[C]Including banana, pinapple, lemon, etc.
[D]Including potatoes, celery, onion, etc.
Source: Industry of Free China, Vol. XX, No. 4, pp. 44-45.

Table 4.10. Value of major agricultural products as percent of total value of agricultural products, Taiwan, 1961.

Crops[A]	%
Rice	44.33
Sweet potatoes	8.66
Sugarcane	6.23
Soybean	1.34
Tea	1.26
Tobacco	1.51

[A]No other crops are over one percent of the total value of agricultural products in 1961.

Source: Taiwan Agricultural Yearbook, 1962, pp. 32-33.

hectare took place, an increase of 28 percent during the period 1953-62. Within a ten-year period, the annual average growth rate of rice was about 2.8 percent.

The production of sweet potatoes rose by 35 percent and yield per hectare increased 38 percent during the period 1953-62. This clearly indicates that area planted was not the explanation of this increase. As a matter of fact, the planted area of sweet potatoes decreased two percent during this period. The annual average growth rate was 3.5 percent. It is noted that changes in planted area of sweet potatoes were the smallest among these three crops. The area varied in the range between 228 thousand and 247 thousand hectares. There were two good reasons for this stability in hectares. First, the price of sweet potatoes was so low that farmers had little incentive to expand the planted area. Also there is an increasing difficulty for further expansion of

the planted area because of competition from other crops. Secondly, the Government's policy has been to discourage the expansion of the area, but it did encourage an increase of yield per hectare.

One interesting economic relationship is the effect of the supply of sweet potatoes on hog prices. In Taiwan sweet potatoes are used mainly for feeding hogs. The demand for sweet potatoes has been increasing in recent years due to the rapid increase in the demand for hogs. It becomes obvious that a reasonably stable price of hogs requires an increasing supply of sweet potatoes. But it is difficult to induce farmers to expand their production at the present low price of sweet potatoes. This question remains to be solved.

The production of sugarcane lagged behind during the whole period 1953-62. It declined to 73 percent of the 1953 level. The yield and area planted also dropped to 87 and 82 percent respectively, in 1962 compared with 1953. The decline of the sugar industry in the recent decade is primarily due to the low world price of sugar, the low purchasing price provided by the Taiwan Sugar Company to sugarcane farmers, and competive use of land, mainly for rice, since rice prices were relatively high compared to sugar, as shown in the column 5 of Table 4.12.

Factors Affecting the Increased Agricultural Output

As pointed out earlier, the total agricultural output in Taiwan increased 44 percent during the period 1953-62. The annual average growth rate of agricultural production was as high as 4.9 percent during the same period. In the United States, total farm output rarely has

Table 4.11. Area and output of three principal crops, Taiwan, 1945-1962.

Unit: Area: Ha.
Production: M.T.
Yield per ha.: Kg.

Period	Rice			Sweet potatoes			Sugarcane		
	Planted area	Production	Yield per ha.	Planted area	Production	Yield per ha.	Harvested area	Production	Yield per ha.
1945	502,018	638,829	1,273	134,715	1,165,263	8,650	107,676	4,159,279	38,628
1946	564,016	894,021	1,585	176,029	1,330,506	7,558	36,205	1,006,526	27,801
1947	677,557	999,012	1,474	213,403	1,782,798	8,354	29,905	796,012	26,618
1948	717,744	1,068,421	1,489	224,247	2,002,865	8,932	85,157	3,113,062	36,557
1949	747,675	1,214,523	1,624	236,164	2,166,048	9,172	122,392	6,193,818	50,606
1950	770,262	1,421,486	1,845	233,057	2,200,833	9,443	121,940	5,860,958	48,064
1951	789,075	1,484,792	1,882	231,389	2,021,719	8,737	79,249	3,584,997	45,237
1952	785,729	1,570,115	1,998	233,502	2,090,463	8,953	97,971	4,800,883	49,003
1953	778,384	1,641,557	2,109	237,788	2,276,942	9,576	113,230	8,394,348	74,136
1954	776,660	1,695,107	2,183	247,551	2,556,823	10,328	95,679	6,310,090	65,950
1955	750,739	1,614,953	2,151	245,513	2,437,443	9,928	77,941	6,088,871	78,121
1956	783,629	1,789,829	2,284	230,236	2,568,104	11,154	90,901	6,343,248	69,782
1957	783,267	1,839,009	2,348	228,760	2,693,417	11,774	98,231	7,083,395	72,110
1958	778,189	1,894,127	2,434	228,699	2,957,893	12,934	101,454	7,521,985	74,142
1959	776,050	1,856,316	2,392	226,487	2,894,146	12,778	99,219	8,093,447	81,571
1960	766,409	1,912,018	2,495	235,387	2,978,676	12,654	95,543	6,736,236	70,505
1961	782,510	2,016,276	2,577	235,794	3,233,563	13,713	100,180	7,922,383	79,082
1962	794,266	2,112,874	2,660	233,687	3,079,586	13,175	93,496	6,142,408	65,697

Source: Industry of Free China, Vol. XX, No. 4, (October 1963), pp. 44-45.

Table 4.12. Sugar price paid by Taiwan Sugar Corporation as compared with market price for rice.

Year	Purchase price for sugar plus subsidy by TSC	Index of sugar price actually paid by TSC	Market wholesale price for brown rice	Index of market price for brown rice	Ratio of sugar price to rice price
	(1) (New Taiwan dollars/100kg)	(2) 1953 = 100	(3) (New Taiwan dollars/100kg)	(4) 1953 = 100	(5) = (1)/(4)
1953	237	100	281	100	0.84
1954	140	59	244	87	0.57
1955	180	76	257	91	0.70
1956	200	84	277	99	0.73
1957	249	105	301	107	0.83
1958	238	100	310	110	0.77
1959	275	116	327	115	0.84
1960	284	120	491	173	0.58

Note: (a) Data on purchase price for sugar paid by TSC and subsidy given to the cane farmers are from Taiwan Sugar Statistics, 1959 edition, published by Taiwan Sugar Corporation.

(b) Figures of market wholesale price for brown rice are simple arithmetic averages of wholesale prices in 9 localities as published by Taiwan Provincial Food Bureau in Taiwan Food Statistics Book, 1960.

Source: Economic Bulletin for Asia and the Far East, Vol. XIV, No. 1, (June 1960), p. 70.

increased more than two percent a year.[15] Such a tremendous increase in agricultural output raises the most fundamental question in the process of economic development: How did Taiwan improve its agriculture? To be more specific, what factors accounted for this rapid increase in agricultural output? This section attempts to answer this question. The crucial variables which affect the agricultural output will be examined, or statistically measured.

Theoretically speaking, the supply of agricultural output is mainly determined by changes in crop acreages, the price of the output, weather, seed, irrigation, fertilizer and some other institutional variables. In the present case, changes in crop acreages seem not important. The total crop acreages cultivated changed little from 831,951 hectares in 1946 to 871,759 hectares in 1961, or about five percent change compared with 1946 as a base year. Weather is an important factor, but no data at hand can analyze its effects on production. Government policy--three Four-Year Development Plans and price policy have been discussed in Chapter III. Thus in this section emphasis will be given to those factors which have not been discussed earlier. It should be pointed out that the analysis made below is based on a static proposition: Given such factors in a given period of time, what were their possible effects on the increase of agricultural output?

As noted earlier, an expansion of crop production has been the major government policy goal. To carry out this goal, a number of

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[15] R. F. Christensen, W. E. Hendrix, and R. D. Stevens, How the United States Improved its Agriculture, ERS Foreign-76, USDA, (March 1964), p. iv.

measures have been taken during the past decade. Basic research in plant-breeding--coupled with a highly effective system of seed improvement, multiplication and extension--has been developed to increase crop production. A seed certification system for each major food crop has also been established. It is estimated that as a result of these measures food production was increased by 5 percent.[16]

In rice improvement, efforts are devoted to develop new varieties resistant to diseases and highly responsive to heavy manuring. The improvement of native (Indica) varieties was a big success. To be more specific, taking fiscal year 1961-62 as an example, the government (a) supplied the farmers with about 600,000 tons of chemical fertilizers and set up demonstration farms at various localities to show the most effective way of using fertilizers, (b) extended over US $1.1 million as food production loans to solve the financial difficulties of the farmers, (c) helped the farmers to exchange ordinary rice for about 2,400 tons of quality rice seeds so as to improve the quality of rice and to increase the unit yield. New leading strains in seed improvement such as Chianan No. 242, Hsinchu No. 56, Taichung Native No. 1 have all shown excellent performance in utilizing fertilizers and resisting diseases, (d) extended loans of US $161,000 for water pumps and other equipment to assist the farmers in exploring underground water-supplies and expanding the irrigated areas, (e) sold at cost pesticides and insecticides totaling about US $300,000 to the farmers to protect their crops from attacks of insects and (f) encouraged the farmers to make canvas coverings to protect young

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[16] China Yearbook 1962-63, China Publishing Co., Taipei, (1964), p. 375.

seedlings against cold; lent grains to poor farmers; supplied fodders to encourage hog-raising; helped build compost houses and cement yards for storing manure and for drying green crops, etc.

In other words, the increase in rice production was made possible by the improvement of seeds, expanded supply of chemical fertilizers, increased use of pesticides and insecticides, and production loans, etc.

With the development and extension of new varieties coupled with the improvement in cultural practices and methods of disease and insect-control, helped sweet potatoes, wheat, peanut and soybenas to achieve record per hectare yields in 1961. The hybrid corn, which was first introduced in Taiwan in 1960, was further tried in 1961. A total of 5,000 acres were planted and the approximate yield per hectare was about 9,354 lbs, or more than twice as high as the average yield of the common corn.[17]

All these various programs were partly assisted by JCRR. Its role deserves our attention.

Since its transfer from the Chinese mainland to Taiwan in August 1949, the JCRR has sponsored to date a total of 5,114 work projects for the improvement of agriculture both on Taiwan and on the offshore islands. In the past 13 years, JCRR has expended in its operations US $6,801,730 and NT $2,724,066,493 (equivalent to US $68,101,662) derived from the proceeds of U.S. commodity sales, known as the Counterpart Fund.

The JCRR program represents a coordinated effort to apply practical solutions to the rural problems. JCRR does not undertake any project by itself; it provides technical and financial assistance to organizations which are fully responsible and qualified for carrying out approved projects. Commencing with crop improvement and irrigation, the JCRR has

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[17] Ibid., p. 375.

gradually expanded its work to 10 major fields. They are: crop production, livestock, fishery, rural organization, agricultural extension service, land reform, rural health, rural economy, agricultural credit and subject matter support.

For our interest, the agricultural extension service, agricultural credit, disease and insect pest control, fertilizers and irrigation, land reform and US economic aid will be further analyzed in some detail. These factors are often called the institutional factors. Their importance to agricultural development is usually recognized, but discussion on these factors is often lacking. Due to the nature of these factors, an accurate assessment of their effects on the increased agricultural output is difficult, if not impossible.

Agricultural Extension Service

The agricultural extension work in Taiwan has been carried out by the Taiwan's Provincial Farmers' Association in cooperation with the public offices at each level with the financial and technical assistance of the Provincial Department of Agriculture and Forestry and JCRR. The agricultural extension service has three phases: farm extension work with adult farmers, 4-H club with rural youth, and home economics extension work with farm women and girls.

It is difficult to measure the effects of agricultural extension program on agricultural production. There follows a description of their activities related to agricultural production in recent years.

The farm extension program, started on the island in 1955, has been conducted on the basic policy of dealing with the whole farm enterprise, instead of with individual subject matter as in the past. It expanded to 289 of the 317 townships in 1962. Thirty-two farm

supervisors in 22 counties and cities assist the 555 township advisers and supervise the work.

In 1961 the township advisers assisted farmers in setting up 5,417 demonstrations exhibiting the results of improved practices in the cultivation of rice, wheat, sweet potatoes, soybeans; in fertilizer application, and in hog, poultry and cattle raising.[18] They worked with 2,582 organized farm discussion groups, having a total of 50,862 members. These groups meet each month to discuss various farm problems. It was found that "Crop yields of these farm discussion group members averaged over 10 percent higher than other farmers in the village."[19]

The 4-H club phase of the extension program is also worth noting. There are 6,195 clubs with a total membership of 78,496 in 1961. Each member in the club carries out his own project such as growing rice, vegetables, or sweet potatoes; raising pigs, poultry or rabbits; or improving the home. He follows the instructions of the township adviser and keeps a complete farm record. Members in the local community also engage in other activities, such as vaccinating poultry, planting roadside trees, and exterminating rats.

Another phase of the extension program is home economics work. A total of 11,070 4-H club girls have enrolled in 871 home economics clubs, and 21,090 farm women have enrolled in 1,243 home improvement clubs to learn how to use more homegrown food, how to plan healthful and inexpensive meals with limited funds, and how to cook rice and vegetables to preserve their food value.

Closely related with the agricultural extension program is the intensive village improvement program. This work is carried on in selected villages in various parts of the island to demonstrate to other villages

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[19]China Yearbook, 1962-63, op. cit., pp. 380-381.

how rural residents can increase production and raise their standard of living by self-help and cooperative efforts. In 1962, this program was carried on in 90 villages in 46 townships in Taiwan.

Agricultural Credit

A recent study undertaken in 1961 indicates that 417 farm families, 70 percent of the total sample farms, borrowed money in 1960. But only 20 percent of the borrowed farm families obtained credit from the local farmers' association at a rate of interest of less than 2 percent per month. Most of the remaining borrowers obtained loans from private money-lenders at a rate of interest of more than 3 percent per month.[20] This result illustrates farmers intensive use of credit and urgent need for more credit at a reasonable interest rate.

For over half a century Taiwan farmers have been receiving credit through their farmers' associations. In the past, however, loaning funds mainly came from deposits--a very small and unstable source of funds. This could not meet the farmers' need. Based on the previous experience, an island-wide agricultural plan known as the Unified Agricultural Credit Program was put into operation in 1961. Its immediate purpose is to create a permanent and dependable source of credit at reasonable interest rates and on terms that meet the farmers' needs. To help bring about a better system of agricultural credit, the JCRR also took an active part. From 1955-1960, JCRR embarked upon a demonstration program with over half of the Taiwan's 317 farmers' associations. It made NT $112,000,000 (US $2,800,000) available through counterpart funds.

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[20] A Study on the Supply of and Demand for Agricultural Credit in Taiwan, Department of Agriculture and Forestry, (December 1961), p. 53.

Over 50,000 farmer loans were made during this period.

Agricultural credit is also provided by the Land Bank of Taiwan, the Cooperative Bank, Food Bureau, Taiwan Sugar Corporation, in addition to the farmers' association. At the end of 1960, the amount of outstanding agricultural loans for the island as a whole was NT $3,069,216,000. The efforts of the government and other institutions in extending credit to farmers are demonstrated by the following table which summarizes the amount of production loans obtained from other than private sources from 1951-60.

The credit from government sources since 1951 increased by about 16 times while that from cooperative sources increased by more than 28 times. The loan to value ratio (column 7 of Table 4.13), a more meaningful indicator, also increased but by less than 4 times.

In 1961, an Agricultural Planning Board was established. An agricultural credit fund, about NT $300 million, was set up to strengthen the credit departments of township farmers' associations in serving production loans to the members, and to improve the financial resources and services of the Cooperative Bank and the Land Bank.

Has the increased use of credit resulted in greater agricultural production and productivity? Rada and Lee conclude that "without question, credit increased the productivity and production on some farms, especially on those altering land-use patterns, adapting to new market opportunities, or changing cultivation methods or techniques."[21]

Diseases and Pest Control on the Farms

Another factor is the control of diseases and pest on the farms.

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[21]Rada and Lee, op. cit., p. 29.

Table 4.13. Production credit from government and cooperative sources,[A] Taiwan, 1951 to 1960.

Period	Loans from: Government[B] (NT $000)	Loans from: JCRR[C] (NT $000)	Loans from: Cooperative sources[D] (outstanding at the end of year) (NT $000)	Total production loans (NT $000)	Gross value of agricultural production (NT $000)[E]	Loan-to-value ratio (percent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)=(5)/(6)
1951	92,662	9,699	70,499	172,860	3,812,441	4.5
1952	155,462	16,737	184,156	356,355	5,837,552	6.1
1953	152,686	19,694	269,533	441,913	8,681,412	5.1
1954	110,876	21,459	353,453	485,788	7,430,644	6.5
1955	159,973	44,625	572,824	777,422	9,494,860	8.2
1956	180,110	46,447	729,897	956,454	10,574,045	9.0
1957	125,879	60,563	833,503	1,019,945	12,390,940	8.2
1958	1,150,074	54,571	1,329,104	2,533,749	13,709,273	18.5
1959	1,135,508	97,065	1,785,522	3,018,095	15,611,830	19.3
1960	1,490,272	151,999	1,980,984	3,623,255	20,659,550	17.5

[A]Does not include credit from private sources. In 1952, private credit was estimated to supply 64 percent of all credit which if added to that shown in this table would make the total external production credit exceed 1 billion. In 1960, private credit was down to 43 percent which suggests that the total production credit used by farmers exceeded more than NT $6 billion. The adjusted loan-to-value ratio for the two years would be roughly 17 and 30 percent, respectively. Credit from private sources increased in amount from about NT $600 million in 1952 to NT $2.5 billion in 1960.

[B]Mostly the loans of the Provincial Food Bureau, Taiwan Sugar Corporation and the Taiwan Tobacco and Wine Monopoly Bureau to farmers.

[C]Amounts released through FA's by JCRR. In addition, JCRR has made more than NT $800 million in grants-in-aid, of which more than NT $300 million wnet into irrigation.

[D]Mainly credit cooperatives, cooperative banks and farmers' associations. The statistics exclude JCRR assistance. The data represent balances outstanding at the end of the year. Most loans are for a year or less although since 1958 loans with maturities of more than one year have increased substantially.

Table 4.13 (cont.)

[E] Includes the value of agricultural production on government-operated farms, which was estimated to be about 2 percent of all production in 1960.

Sources: Credit data estimated by Rural Credit Division, JCRR; value of agricultural production from annual editions of Taiwan Agricultural Yearbook, Provincial Department of Agriculture and Forestry.

This factor either positively helps increase the agricultural output, or negatively helps prevent losses. A recent study shows that the number of occurrence of diseases and insects were reduced from 49 times in 1949-53 to 36 times in 1954-58.[22] The estimated average loss per year was NT $200 millions in 1949-53 and substantially declined to NT $36 millions in 1954-58.

Fertilizers and Irrigation

Historically, fertilizers and irrigation have been a major source of increased agricultural output. Since 1945, the quantity of fertilizers distributed per hectare has increased rapidly as shown in Table 4.14. In 1946, and again in 1949 the distribution of fertilizers was 132-135 Kg. per hectare, and increased to 690 Kg. per hectare in 1962. Comparing with the pre-war period, using 1938 as a base, the fertilizer applied to rice in the period 1946-49 was about 99.4 percent of 1938. At the same time, rice production jumped from 1,585 Kg. per hectare in 1946 to 2,600 Kg. per hectare in 1961. A statistical analysis gives the following results.

Equation 2: Period 1946-62

$$Y = 1310.519 + 1.679\ X_1$$

$$(27.028)^*\quad (17.643)^*$$

*Numbers in parentheses are t-values.

$R^2 = .951$ = the percent of total variance in average rice production explained by the equation

$t_{.99} = 2.947$

where Y: average production of brown rice per hectare (Kg.)

X_1: average amount of fertilizer allocated per hectare (Kg.)

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[22] The Agricultural Economy of Taiwan, Bank of Taiwan, (1962), p. 48.

The result shows that there is a significant relationship between Y and X_1 at the .99 level of confidence. The b value of X_1 indicates that a one Kg. increase in fertilizer, given other factors constant, will result about 1.7 Kg. increase in rice production per hectare.

The result suggests that fertilizer has significant effects on the unit yield of rice. But care should be taken not to over-emphasize this result. More reliable results might be obtained when fertilizers and irrigation are both taken into account as shown in equation 3 to be presented shortly.

Irrigation is another important factor. In 1960, 60 percent of all cultivated areas were irrigated. It is estimated that the potential paddy land is about 85 percent of total arable land.

The irrigation projects underway and scheduled for completion in the 1960's will require an estimated NT $6.6 billion investment, more than all of the irrigation investments of record since 1900. The effect of irrigation on agriculture has been recently estimated by Rada and Lee. They conclude,[23]

> Each one percent increase in irrigated area has been associated with a 1.164 percent increase in the multiple-crop index and about a NT $100 million in the real value of agricultural production.

However, quantitive analysis is seldom used, if any, to ascertain the effects of fertilizer and irrigation upon agricultural output. The

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[23]For the period of 1900-39 and 1950-60, the relationship between the multiple-crop index and the real value of crop production (gross value deflated by the general price index, 1950-52 = 100) averaged about NT $100 million increase in crop value for each one point increase in the multiple crop index. "Tracing this cause and effect relationship back to irrigation, we might conclude that a one percent increase in irrigated acreage would result in an increase of NT $116 million in the real value of crop production." See Rada and Lee, op. cit., p. 23.

Table 4.14. Average production of rice and fertilizers allocated, Taiwan, 1946-1962

unit: Kg.

Period	Average production of brown rice per hectare	Average amount of fertilizers allocated per hectare
1946	1,585	132
47	1,474	114
48	1,489	121
49	1,624	135
50	1,845	301
51	1,882	355
52	1,998	461
53	2,109	486
54	2,183	593
55	2,151	589
56	2,284	626
57	2,348	629
58	2,434	643
59	2,392	643
60	2,495	660
61	2,577	677
62	2,600	690

Source: Industry of Free China, Vol. XXI, No. 1, (January 1964), p. 13.

regression analysis in equation 3 is used to show whether there exists a significant relationship between the combined use of commercial fertilizers and irrigation and the output of rice.

Equation 3: Period 1950-60

$$Y = -85.1278 + .4128\ F + 1.4387\ I$$

$$(-2.8896)^{*}\ (14.2015)^{*}\ (4.7474)^{*}$$

*Numbers in parentheses are t-values

$R^2 = .967$ = the percent of total variance in rice production explained by the equation

$t_{.99} = 3.355$.

degrees of freedom = 8

where Y: Rice production per crop hectare (Kg.)

F: Fertilizer applied to rice (Kg.)

I: Expanded irrigation hectare

Partial correlation coefficient of F = .9807

Partial correlation coefficient of I = .8591

The t test shows that there exists a significant relationship among the rice yield and fertilizer and irrigation at the .99 level of confidence. Comparing the results of equation 2 and equation 3 indicates that there is a very high correlation between the two inputs (and probably with other inputs). Fertilizer is applied to paddy rice, thus adding irrigation to equation 2, as represented by equation 3 does not greatly increase the total variance explained by the formula, but if equation 2 were to relate fertilizer to rice yields or non-irrigated rice land, very little rice land would be included and the equation might well show little association.

A one Kg. increase in fertilizer used will increase rice production

per hectare by 0.41 Kg; and an increase by an irrigated hectare will increase rice production per hectare by 1.43 Kg., given other factors constant.

It should be noted that although R^2s are high in the foregoing two equations, yet other inputs (which could not be incorporated), i.e., weather, labor efficiency, improved crop varieties, pest control, etc., may also contribute to the high unit yield of rice.

Equation 4: Relationship between total value of agricultural output and fertilizer consumption: 1950-1959

$$X_1 = 320{,}207{,}630.007 + 8.343\ X_2$$
$$(.149)^* \qquad (4.340)^*$$

*Numbers in parenthes are t-values

$R_2 = .665$

degrees of freedom = 8
partial correlation coefficient = .838

$t_{.99} = 3.25$

where X_1: total value of agricultural output (NT$)

X_2: total value of fertilizer consumption (NT$)

The t test shows that there is a significant relationship between X_1 and X_2 at .99 level of confidence. A dollar increase in X_2 will result in $8 increase in total value of agricultural output. Equation 4, of course, indicates that other crops, on the average, are far less responsive to fertilizer than is rice.

Land Reform

Land reform in the traditional and accepted sense of the term, means the redistribution of property in land for the benefit of small

farmers.[24] A broader definition of land reform refers to the full range of measures that may or should be taken to improve the structure or relation among men with respect to their rights in land. This broader definition is sometimes paraphrased as "land tenure reform."[25] Land reform in Taiwan falls into the middle of the above two definitions. It refers to the rent-reduction, sale of public land, and Land-to-the-Tiller program.

The land reform program began with the enactment in 1949 of the farm rent-reduction statute which set a ceiling on farm rentals at 37.5 percent of the annual main-crop yield. This was followed in 1951 by the sales of public land to tenant farmers, and in 1953 by the implementation of the Land-to-the-Tiller program. All these programs have been carried out through lawful procedures in order to enable tenant farmers to enjoy the fruits of their labor, and acquire ownership of the land which they cultivate. The procedure adopted in Taiwan is very close to what Warriner would expect. She writes,[26]

> The main economic argument for land reform is the need for securing a more equal distribution of income by eliminating these monopoly elements. In the first case the aim is to reduce the price for the use of land, i.e., a reduction in rents, and in the second case, the aim is to subdivide big holdings to secure a full use of land, an increased demand for labour, and higher wages for the farm worker.

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[24]Doreen Warriner, "Land Reform and Economic Development," reprinted in Carl Eicher and Lawrence Witt, Agriculture in Economic Development, McGraw-Hill Co. (1964), pp. 272-273.

[25]Philip M. Raup, "The Contribution of Land Reform to Agricultural Development: An Analytical Framework," Economic Development and Cultural Change, Vol. XII, No. I, (October 1963), p. 3.

[26]Warriner, op. cit., p. 284.

A brief discussion of these three programs in Taiwan will be in order.

The statute for farm rent reduction limits rentals of farm land to 37.5 percent of the annual yield according to a standard rate for each grade of farm land. The standard yield is not necessarily the actual harvest but is closely related to soil fertility and productivity, on the basis of which paddy fields and dry land are divided into 26 grades. Thus, with the amount of farm rent payable by every tenant definitely fixed, all surplus where the farm produces over and above this amount is his to enjoy. This serves as an immense stimulus for the farmers to make improvements and to increase production.

The sale of public land was designed to assist tenant farmers to become owners by reasonable sale on an installment basis. The price of such land was fixed at two and a half times the value of the annual main-crop yield, to be paid by the tenant purchaser in semi-annual installments over a period of ten years. This program set the pattern for the subsequent Land-to-the-Tiller program.

The Land-to-the-Tiller program aims at the equalization of land ownership through government purchase of privately-owned farm land in excess of three hectares (about 7 acres) of riceland per farm and its resale to tenant farmers. Of the purchase price, 70 percent was paid with land bonds and the remaining 30 percent by stock in government-owned industries. The land bonds bear an annual interest of four percent and are redeemable in rice and sweet potatoes in twenty semi-annual installments over a period of ten years.

Each landlord was allowed to keep some three hectares of medium-grade paddy field, or twice that much of dry land. Holdings in excess

of that limit had to be sold to the Government. However, a farmer may own any amount of land which he and immediate members of his family actually till. A landlord whose land is partly leased to others and partly tilled by himself, is obliged to sell to the Government such portion of his tenant land as exceeds the statutory limit.

Three crucial questions which often arise in relation to land reform should be examined here: First, will land reform reduce the production when this involves subdivision of the land? Secondly, can it promote more investment through the incentives of individual enterprise? Thirdly, what are the effects of land reform on agrarian structure? There are no general and easy answers to these questions. The historical experience in advanced countries gives no definite answers to these three questions.[27]

The empirical result of land reform in Taiwan does shed some light on these three questions. At the present time, there are at least four empirical studies which deal with various effects of land reform.[28] In attempting to answer the above-mentioned three questions, emphasis is given to the effects of land reform on production, incentive (investment), and agrarian structure.

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[27]Warriner, op. cit., p. 288.

[28]H. S. Tang, Land Reform in Free China, JCRR, Taipei, (October 1954); Land Reform in Taiwan, The Land Bureau, Taipei, (October 1958); H. S. Tang and S. C. Hsieh, "Land Reform and Agricultural Development in Taiwan," in Walter Frochlich's book, Land Tenure, Industrialization and Social Stability, The Marquette University Press, Milwaukee, Wisconsin, (1961); and T. H. Lee, "A Study on Structural Change of Agricultural Production in Taiwan," Proceedings of Agricultural Economics Seminar, JCRR, Taipei, (March 1959).

Production Effect: In determining the effects of land reform on production, Tang and Hsieh conclude that "These figures (in Table 4.15) show that agricultural production, particularly rice, other crops, livestock, and poultry, increased remarkably after land reform."[29]

Table 4.15. Indices of agricultural output, Taiwan, 1950-1955.

Year	Total output	Total crops	Rice	Sugar-cane	Other crops	Livestock and poultry
1950	100.00	100.00	100.00	100.00	100.00	100.00
1951	102.08	99.79	104.46	61.16	105.72	126.17
1952	110.02	107.30	110.46	81.91	110.98	138.71
1953	123.05	117.84	115.48	143.22	112.27	178.01
1954	123.60	117.82	119.25	107.67	118.87	184.53
1955	121.63	114.97	113.62	103.88	123.07	191.80

Source: Tang and Hsieh, "Land Reform and Agricultural Development in Taiwan," in Walter Prochlich's book, Land Tenure, Industrialization and Social Stability, The Marquette Univ. Press, (1961), p. 133.

There is no doubt whatsoever as to the increase of total agricultural production since 1949, the first year which land reform was launched. But there does exist a serious question: To what extent, can the increase in the total agricultural production be attributed to the land reform? It is evident that there were a number of other factors which also had favorable effects upon the agricultural production. All the other studies cited above reached a similiar conclusion--agricultural production has increased as a result of land reform.[30] None of them, unfortunately, attempted to

[29]Tang and Hsieh. Ibid, p. 133.

[30]The Land Bureau, op. cit., p. 16; Lee, op. cit., pp. 82-83.

ascertain the extent to which the increase of agricultural production is due to land reform. It could only be concluded that land reform might have favorable effects on the agricultural production, but it is not certain to what extent it did contribute to the increase of agricultural production.

Another way to check whether production has been affected by land reform is to study the incentive effects through the changes in farmers' investment pattern and outlay.

Incentive Effect: One of the strong arguments for land reform, whatever its specifics, is to provide a stronger incentive for agricultural progress to the individual farmer. This strong incentive is usually reflected in the farmers' more intensive use of labor, more investment in land and other fixed equipment, and finally results in an increased farm income.

An estimate of farm income and its distribution is shown in Table 4.16. The total gross farm income nearly trebled from 1950 to 1955. The total net farm income also increased by 3.4 times. The increase in net income is, of course, less than this proportion due to the inflation at an average of 10 percent rise in the general price level during the 1950's. From Table 4.16, it can be seen that the greatest changes occurred in wage payments and rentals during this period. Total wage payment which accounted for 39 percent of total income in 1950 increased to 48 percent of total income in 1955. Wage income for family labor increased from 26 percent of total income in 1950 to 39 percent of total income in 1955, while wages for hired farm labor decreased from 12.5 percent of total income in 1952 to 8.6 percent of total income in 1955. Part of this decrease might be accounted for by a decreasing number of wage earning

Table 4.16. Farm income and its distribution, Taiwan, 1950-1955.

(unit: NT $1,000)

Item	1950		1955	
	NT $	%	NT $	%
Gross farm income	3,481,078	-	10,419,875	-
Net farm income	2,251,809	100	7,735,862	100
1) Total wage payment	877,616	38.97	3,715,439	48.03
Wage income for family labor	596,589	26.49	3,054,289	39.48
Wage for hired farm labor	281,027	12.48	661,141	8.55
2) Total rent payment	975,058	43.30	2,355,143	30.44
Rent for farmers' own land	512,271	22.75	1,889,437	24.42
Land rent paid	462,757	20.55	465,706	6.02
3) Total interest payment	259,145	11.51	1,016,880	13.15
Interest for farmers' own capital	175,617	7.80	749,201	9.69
Interest paid	83,528	3.71	267,679	3.46
4) Taxes and fees	140,020	6.22	648,400	8.38

Source: Tang and Hsieh, "Land Reform and Agricultural Development in Taiwan," in Walter Frochlich's book, Land Tenure, Industrialization and Social Stability, The Marquette Univ. Press, (1961), p. 129.

farm laborers and an increasing number of farm owners. It is also noted that the total rental payment, mainly land rental paid to landlords, decreased by 14 percent during the period.

The change in the distribution of farm income resulting from the rental reduction and an increase in the number of land owners through land reform have enabled the farm owner to obtain a larger share of the farm income from family labor.

Another result of the land reform is the change of investment pattern. Table 4.17 shows a considerable increase in land improvement from less than one percent in 1950 to 12 percent in 1955. Since farm ownership means social and economic security, increased farm ownership would contribute to more agricultural improvement. So would a higher farm income. A relative increase of investment was also shown in the purchase of farm implements and new construction of farm house. Overall speaking, the pattern of investment had been changed from heavy emphasis on livestock to rapid increase in fixed capital formation after the land reform program.

Agrarian Structure Effect: The land reform program is expected to have a decisive effect on the change of farm tenancy. Before 1949, the first year the land reform was in effect, 39 percent of the total farm families were tenant farmers. The Land-to-the-Tiller Program reduced tenant farmers to 17 percent in 1957. Owner operators increased from 36 percent before reform to 62 percent after reform.

Among the 789,429 landowner families after the land reform, there was a significant increase in the number of owners owning land of less than three hectares and a decrease in the number of landowners owning land of three or more hectares. But no evidence indicates that agricultural output was decreased because of the increase of small size of farms.

Table 4.17. Change of investment pattern, Taiwan, 1950 and 1955.

(in thousands of NT)

Item	1950 NT $	1950 %	1955 NT $	1955 %
Total investment	527,221	100.00	1,118,829	100.00
Net increment of large plants	8,967	16.50	27,914	2.49
Net increment of livestock	189,033	35.86	-	-
Net increment of farm products	82,010	15.55	180,756	16.16
Land improvements	3,845	0.73	137,480	12.29
Purchase of farm implements	19,787	3.75	73,010	6.52
Net construction of farm houses	50,757	9.63	177,318	15.85
Repayment for land price	-	-	240,330	21.48
Public investment on irrigation facilities and other agricultural construction	94,812	17.98	282,021	25.21

Source: Tang and Hsieh, "Land Reform and Agricultural Development," in Walter Frochlich's book, Land Tenure, Industrialization and Social Stability, The Marquette Univ. Press, (1961), p. 132.

Out of total area of 681,154 hectares of private cultivated land in Taiwan, 61.4 percent was cultivated by owners before the land reform. After the implementation of the Land-to-the-Tiller program, the area under owner-cultivation was increased to 84.8 percent of the total.

The above evidence indicates that the land reform has considerable impacts on agrarian structure.

United States Economic Aid

Finally we should briefly examine the United States economic aid with special reference to Public Law 480. Table 4.18 summarizes the impact of U. S. aid on the relative development of agriculture and

industry for the period 1953 to 1960.

Table 4.18 Percentages of gross fixed capital formation in various industries financed by United States aid, Taiwan, 1953-1960.

Year	Agri-culture	Mining manufacturing and electricity, gas and water	Transpor-tation and communica-tion	All others	Total gross fixed capital formation
1953	7.1	42.0	17.1	2.0	17.1
1954	11.0	38.1	21.0	4.1	18.7
1955	12.9	50.3	14.8	7.9	27.3
1956	18.5	49.9	16.2	13.6	29.3
1957	24.3	60.0	36.5	19.5	39.5
1958	20.0	48.9	26.5	15.3	32.4
1959	19.9	36.2	21.1	7.8	24.1
1960	22.2	31.6	25.5	6.7	22.0

Source: ICA China Mission and DGBAS

The percentage for agriculture increased rapidly from 7.1 in 1953 to 22.2 in 1960. However, the value of P.L. 480 commodities obtained by Taiwan accounted for one-tenth of the total U.S. economic aid. A recent study[31] concludes that the effects of Title I loans to capital creation projects in rural areas are likely to put some unemployed workers to work and this will add to total output. Also, "the cotton imported under P.L. 480 has greatly helped develop Taiwan's textile industry. Wheat imported under Public Law 480 encouraged the rise of a milling industry which was

[31] Yu-Hsin Kao, Effects of Public Law 480 Surpluses on Economic Development with Special Reference to Taiwan, Unpublished M. A. thesis at the University of Alberta, Edmonton, Alberta, (December 1963).

non-existent before World War II." In addition, "the value of Title I food as a check to inflation and as substitute for rice which made rice exports possible, added greatly to Taiwan's foreign exchange earnings and contributed to the sustained growth of Taiwan's economy."[32]

Summary

From the foregoing analysis on those factors, it can be concluded that the rapid increase in agricultural output in the post-war period was a result of deliberate effort. The Government "balanced growth" policy embedded in the three Four-Year Development Plans, with the cooperation of JCRR, Farmers' Association, and farmers, seem to be a key factor. Other factors responsible for the increased agricultural output can be classified into two categories. The first category includes those "used" factors, i.e., irrigation, fertilizers, and seed improvement, among other things, in the sense that they all contributed the increased agricultural output in the pre-war period. They demonstrated once again their effectiveness in the increase of output in the post-war period. The second category includes those "new" inputs, i.e., agricultural extension service, agricultural credit, disease and insect pest control, land reform, U.S. economic aid, in the sense that either they were not fully utilized or they were absent in the pre-war period. All these factors[33] along with simultaneous development of interactions between the agricultural and non-agricultural sectors provide the answer to the question how Taiwan improved its agriculture during the post-war period.

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[32] Ibid., pp. 119-121.

[33] Two additional factors which are not elaborated here but certainly have favorable effects on agricultural output are the well-established educational system and social overhead capital.

Estimation of the Agricultural Product Contribution

Kuznets' formula is used to compute the product contribution of agriculture to the growth of total product in the period 1953-60.[34]

Designate:

P_a = product of agriculture = 33.4 percent (average of net domestic production in 1953-60)

P_b = product of all other sectors (non-agricultural sector) = 66.6 percent (average of net domestic production in 1953-60)

P = total product = $P_a + P_b$

ΔP = increment in total product-aggregate growth

r_a = rate of growth of P_a = 3.4 percent (average figure in 1953-60)

r_b = rate of growth of P_b = 7.4 percent (average figure in 1953-60)

Then, $$\Delta P = P_a r_a + P_b r_b$$

And the equation for the share of the growth of agricultural product in the growth of total product is:

$$\frac{P_a r_a}{\Delta P} = \frac{1}{1 + \left(\frac{P_b}{P_a} \times \frac{r_b}{r_a}\right)} = \frac{1}{1 + \left(\frac{66.6}{33.4} \times \frac{7.4}{3.4}\right)} = 19\%$$

Thus the product contribution of agriculture to the growth of total output was about 19 percent. It can be easily understood that if the rate of growth of the non-agricultural sector is increasingly higher than that of agriculture, i.e., if $\frac{r_b}{r_a}$ rises, the decline in the share of agriculture in the growth of total product will be greater.

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[34] Kuznets, "Economic Growth and the Contribution of Agriculture," op. cit., pp. 105-106.

CHAPTER V

THE ROLE OF THE AGRICULTURAL SECTOR: MARKET ASPECT

Kuznets states that agriculture makes a market contribution to economic growth by "(a) purchasing some production items from other sectors at home or abroad; (b) selling some of its product, not only to pay for the purchases listed under (a) but also to purchase consumer goods from other sectors or from abroad, or to dispose of the product in any way other than consumption within the sector."[1] Following his general guideline, the market aspect of agriculture in relation to economic development will be analyzed in two categories: (a) selling agricultural products to the domestic and international markets; (b) purchasing farm inputs and consumer goods from the non-agricultural sector. Selling and purchasing in this process involve an element of diversification of structure which reduces the economic independence of the agricultural sector and stimulates more engagement in trade with other sectors at home and abroad. Thus agriculture makes it possible for other sectors to emerge and grow; just as other sectors and the international flows make it feasible for the agricultural sector to grow and be more efficient.[2] These interrelationships between the agricultural and non-agricultural

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[1] Kuznets, "Economic Growth and the Contribution of Agriculture," op. cit., pp. 109-110.

[2] Ibid.

sectors change the structure of the economy as a whole. These changes are important in and of themselves -- apart from the contribution that they make to growth in total or per capita output. For this very reason, the analysis of market aspect must intimately be related to the discussion of structural changes of the economy.

It should be pointed out at the outset that due to the severe limitation of the data on the inter-sec toral relationship, our analysis in most cases is not able to delve as deeply as we would like to. It seems that unless there are adequate input-output data, the market aspect of agriculture cannot be throughly discussed.[3]

Selling Agricultural Products to the Domestic and International Markets

There are no aggregate data available which will show the sale of agricultural output in the domestic market. However, data are available on certain commodities. For our purpose rice is chosen to examine the aspect of selling agricultural output to the domestic market because it is an overwhelmingly important commodity in the economy. A consumption study undertaken in 1956 shows that rice constitutes about 76 percent of daily food consumption. Sweet potatoes, wheat flour and other foods accounted for the rest.[4]

As indicated in Chapter IV, rice production rose by 28 percent with only a two percent increase in planted area during the period 1953-62,

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[3]Chenery and Clark point out,"... a minimum of ten man-years may be estimated as the cost of assemblying an input-output table of moderate size (40-50 industrial sectors), even when the basic census and other materials are in relatively good order." See Interindustry Economics, John Wiley & Sons, Inc., N.Y., (1959), p. 196.

[4]Sing-min Yeh, Per Capita Consumption Level of Basic Food in Taiwan, JCRR, Economic Digest Series, No. 11, (December 1957), p. 3.

taking 1953 as a base period. Despite the high population growth at 3.6 percent per year, the marketable surplus still steadily increased in 1953-58 except 1955. The marketed surplus as a percentage of total rice production, a more meaningful indicator, rose from 43.6 percent in 1953 to 49.3 in 1958 (column 9 of Table 5.1). This is the market contribution of rice to economic growth because this involves a whole range of activities in selling and buying rice. Data also show that the total rice used on the farm (column 6 of Table 5.1) was quite stable throughout the whole period except 1958. But if the total rice used on the farm is expressed as the percentage of total production, the percentage was declining except during the drought of 1955 (column 7). This explains why the marketable surplus was increasing. But basically this trend is largely due to a rise in net product per agricultural worker.

This finding rejects the current hypothesis that it is futile to raise agricultural output, because the increments will be almost entirely consumed by the peasant population, leaving very little saved or marketed.

In this connection, analysis should be given to the race between the rate of rice production and population growth. Comparison between them is shown in Table 5.2. From 1949 to 1961, except for the drought of 1955 and for the flood of 1959, the amount of rice production always increased over previous year. During the whole period, the average rate of the increase of rice production, 4.5 percent, was higher than the average rate of population increase at 3.5.

A recent survey also reveals that Taiwan has built up its largest rice stocks in recent years--310,000 tons in spite of frost, drought and

Table 5.1. Marketable surplus of rice, 1953-58.

(1,000 metric tons)

Year	Total production (1)	Seed and feed (2)	Consumption by farmers themselves (3)	Sales to government (4)	Free market sales (1)-(2)-(3)-(4)= (5)	Total on farm disposal (2)+(3)= (6)	As % of total production (6)/(1)= (7)	Marketable surplus (4)+(5)= (8)	As % of total production (8) - (1)= (9)
1953	1,642	105	821	502	214	926	56.4	716	43.6
1954	1,695	107	821	537	230	928	54.8	767	45.3
1955	1,615	102	818	522	173	920	57.0	695	43.0
1956	1,790	111	819	587	273	930	52.0	860	48.0
1957	1,839	113	830	607	289	943	51.3	896	48.7
1958	1,894	115	846	617	316	961	50.7	933	49.3

Source: Economic Bulletin for Asia and the Far East, Vol. XIV, No. 1, (June 1963), p. 60.

Table 5.2. Average rate of rice production increase compared with population increase, Taiwan, 1949-1961.

Year	1,000 persons	%	Percentage of increase (+) or decrease (-) over previous year	1,000 M.T. (unhulled)	%	Percentage of increase (+) or decrease (-) over previous year
1949	7,397	100	-	1,215	100	-
1950	7,554	102.1	(+) 2.1	1,421	117.0	(+) 17.0
1951	7,869	106.4	(+) 4.2	1,485	122.2	(+) 4.5
1952	8,128	109.9	(+) 3.3	1,570	129.2	(+) 5.7
1953	8,438	114.1	(+) 3.8	1,642	135.1	(+) 4.6
1954	8,749	118.3	(+) 3.7	1,695	139.5	(+) 3.2
1955	9,078	122.7	(+) 3.8	1,615	132.9	(-) 4.7
1956	9,390	126.9	(+) 3.4	1,790	147.3	(+) 10.8
1957	9,690	131.0	(+) 3.2	1,839	151.4	(+) 2.7
1958	10,039	135.7	(+) 3.6	1,894	155.9	(+) 3.0
1959	10,431	141.0	(+) 3.9	1,856	152.8	(-) 2.0
1960	10,792	145.9	(+) 3.5	1,912	157.4	(+) 3.0
1961	11,150	150.7	(+) 3.3	2,016	165.9	(+) 5.4
Average of 1949-61			3.5			4.5

Source: China Yearbook 1962-63, China Publishing Co. (1964), p. 402.

typhoons. The stocks were thought likely to reach 400,000 tons by the end of 1963.[5]

[5] International Financial News Survey, IMF, Vol. XVI, No. 4, (January 1964), p. 29.

But a pessimistic view is not lacking as to the future trend of agricultural production vs. population increase. As Hsieh and Lee point out.[6]

> One thing should be noted that the annual growth rate of agricultural output tends to decline in the future, while the annual growth rate of population tends to maintain at or even to increase to a high level if positive measures are not taken to check its growth.

It is clear that up to now the supply of rice has more than met the domestic demand. Without the significant increase in rice production it is likely that there would have been a substantial rise in food prices leading to general inflation. Thus rice at least has fulfilled a part of this role in the development process. In Ohkawa's term, a balanced growth has been attained in the sense that the demand and supply relation of food maintain a sustained balance.[7]

It should be immediately added that although a balanced growth has been attained in Ohkawa's sense, the percentage of net agricultural product in national income has declined sharply. It dropped from about 40 percent in 1954 to 33 percent in 1960, including forestry and fishery, or to 28.5 percent in 1960, excluding forestry and fishery. This also conforms to Kuznet's generalization, namely, economic growth is generally associated with a decline in the share of the agricultural sector in national income.

A closely related aspect in the process of development is the relative change of domestic production between the agricultural and non-agricultural sector. It is shown in Table 5.3.

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[6]Hsieh and Lee, op. cit., pp. 4-5.

[7]K. Ohkawa, "Discussion on Economic Growth and the Contribution of Agriculture: Notes on Measurement," Proceedings of the International Conference of Agricultural Economists, Oxford Univ. Press, (1963), p. 63.

Table 5.3. Percentage distribution of net domestic product in Taiwan, 1953-62.

Year	Agricultural sector including forestry, fishery and livestock	Non-agricultural sector	Industrial production[a]	Total net domestic product
1953	39.4	60.6	15.8	100
54	33.3	66.7	17.8	100
55	33.4	66.6	18.4	100
56	32.9	67.1	19.4	100
57	32.0	68.0	20.6	100
58	31.7	68.3	20.2	100
59	30.5	69.5	21.4	100
60	34.1	65.9	19.8	100
61	31.7	68.3	20.3	100
62	30.7	69.3	21.5	100

[a]Including mining and manufacturing

Source: Industry of Free China, Vol. XV, No. 6. (December 1963), pp. 52-53.

The most rapid changes lie in the agricultural and industrial sector. The percentage accounted for by agriculture declined from 39.4 in 1953 to 30.7 in 1962 whereas the relative share of the industrial sector increased from 15.8 in 1953 to 21.5 in 1962. The gain in the non-agricultural sector is the reciprocal of the agricultural sector, increasing from 60.6 percent in 1953 to 69.3 in 1962.

At this point, the change in domestic industrial production should be further examined. The index numbers of changes in industrial production from 1946 to 1962 are shown in Table 5.4. Industrial production showed a steady and remarkable progress throughout the whole period. Using 1953 as a base period, the industrial production as a whole increased from 100 to 245 in 1962. Manufacturing industries and public utilities increased a little over 150 while mining and construction of buildings increased by 103 and 41 percent, respectively, from 1953-62.

Over-all, the relative picture of the majority of industries remained unchanged in the period under review. Light industries continued to maintain a predominant position in manufacturing. The processing of food, beverages, tobacco and textiles still made up more than half of industrial production. It could be concluded that although the structure of the composition of industries did not change much, yet the trend was for a substantial increase.

We now examine the selling of agricultural output abroad. The importance of exporting agricultural products in Taiwan's economy can be traced back to the pre-war period. In the period 1920-58, five major agricultural commodities, sugar, rice, pinapple, tea and banana, provided about 80 percent of total foreign exchange earnings. Rice and sugar accounted for about 70 percent of total foreign exchange during the period 1920 to 1957 except for a few years in the 1950's.

The importance of rice and sugar has been rapidly declining since 1957, dropping to 34 percent and 22 percent respectively in 1961 and 1962. This situation was mainly due to the decrease in international price of sugar and an increase in population which reduced the rice available for export.

Table 5.4. Index numbers of industrial production, Taiwan, 1946-1962.

base: 1953 = 100

Year	General	Mining	Manufacturing	Construction of building	Public utilities
No. of commodities	160	16	137	4	3
1946	18.2	42.6	13.0	-	28.7
47	23.7	52.0	17.7	-	35.4
48	39.7	74.6	33.1	-	48.9
49	49.4	69.9	45.3	-	57.1
50	54.1	66.2	49.3	-	74.9
51	63.7	77.7	58.1	-	87.6
52	80.5	104.8	75.0	-	93.3
53	100.0	100.0	100.0	100.0	100.0
54	107.0	100.1	106.8	105.6	115.1
55	119.1	113.6	119.6	144.7	123.1
56	125.1	120.1	124.7	104.5	135.3
57	142.2	133.5	142.9	117.5	149.1
58	153.2	143.6	153.0	176.6	162.3
59	173.0	154.8	175.3	118.1	182.0
60	196.9	174.2	199.8	134.3	206.7
61	219.8	183.5	225.1	127.7	229.9
62	245.6	203.2	252.0	140.9	255.6

Source: Industry of Free China, Vol. XIX, No. 3, (March 1963), pp. 74-75.

The declining percentage of rice and sugar in the total value of exports has been steadily replaced by the increasing exports of processed farm goods and manufactured products. This brings about a changing pattern of exports and imports.

The composition of exports and imports usually reflects the changes in the economic structure. The continued increase in the ratio of exports of industrial products to total exports since 1958 demonstrates the pace of industrialization (columns 7 and 8 of Table 5.5). The percentage of agricultural and processed farm products in terms of total exports has rapidly declined from 87 percent in 1956 to 51 percent in 1962 (columns 4 and 6).[8] Within seven years, the record shows that the weight of agriculture in overall exports has declined significantly while that of industrial goods increased greatly.

The changes in the pattern of imports are not as evident as the changes in exports.

Imports are classified into capital goods, raw materials and consumption goods.[9] Changes in their relative weight also reflect changes in the economic structure. An examination of Table 5.6 indicates there are no obvious percentage changes in any of the three categories. In view of Taiwan's situation, however, a faster economic growth rate will require an increasing amount of imported capital goods and raw materials. This probably can only be achieved at the expense of consumption goods. But

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[8]The reason for such rapid drop is mainly due to the decline of exports of rice and sugar, which was previously discussed in Chapter IV and will be discussed more in Chapter VI.

[9]Capital goods include machinery, tools, vehicles, electrical supplies, etc. Raw materials include ores, metals, raw cotton, chemical fertilizer, crude oil, wool and artificial fibers, chemicals, oil, grease, wax, etc. Consumption goods include wheat, beans, pharmaceuticals and others.

Table 5.5. Changes in the composition of exports of Taiwan, 1956-62.

unit: US $1,000

Year	Total		Agricultural products		Processed farm products		Industrial products		Handicrafts and others	
	Amount (1)	% (2)	Amount (3)	% (4)	Amount (5)	% (6)	Amount (7)	% (8)	Amount (9)	% (10)
1956	130,060	100	19,650	15.1	93,345	71.8	15,510	11.9	1,557	1.2
1957	168,506	100	28,183	16.7	125,820	74.7	12,313	7.3	2,190	1.3
1958	164,435	100	39,133	23.8	103,724	63.1	18,798	11.4	2,778	1.7
1959	160,540	100	38,463	24.0	86,087	53.6	34,012	21.2	1,978	1.2
1960	169,866	100	19,997	11.8	94,873	55.8	51,767	30.5	3,229	1.9
1961	214,041	100	32,734	15.3	91,405	42.6	85,058	39.7	4,843	2.3
1962	238,605	100	33,052	13.8	85,809	36.0	112,641	47.2	7,107	3.0

Source: Industry of Free China, Vol. XX, No. 1. (July 1963), p. 12.

Table 5.6. Changes in composition of imports of Taiwan, 1956-62.

unit: US $1,000

Year	Total		Capital goods		Raw materials		Consumption goods	
	Amount (1)	% (2)	Amount (3)	% (4)	Amount (5)	% (6)	Amount (7)	% (8)
1956	228,225	100	61,996	27.15	122,686	53.76	43,373	19.09
1957	252,235	100	72,925	28.91	126,812	50.28	52,498	20.81
1958	232,785	100	69,073	29.67	114,968	49.39	48,774	20.94
1959	244,367	100	77,538	31.73	122,884	50.29	43,945	17.98
1960	252,216	100	70,209	27.84	120,193	47.65	61,814	24.51
1961	323,526	100	76,963	29.97	153,276	47.38	73,288	22.65
1962	331,935	100	94,980	28.61	167,451	50.45	69,504	20.94

Source: Industry of Free China, Vol. XX, No. 1, (July 1963), p. 15.

the picture in the past few years does not suggest this direction.

Purchasing Farm Inputs and Consumer Goods from the Non-Agricultural Sector

With the expansion of agricultural output, farm inputs also increased. The available data covering the period 1953-60 indicate that the input of land remained quite the same (column 1 of Table 5.7), while those of labor, cattle, and irrigation and drainage registered relatively small gains, as shown in Table 5.7. The input factors which registered the largest expansion were materials (pesticide, etc.), and chemical fertilizers. These two items were largely supplied from the non-agricultural sector. A 1957 farm income study shows that farmers spent 22 percent of their total farm expenditures in fertilizer, which was the largest item of expenditures.[10] The need to purchase these new inputs from other sectors, as Kuznets points out, means an increasing "marketization" of the production process within agriculture.[11]

As mentioned above, fertilizer is the largest expenditure item which farmers spend. About one third of the total consumption in 1962 was imported. Thus the agricultural sector stimulates the international as well as the domestic economy. The total imported chemical fertilizer amounted to 4 million M.T., equivalent to 6 billion N.T. dollars during the period 1952-62.[12]

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[10] Y. C. Tsui, A summary Report on Farm Income of Taiwan in 1957 in Comparison with 1952, JCRR, (December 1959), p. 44.

[11] Kuznets, op. cit., p. 110.

[12] Industry of Free China, Vol. XXI, No. 2, (February 1964), p. 98.

Table 5.7. Comparison of indices of farm input and output, in Taiwan, 1953-60.

(1953=100)

Year	Land input (1)	Labour input (2)	Chemical fertilizer (3)	Seed (4)	Animal feed (5)	Cattle input (6)	Depreciation equipment (7)	Materials (8)	Irrigation and drainage (9)	Total input (10)	Total output (11)	10/11 (12)
1953	100	100	100	100	100	100	100	100	100	100	100	100
1954	100	100	118	101	104	106	98	165	99	101	100	101
1955	100	98	120	99	106	106	96	254	98	103	99	104
1956	100	102	131	101	112	106	97	224	100	106	108	98
1957	100	109	135	106	120	106	98	279	101	109	115	95
1958	101	112	140	107	131	107	101	376	101	113	122	93
1959	101	111	139	107	126	108	94	390	100	112	122	92
1960	100	109	124	110	126	108	92	504	105	111	123	90

Note: Indices of inputs and index of total output are based on estimates by the Rural Economics Division of JCRR.

Source: Economic Bulletin of Asia and the Far East, Vol. XIV, No. 1, (June 1963), p. 60.

Table 5.8. Categories of total fixed farm capital and working capital, Taiwan, 1953-1960 at 1953 prices (in NT$ million).

Year	Farm land (1)	Houses and farm buildings (2)	Large implements and tools (3)	Others[A] (4)	Total fixed capital 5=(1)+(2)+(3)+(4)	Working[B] capital
1953	15,832	6,293	696	3,293	26,114	4,375
54	15,931	6,180	688	2,906	25,706	4,355
55	15,987	5,954	678	4,250	26,869	4,696
56	15,959	6,190	660	3,471	25,764	4,696
57	15,840	7,362	712	4,314	27,688	5,029
58	15,900	8,031	1,423	3,907	29,261	3,596
59	15,813	8,632	1,601	5,234	29,791	5,629
60	15,942	8,296	1,467	4,147	29,835	5,122

[A]Including livestock, orchard, and facilities for land improvement.
[B]Including fattening hogs, poultry, chemical fertilizer, seeds, feeds, materials, and hired labor expenses.

Source: Estimates by JCRR.

Farmers' increase in purchasing farm inputs from the non-agricultural sector can also be examined by turning to Table 5.8.

Comparing the years 1953 and 1960, the total increased value of houses and farm building, large implements and tools, and working capital were N.T. $3.5 billion. Although no detailed data were available as to the original sources of these purchases, yet, by the nature of these goods, a high proportion of them must be supplied by the non-agricultural sector at home and abroad.

Another important aspect is the interaction as agricultural and industrial products are used as the inputs in agricultural and industrial production. A comparison is made in Table 5.9. Column 2 of the table indicates the use of agricultural products as industrial inputs throughout the period is lower than the 1953 level. It shows that the industrial pattern of Taiwan took on a different character and did not as often require agricultural raw materials as did the previously existing industry. But, the use of industrial products as inputs in agricultural production has increased steadily throughout the whole period, as shown in column 1 of Table 5.9. The UN study thus concludes: "During the period 1953-59, therefore, industry absorbed an increasingly smaller proportion of agricultural products, whereas agriculture absorbed an increasingly greater proportion of industrial goods."[13] This trend demonstrates a basic change of the structure of farm production--the inputs of the manufactured products gaining increasing importance relative to those of primary factors.

Next we discuss farmers' purchase of consumer goods (as opposed to producer goods) from the non-agricultural sector. As farmers' income increases, their purchase of consumer goods is also expected to rise. A recent farm income study shows that "the real average gross family receipts per farm increased from NT $12,000 in 1952 to NT $14,700 in 1957 showing an increase of 17 percent."[14] In other words, average gross farm family receipts increased at 3 percent per year within this period. On a per capita basis farm family earnings climbed from NT $900 in 1952 to

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[13] Economic Bulletin for Asia and the Far East, op. cit., p. 46.

[14] Tsui, op. cit., p. 21. The increase in farm receipts, if expressed in current values, was well over 90 percent from 1952 to 1957. Tsui, op. cit., p. 3.

Table 5.9 The use of agricultural and industrial products as the inputs in agricultural and industrial production, Taiwan, 1954-1960.

(1953=100)

Year	Agricultural requisites of industrial origin (1)	Industrial materials of agricultural origin (2)
1954	92	75
1955	98	72
1956	104	77
1957	123	85
1958	131	85
1959	137	-
1960	-	-

Note: Column (1) Agricultural requisites of industrial origin consist of calcium cyanamide, calcium superphosphate, fused phosphate, ammonium sulphate, ammonium anhydrous, soybean cake, and peanut cake.

(2) Industrial materials of agricultural origin consist of sugarcane, rice, sweet potato, wheat, soybean, peanut, pineapple, tea (crude), tobacco leaf, citronella, jute, and cotton.

Source: Economic Bulletin for Asia and the Far East, Vol. XIV, No. 1, (June 1963), p. 69.

NT $1,000 in 1957. This shows an increase of 11 percent during this five year span. Other important findings include: First, in 1957, out of the farm family earning about NT $14,000 per farm, their farm family living expenditures took a share of NT $13,000 or 92 percent of the total, leaving NT $1,000 as surplus. Thus the income and savings ratio of farm families in 1957 was 7.6 percent.

Second, in 1952, farm families received 13 percent of their income from non-farm sources, which was increased to 22 percent in 1957. Cash income also jumped from 44 percent to 63 percent in the same period.

Third, farm expenditures spent in cash was increased from 40 percent in 1952 to 64 percent in 1957. Rapid increases in cash farm expenditures imply that more inputs were purchased, indicating an increasing degree of commercialization on the farm.

These findings suggest the rise of rural purchasing power and the existence of some non-farm job opportunities in Taiwan.

Based on some limited evidence, we now want to speculate about the farmers' expenditure pattern. Two farm household surveys in 1950/51 and 1958 indicate that two significant changes in farmers' consumption expenditure took place.[15] First, expenditures on food dropped from 45.5 percent in 1950/51 to 37.9 percent in 1958. To this extent Engel's Law seems to apply in the expenditure pattern of rural families in Taiwan. This indicates that with the increased income, farmers in general spent relatively less of their income on agricultural products and relatively more on non-agricultural products during this period. Second, impressive increases in educational expenditure were recorded in this period: from 1.5 percent to 4.8 percent. This is very encouraging in view of the belated recognition of the importance of human growth in economic development.

An indirect indicator which reflects the farmers' consumption pattern is their income elasticity for consumer goods, as shown in

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[15] Economic Bulletin for Asia and the Far East, op. cit., pp. 43-44.

Table 5.10. The income elasticities of the demand for the consumption items, e.g., housing and furniture, and recreation, entertainment and ceremony, were greater than one. Those goods are sometimes termed a "luxury." This means the percentage of income spent on these goods increases as income increases. Since these goods are supplied by the non-agricultural sector, this implies that higher income will result in more purchase of these goods. The income elasticities of demand for other consumption goods included in the table were greater than zero but less than one. These goods in question are termed a "necessity." It means the percentage of income spent on the goods in question decreases as income increases.[16]

Table 5.10. Farm families average income elasticities for various consumption items, Taiwan, 1950/51 and 1958.

Consumption item	1950/51	1958
Food	0.54	0.54
Staple food	0.48	0.42
Supplementary	0.62	0.71
Beverages and tobacco	0.68	0.73
Clothing and other belongings	0.72	0.65
Household operation	0.78	0.68
Housing and furniture	1.17	1.06
Water, electricity and fuel	0.68	0.64
Education	1.26	0.39
Medical care	0.52	0.44
Recreation, entertainment, and ceremony	0.83	1.44
Miscellaneous	0.85	0.87

Note: These have been derived from the data of annual average income and consumption expenditures per male adult equivalent in farm families of various income brackets, 1950, and 1958.

Source: Economic Bulletin for Asia and the Far East, Vol. XIV, No. 1, (June 1963), p. 67.

[16]Milton Friedman, Price Theory, Aldine Publishing Company, (1962), pp. 47-48.

A brief comparison of the income elasticities between 1950 and 1958 indicates that no change took place on food consumption. For clothing and other belongings, the income elasticity of demand decreased in 1958 compared with that in 1952. "This was due probably to wartime privations and postwar hardships, which slowed down the farmers' replenishment of their stock of clothing prior to 1950. This explains also the decrease in the elasticity of demand for housing and furniture."[17] The decrease in the income elasticity of demand for education between 1950 and 1958 may be due to the significant extension of education and also perhaps of a faster increase in household incomes in relation to the increase in costs of education.[18] Although there are no detailed data available on the quantitive increase in farmers' purchase of consumer goods, yet it reveals the general trend of consumption pattern.

Estimation of the Magnitude of Agricultural Marketization

Finally an effort is made to estimate the magnitude of marketization of the net product of agriculture to total marketed net product. Such an estimation will provide an approximation of the market contribution of agriculture in the process of development.

Due to the data limitation, calculation on the magnitude of marketization will be made in two periods: 1930-40 and 1953-60. The estimating method used is very simple and developed by Kuznets in 1961.[19] His method is based on two different sets of assumptions. For the present purpose,

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[17] Economic Bulletin for Asia and the Far East, op. cit., p. 45.

[18] Ibid., p. 45.

[19] Kuznets, op. cit., pp. 112-113.

the first set of assumptions seems more relevant. Needless to say, these assumptions can be immediately relaxed as soon as the empirical data are available.

First we disregard the minor fraction of the net agricultural product that may be saved rather than consumed. Let us assume the per capita consumption of agricultural net output is the same in both the agricultural and non-agricultural sectors, despite the difference in their total income per capita. The average data of 1930-40 show that the share of the agricultural sector in total product[20] was 48 percent and in the labor force was 64 percent. Per capita consumption of agricultural output throughout the economy will be 0.48 (in percentage of total product); the consumption by the agricultural population of its own product will be 31 percent (= 48% multiplied by 64%) of national product; and their consumption of other goods will be 17 percent (i.e., 48% of total net product minus 31% represented by agricultural output). If we also assume that all the non-agricultural final output goes through the market, the total marketed net output is 69 percent of total output, of which 17 percent is agricultural final output. Therefore the contribution of agriculture to total marketed net product during the period 1930-40 was about 25 percent (17% of marketed agricultural output divided by 69% of total output). From this simple manipulation it becomes evident that, as the share of agriculture in national product and in labor force decline, its proportional contribution to the growing marketed net product will also decline. To demonstrate this case, we turn to the recent period 1953-60.

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[20] In Kuznets' method, this should be NNP. But no NNP data are available in this period.

Following the same assumptions made above, given the data on the share of the agricultural sector in NNP as 33 percent and in the labor force as 57 percent, we obtained the consumption by the agricultural population of its own product as 19 percent (57% multiplied by 33% of NNP). Also assume that all the non-agricultural product goes through the market, the total marketed net product is then 81 percent of which 14 percent is agricultural final output. The contribution of agriculture to total marketed net product is then about 17 percent during this period, in contrast to 25 percent in 1930-40.

This simple calculation demonstrates Kuznets' conclusion that "the market contribution of agriculture to a country's economic growth, strategic in the early periods of growth, must, in the nature of the case, diminish in relative weight once growth has proceeded apace."[21]

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[21]Kuznets, op. cit., p. 113.

CHAPTER VI

THE ROLE OF THE AGRICULTURAL SECTOR: FACTOR ASPECT

The factor aspect of the agricultural sector as it relates to economic growth essentially involves a transfer or loan of resources, these resources being productive factors, from the agricultural sector to others. Kuznets points out, "The resources being transferred are either capital, or rather funds for financing acquisition of material capital, or labor."[1] These two factors: capital and labor are analyzed separately below.

Capital

Two different types of capital transfer may occur. The first type is a compulsory transfer from agriculture for the benefit of other sectors; and this is ordinarily done through government taxation. Under this type, we will discuss the low government purchasing price of rice, the high government exchange price of fertilizers to rice, and land tax. The other form of capital transfer is the utilization of savings originating in the agricultural sector in financing the growth of the non-agricultural sector. In addition, agriculture's share in total domestic capital formation and its contribution to foreign exchange earnings will also be discussed.

Low Government Purchasing Price of Rice

As noted earlier, rice is an important commodity. A change in the rice price has an immense impact upon the economy as a whole. The Government has been imposing low price policy of rice. Partial rationing has

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[1]Kuznets, op. cit., p. 114.

been employed by the Government to implement this policy. The prices of compulsory purchase of rice paid by the Government has been kept lower than the market price. For instance, the price spread for ponlai rice between government purchase and the free market amounted to NT $2,087 and NT $1,724 per m/t in 1960 and 1961. With the quantity of 599,778 m/t and 738,325 m/t collected by the government in these two years, the loss incurred to the farmers amounted to more than NT $1.2 billion each year. A detailed account of such loss for rice farmers in the past 11 years is shown in Table 6.1. The total loss to the rice farmers in the whole period amounted to NT $6 billion. It is an incredible contribution by the rice farmers to the total Government revenue. In other words, "Rice farmers, accounting for more than 80 percent of all farmers, had been denied the full market price for about 30 percent of their rice production collected by the government since Retrocession."[2]

The 6 billion NT dollar revenue collected by the Provincial Food Bureau was mainly used to subsidize the special groups, notably the military and government personnel and an infant fertilizer industry whose production costs in 1962 were still above world market prices. Thus Rada and Lee conclude, "The net contribution, i.e., benefits minus costs, of this complex subsidy system to the national welfare is questionable, particularly if measured against net profits from alternative uses of the funds."[3]

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[2]Rada and Lee, op. cit., p. 30.

[3]Ibid., p. 30.

Table 6.1. The preempted value to farmers of rice collected[A] and compulsorily purchased by Government, Taiwan, 1951-1961.

Year	Price spread[B] NT$/m/t.	Rice collected from farmers m/t	Total value NT$
1951	224	404,227	90,546,848
1952	679	425,467	288,892,093
1953	1,224	423,308	518,128,992
1954	565	525,938	297,154,970
1955	639	496,354	317,170,206
1956	813	515,664	419,234,832
1957	935	535,347	500,549,445
1958	898	650,641	584,275,618
1959	933	606,301	565,678,833
1960	2,087	599,778	1,251,736,686
1961	1,724	738,325	1,272,872,300

[A]Ponlai rice, brown-rice equivalents.

[B]Amount official rice price below free market farm rice price.

Source: Computed from Taiwan Provincial Food Bureau's Financial Operating Statements.

The low price of rice is desirable to consumers in view of the fact that rice accounts for about three quarters of their daily diet. Not only was the rice price low, but also the long-term trend of agricultural prices was low during the period 1914-1959. As the data in Table 6.2 indicate, except for the period 1945-50, the ratio of agricultural prices was always relatively lower than the general price level in the remaining

period.[4] The rise of the relative ratio in 1945-50 was due to high inflation and low agricultural production.

The relatively low agricultural prices would have two favorable effects on economic growth. First, consumers would have more money to spend for something else, presumably non-agricultural products.

Table 6.2. Long-term trend of the relative ratio of agricultural prices,[A] Taiwan.

Base period = 1936-38

Period	Relative Ratio of agricultural prices
1914-1920	84
1920-1939	92
1939-1944	78
1944-1950	137
1950-1959	70

[A]Relative ratio refers to the price ratio between the agricultural prices and general price level.

Source: T. H. Lee, "Agricultural Prices in Taiwan," Research Bulletin, 75, Bank of Taiwan, (April 1962), p. 177.

Second, the industrial sector will benefit from these low prices either because industrial wages are kept stable more easily or because the cost

[4]Qualifications should be added in interpreting the result of Table 6.2. First, in computing the general price level, agricultural products were presumably included. Thus the results might be biased. Second, the selection of the base period makes quite a difference here. If 1914-20 were used as a base period, for instance, then the relative ratios of agricultural products would be much higher than what we have in the present table.

of buying agricultural products as inputs in its production would be cheaper. But what are the effects of these low agricultural prices on farmers? The UN study concludes that due to the substantial increase in agricultural productivity, "there is no evidence that the economic position of farmers in general has deteriorated during the period under review (1953-60)."[5] However, it is recognized by the UN experts that the low agricultural price policy could have exercised an unfavorable influence on the production.

High Government Exchange Price of Fertilizers to Rice

It has been recognized that the farmers' use of fertilizers is an important item in their farm expenditures. In Taiwan, there is a peculiar fertilizer-rice barter system which has been in effect since 1948. This barter system serves two functions. First, the government provides a high quality and enough quantity of fertilizers to the farmers, and the government gets rice in return. Second, this system enables the government to collect a tremendous revenue from this operation. The schema is rather simple, i.e., farmers can exchange fertilizers for rice at a certain ratio set by the Bureau of Food. The schema is voluntary in its nature. Theoretically, farmers can buy fertilizers anywhere they like. But farmers, in most cases, are tempted to exchange rice for fertilizers from the government because (a) a fertilizer loan can be made to credit needing farmers, and (b) the government provides the fertilizers with the proper proportions for their soils.

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[5]Economic Bulletin for Asia and the Far East, op. cit., p. 51.

A recent study[6] shows that at the present exchange ratio between rice and various kinds of fertilizers, the estimated loss incurred to the farmers in a single year, 1959, is about 404 million NT dollars. The estimated loss is obtained by comparing the existing ratio provided by the government and open market ratio suggested by the authors of that study. In 1959, the amount of fertilizers exchanged amounted to 500 thousand tons. According to the prevailing ratio, the government obtained 388 thousand tons of rice in return. If using the open market ratio, the government should only get 287 thousand tons of rice in return. This ratio would enable farmers to save 101 thousand tons of rice which amounted to 404 million NT dollars.

The study cited did not compute the loss incurred to the farmers in other years. In view of the constant increase of fertilizers in the post-war period, however, the total revenue captured by the government might be around 4 billion NT dollars, say, in the past decade. This is another significant contribution made by the rice farmers. Thus the rice farmers in Taiwan have been making dual contributions by selling their rice to the government at the enforced low price and by exchanging fertilizers to their rice at an unfavorable ratio during the post-war period.

Land Tax

The forced extraction of surplus from agriculture usually takes the form of a land tax. It is often considered as the main financing source in the early stages of development. The historical experience of Japan

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[6] Chien-sheng Shih, etc., "An Appraisal of the Fertilizer-rice Barter System in Taiwan," College of Law, National Taiwan University, Taipei, (June 1961), pp. 1-30.

is a case in point. The land tax in Japan constituted about 86 percent of the total government tax revenue in 1888-1892, and the direct tax ratio to income produced was between 12 and 22 percent from agriculture, compared with from two to three percent from the non-agricultural sectors.[7] The land tax still represented as much as about 56 percent in 1903-1907. Historically, the land tax in Taiwan did not play such a prominant role as it did in Japan (Table 6.3). During the pre-war period, 1928-1941, the land tax and the income tax, however, were the two main sources. The percentage share of land tax in total government revenue declined from 27 percent in 1928 to 9 percent in 1941. The average of the whole period was 25%. But the absolute amount of land tax was steadily increasing, except for a very small drop in three years.

This declining situation of land tax also holds true in the post-war period (Table 6.4). Throughout the period, the land tax varied from five to seven percent of the government total revenue. The main sources of government revenue were from monopoly profits, custom taxes and a defense surtax, which accounted for about half of the government revenue. In the post-war period, the land tax paid by the farmers is sometimes claimed to be relatively low to the productivity of land. It was estimated that land taxes were only about three percent of the total production in 1958. One way suggested to increase land taxation revenue is to change the present cadastral land tax system (collection system) into taxation on land value. It is estimated "the land tax revenue will be increased three times if

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[7] Ohkawa and Rosovsky, op. cit., Tables 14 and 15.

Table 6.3. Composition of government taxation revenue, Taiwan, 1928-1941.

unit = 1,000 yuan

Year	Income tax	%	Land tax	%	Customs duty	%	Others[A]	%	Total
1928	2,505	12.07	5,596	26.97	4,517	21.77	8,129	39.19	20,747
1929	3,000	13.86	5,614	25.94	4,444	20.56	8,580	79.64	21,638
1930	3,150	16.37	5,630	29.24	2,795	14.52	7,676	39.87	19,251
1931	2,477	13.71	5,629	31.15	2,362	13.07	7,600	42.07	18,068
1932	2,415	13.14	5,692	30.96	5,744	14.93	4,531	40.97	18,382
1933	5,833	29.00	5,759	28.63	2,183	10.85	6,342	31.52	20,117
1934	4,056	20.97	5,835	30.17	2,561	13.24	6,886	35.62	19,338
1935	3,954	17.25	7,489	32.67	2,545	11.10	8,934	38.98	22,922
1936	5,218	20.05	7,940	29.74	3,262	12.53	9,604	37.68	26,024
1937	9,554	26.97	7,935	22.40	2,515	7.10	15,421	43.53	35,425
1938	13,033	31.53	8,340	20.18	1,753	4.24	18,213	44.05	41,339
1939	15,214	34.65	8,329	15.81	2,397	4.52	26,673	45.02	52,613
1940	29,678	33.80	8,333	11.33	2,562	3.48	32,646	51.39	73,219
1941	32,877	33.78	8,311	8.52	2,345	2.40	53,807	55.30	97,340

[A]Others include sugar consumption tax, alcoholic tax, and temporary income tax, etc.

Source: S. W. Chow, The History of Taiwan's Economy Under the Japanese Occupation, Bank of Taiwan, (September 1958), 325-326.

such changes are made."[8] Objections would certainly arise under the proposed system because of its heavier burden on the farmers.

[8]Liu, op. cit., p. 113.

Table 6.4. Percentage distribution of total government revenue, Taiwan, 1952-57

Year	Income tax	Property tax	Land tax	Commodity tax	Custom tax	Monopoly profits	Defense surtax	Others
1952	12.8	16.4	5.6	4.4	20.9	10.7	17.7	17.7
1953	11.2	6.6	7.9	5.4	17.2	13.6	18.4	18.4
1954	10.3	5.1	6.2	9.4	14.7	16.9	16.8	16.8
1955	12.9	5.8	5.1	9.6	14.6	15.7	18.2	18.2
1956	8.1	5.9	6.9	10.2	14.2	14.0	17.0	17.0
1957	7.3	6.6	6.7	10.2	17.1	14.1	18.0	18.0

Source: "The Review and Improvement of the Tax System in Taiwan," The Economic Reference, No. 177, (July 16, 1959), Ministry of Economic Affairs, Taipei.

Estimation of a Flow of Savings Originating in the Agricultural Sector into Capital Formation in the Non-agricultural Sector

The second type of capital transfer is the utilization of savings originating in the agricultural sector in financing the growth of the non-agricultural sector. An empirical estimation of the magnitude involved in this process is possible provided there are enough data. But Kuznets could not find enough data for his purposes, neither do we. We are forced to speculate on the magnitude to some extent.

In what follows, we shall use Kuznets' method[9] step by step and insert the empirical data wherever they are available; if not, Kuznets' hypothetical figures will be used.

[9] Kuznets, op. cit., pp. 116-117.

Data in Taiwan show that the share of the agricultural sector in income of 33 percent (average of 1953-60); and that savings were 11 percent of the agricultural sector income (average of 7 years in the 1950's) compared with a 5 percent savings rate for the non-agricultural sector (since we have data on the savings in agriculture and total domestic savings in Taiwan, thus savings in the non-agricultural sector were treated as a residual.) Total net domestic savings were about 7 percent (average of 1951-59) of national income, 3.6 percent originating in the agricultural sector and 3.4 percent in the non-agricultural sector.

Kuznets points out "the flow of savings out of the agricultural sector to finance capital formation elsewhere would depend largely upon the relative needs of these sectors for capital, which needs are reflected in differential rates of return. Perhaps the incremental capital-output ratio might suggest how much capital is needed to secure additional output....the allocation of savings depends largely upon the relative rates of growth of the agricultural sector and non-agricultural sector."[10]

In order to compute the needed capital formation in the agricultural sector of total capital formation, additional information is needed. Kuznets assumes that the net savings rate is 7 percent, that national product grows at a rate of 3 percent per year, implying an incremental capital-output ratio of 2.3 to 1; and that the rate of growth of the product of the non-agricultural sector is four times that of the product of the agricultural sector, then the needed capital formation in the

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[10]Kuznets, op. cit., p. 116.

agricultural sector of total capital formation will be:

$$(0.33)r + (0.67)4r = 3.0$$

r, the rate of growth for the agricultural sector, is then about 1 percent, that for the non-agricultural sector four times as high, or 4 percent. Multiplying the former by 0.33 yields the increment of the product of the agricultural sector, or 0.33; multiplying the latter by 0.67 yields the increment of the product of the non-agricultural sector, or 2.67. The ratio of the increment in the agricultural sector to increment in total product, and, on the assumption used, of the capital needs of the agricultural sector to total capital needs, is then 11 percent (0.33 divided by 3), whereas savings originating in agriculture are 51 percent (3.6% divided by 7%) savings. There will therefore be a flow of savings originating in the agricultural sector into capital formation in the non-agricultural sector, accounting for 40 (51% minus 11%) out of 89 (40% plus 49%), or somewhat about 45 percent.

As Kuznets warns us, "The example is purely illustrative; and the discussion is designed only to bring out the variables that would have to be measured in empirical study."[11] In the case of Taiwan, the rate of growth of the product of the non-agricultural sector might well be less than four times that of the agricultural sector. The incremental capital-output ratio for the agricultural sector might be lower than the incremental capital-output ratio for the non-agricultural sector. Also, in this example, we only take domestic savings into account, disregarding financing from abroad--mainly U.S. economic aid which averaged at U.S.$ one hundred million a year during the past decade.

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[11]Kuznets, op. cit., p. 117.

Agriculture's Share in Domestic Capital Formation

We shall now discuss the share of agriculture in domestic capital formation and its contribution to foreign exchange earnings.

The distribution of gross domestic capital formation between agriculture and manufacturing is shown in Table 6.5.

Table 6.5. Distribution of gross domestic capital formation, Taiwan, 1952-61.

unit NT$ million

Period	Agriculture (including forestry, fishery and livestock)		Manufacturing	
	Value (1)	% of total domestic capital formation (2)	Value (3)	% of total domestic capital formation (4)
1952	566	19.6	341	11.8
1953	689	19.6	543	15.4
1954	707	18.0	493	12.6
1955	848	19.9	839	19.7
1956	872	18.0	974	20.0
1957	937	15.0	1,300	20.8
1958	1,117	14.7	1,720	22.7
1959	1,813	18.7	1,877	19.3
1960	1,908	14.7	2,428	18.7
1961	2,212	15.1	2,670	18.3

Source: Computed from Industry of Free China, Vol. XX. No. 6, (December 1963), p. 54-55.

The percentage of the agricultural sector in the total domestic capital formation has been declining as shown in column 2 of Table 6.5. But the absolute amount of domestic capital formation has been steadily increasing

throughout the whole period. The amount contributed by the agricultural sector to capital formation in 1961 was about four times the value in 1952. This is the factor contribution made by the agricultural sector. The manufacturing sector gained some advance in the percentage distribution as well as the absolute amount of capital formation comparing 1952 with 1961.

Next, we examine agriculture's contributions to foreign exchange earnings.

Earning Foreign Exchange

Historically, developing economies have created from their national resources major export industries to finance the import of capital equipment and to service the foreign debt during the take-off. The United States, Russian and Canadian grain, Swedish timber and pulp, Japanese silk, etc. fulfilled this function.[12] Except in the recent decade, Taiwan's export earnings mainly relied on sugar, and to a lesser extent, rice. Sugar always accounted for more than 50 percent of the total foreign exchange until 1958. The data in Table 6.6 indicate that Taiwan's economy falls into the usual pattern of a developing country, namely, external trade is highly dependent upon a few agricultural products--rice, sugar, tea, etc. in the present case.

The data in Table 6.6 suggest that, through the period 1920-62, five major agricultural products were the main source of foreign exchange earnings. The data also confirm the general hypothesis that when an economy is developing, the percentage of agricultural exports in the total foreign

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[12]Rostow, The Stages of Economic Growth, op. cit., p. 48.

exchange earning is declining. The percentage of total foreign exchange earning accounted for by the five main products dropped sharply from 81 percent in 1920 to 35 percent in 1962. Taking just the two most important exports, sugar and rice, into account, their percentage change in the total value of exports declined rapidly from 77 percent in 1920 to 24 percent in 1962. However, a percentage figure is often an unreliable indicator of the change in the absolute value under consideration. An absolute export value of, for instance, rice and sugar, may increase but their percentage of the value of total exports may decrease simply because the increase in the value of total export is faster than the increase in the value of rice and sugar. In order to explore this possibility, we turn to Table 6.7 to examine the absolute export value of rice and sugar. In comparing 1952 and 1962 for sugar, it is found that although sugar in 1952 comprised 59 percent against 21 percent in 1962 of total export value, the absolute value of foreign exchange earning in 1962 was NT$ 961 million more than the value in 1952. The same situation is true in the case of rice. In comparing 1952 and 1962, the value of rice exports, 223 million, comprised 15 percent of total value of exports, whereas in 1962 rice accounted for about three percent of the total value of exports but its export value was NT$ 242 million. Both cases seem to indicate that, despite their declining percentage in the total value of exports, agricultural exports still remain as one of the important means of increasing foreign exchange earnings in Taiwan. We should also not overlook the fact that in the present situation, if there were no rapid population growth and a frustrating international price of sugar, more foreign exchange would probably have been forthcoming.

Table 6.6 Percentage distribution of the value of exports by principal commodities, Taiwan, 1920-62.

Year	Sugar (1)	Rice (2)	Sugar and rice (3)=(4)+(2)	Canned pine-apples (4)	Tea (5)	Banana (6)	Sugar, rice pineapple, tea and banana (7)=(1)+(2)+(4)+(5)+(6)	Cotton piece goods
1920	65.8	11.6	77.4	-	3.1	0.6	81.1	-
1930	58.8	16.0	74.8	-	3.7	4.7	83.2	-
1940	59.3	15.5	74.8	-	3.7	5.2	83.7	-
1950	73.6	4.1	77.7	1.1	5.6	2.4	86.8	-
1951	53.3	12.3	65.6	2.4	8.2	4.2	80.4	-
1952	58.9	15.2	74.1	1.9	5.8	5.2	87.0	-
1953	67.2	10.6	77.8	1.9	5.3	2.4	87.4	-
1954	58.0	7.8	65.8	4.2	10.0	4.4	84.4	0.1
1955	49.9	23.3	73.2	4.2	4.4	3.1	84.9	-
1956	52.2	14.1	66.3	5.0	4.2	2.3	77.8	1.2
1957	62.4	12.1	74.5	2.8	3.9	2.4	83.6	1.5
1958	51.8	16.9	68.7	4.4	4.1	3.7	80.9	0.9
1959	40.7	14.9	55.6	5.0	4.4	3.8	68.8	5.9
1960	44.0	3.1	47.1	4.8	3.7	3.7	59.3	7.8
1961	29.2	4.8	34.0	5.3	4.5	4.9	48.7	6.4
1962	20.9	2.8	23.7	4.5	3.4	3.2	34.8	5.7

Sources: Industry of China, Vol 20, No. 6, (February 1963), pp. 104-105. Data proceding 1952 were obtained from Wei-ping Liu, An Economic Analysis of Taiwanian Agricultural Development since 1950, Unpublished Ph.D. dissertation at University of Minnesota, July, 1961, p. 82.

Table 6.7. Value and percentage of exports by sugar and rice, Taiwan, 1952-1962.

	Sugar			Rice and paddy (incl. shops' stores)		
	Quantity	Value		Quantity	Value	
Period	M.T.	NT $1,000	% of total export	M.T.	NT $1,000	% of total export
1952	460,540	863,977	58.86	105,254	223,697	15.24
1953	874,697	1,334,017	67.23	59,393	209,450	10.56
1954	522,188	841,845	58.03	36,072	112,996	7.79
1955	585,901	955,621	49.85	169,801	447,340	23.34
1956	600,507	1,530,607	52.21	109,199	412,342	14.07
1957	748,420	2,291,698	62.37	121,793	443,818	12.08
1958	816,634	2,001,246	51.83	179,310	653,161	16.92
1959	733,869	2,320,233	40.65	160,190	850,492	14.90
1960	862,535	2,625,665	44.01	35,040	183,750	3.08
1961	659,724	2,297,993	29.25	65,000	374,761	4.77
1962	633,947	1,825,127	20.90	42,087	242,913	2.78

Source: Industry of Free China, Vol. XX, No. 6, (December 1963), p. 104.

Labor Migration

In addition to capital contribution, the agricultural sector is said to be able to make another factor contribution by transferring its workers to the non-agricultural sector. Why? The basic reason is that in the process of development, almost by definition, the productivity of agricultural labor will be increased, and thus releases some labor for development activities in the non-agricultural sector without affecting agricultural production. Another reason argued by Lewis is that industrial wages can be kept constant or stable and the entrepreneurs can reinvest their surplus to expand their production. Lewis' reasoning is sometimes questioned because the industrial wages have risen side by side with the outmigration of agricultural workers to the non-agricultural sector. A more recent and generally-accepted version is summarized by Kuznets. He states,[13]

> This transfer of workers from the agricultural to the non-agricultural sector means a sizeable capital contribution because each migrant is of working age and represents some investment in past rearing and training to maturity.

His rough estimates show that in the first decade of this transfer, the magnitude of this investment in agricultural workers would be over six percent of total national product.

No data are available at hand on the size of out-migration from agriculture to other sectors in Taiwan. There is some evidence, however, suggesting that the average annual growth rate of the agricultural population (2.5 percent) was smaller than that of total population (3.7 percent)

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[13]Kuznets, op. cit., p. 118.

during 1950-59, partly due to the migration of population from the agricultural to the non-agricultural sector. As a matter of fact, such migration is expected to take place because, among other things, the productivity of labor and hence the wage level have been considerably higher in the non-agricultural sector than those in agriculture. The net product per capita in agriculture, on the average, amounted to less than 60 per cent of that in the non-agricultural sector.

Now an attempt is made to speculate about the size of out-migration from agriculture in Taiwan. We shall use an indirect approach to compare the projected non-agricultural population with the actual non-agricultural population in the period 1951-1961. We first assume the birth and death rates of the agricultural and non-agricultural populations are the same, and further assume that the increase in the rate of non-agricultural population in each year keeps pace with the growth rate of total population (3.6 percent per year). Thus, the actual non-agricultural population in a given year is greater than the projected non-agricultural population, we will consider the difference between these two is a result of out-migration from agriculture to non-agriculture. This approach is admittedly an expediency due to the lack of data and claims no more than a rough approximation.

The actual non-agricultural population data are shown in column 1 of Table 6.8. The following formula is developed to estimate the projected non-agricultural population:

$$P_i = p_{i-1} (1 + 3.6\%)$$

where P_i: the <u>projected</u> non-agricultural population at a given year, i.

P_i -1: the <u>actual</u> non-agricultural population (i - 1).

3.6%: the average growth rate of total population in the period 1950-60.

Thus, for example, P_{1951} = 3,556,000 (1 + 3.6%) = 3,684,000 persons, where 3,556,000 persons are the actual non-agricultural population in 1950, and 3,684,000 persons are the projected non-agricultural persons in 1951. Then we compare the projected and actual non-agricultural populations in 1951. We find that the projected non-agricultural population is greater than the actual non-agriculture population by 25,000 persons. These 25,000 persons will be assumed as the out-migrants from agriculture. Based on this procedure, we record the following results in Table 6.8.

Table 6.8. Estimated labor out-migration from agriculture to non-agriculture, Taiwan, 1951-60.

(in thousand person)

Year	Actual non-agricultural population (1)	Projected non-agricultural population (2)	Out-migrants from agriculture to non-agriculture (3) = (1)-(2)
1950	3,556	-	-
1951	3,709	3,684	25
1952	3,879	3,843	36
1953	4,056	4,019	37
1954	4,260	4,202	58
1955	4,475	4,413	62
1956	4,692	4,630	62
1957	4,900	4,861	39
1958	5,159	5,076	83
1959	5,416	5,345	71
1960	5,419	5,611	-192
1961	5,682	5,614	68

During these past 11 years, the estimated out-migratists from agriculture were about 350,000 persons, shown in column 3 of Table 6.8. As Kuznets emphasizes, each migrant represents some investment in past rearing and training to maturity. For the purpose of illustrating this factor contribution, let us assume that the past investment in each migrant is about NT $5,000, thus, such contribution made by the agricultural sector during this period amounts to NT$ 1.75 billion.

Next, we shall examine the utilization of agricultural labor force in Taiwan. It is sometimes claimed that a large extent of disguised unemployment or under-employment exists in most of the Asian countries.[14] It is argued that the labor transfer will make a contribution to development only if the surplus labor force can be employed by the non-agricultural sector. In what follows, we shall critically examine the utilization of agricultural labor force in Taiwan. We first turn to a recent study on disguised unemployment. The study shows that "the number of disguised unemployment increased steadily from 699 thousand in 1952 to 1018 thousand in 1959."[15] According to the definition of disguised unemployment, 1,018,000 persons, 40 percent of total agricultural labor force, can leave agriculture for other employment without affecting agricultural production. In this report,[16]

> Unemployment is the number of excess population over the number of labor required according to the employment statistics. If in the population statistics, some people are not entirely out of work but the work can be done by fewer people than we count the difference disguised unemployment.

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[14]Harry Ohima, "A Strategy for Asian Development," op. cit., p. 296.

[15]JCRR. A Study on the Effects of the Population Trend on Economic Development in Taiwan, Taipei, p. 14.

[16]Ibid., p. 15.

The definition is a vague one. The method used in the study to measure the extent of disguised unemployment has some obvious hazards.[17] This is another poor empirical study dealing with this subject. It also illustrates that a careful appraisal of the definition and methodology is necessary before one so blindly accepts an author's statement that 10, 20, or 40 percent of the labor is redundant in agriculture.

Now we shall further examine two studies on rural under-employment in Taiwan.

One study indicates that average labor input per hectare of land increased from 228 man-days in 1936-39 to 281 days in 1952-56.[18] Labor input per hectare has rapidly increased. However, the annual average working days per farm worker decreased from 172 man-days in 1935-39 to 164 man-days in 1952-58, indicating a decreasing trend of working days per worker. Hsieh and Lee claim that these facts show that there exists a serious rural under-employment problem.[19]

A more recent UN[20] study shows that there was an increase of nine percent in the number of days worked by farm workers between 1953 and 1960 (column 2 of Table 6.9). The annual average number of work days on farms per farm worker, however, was approximately 180, about 49 percent of one year, leaving 185 days off farm, about 51 percent of one year.

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[17]A critical review of the empirical studies on this subject, see Charles Kao, Kurt Anschel, and Carl Eicher, "Disguised Unemployment in Agriculture: A survey," in Eicher and Witt, Agriculture in Economic Development, op. cit., pp. 129-143.

[18]Hsieh and Lee, An Analytical Review of Agricultural Development in Taiwan, op. cit.

[19]Ibid. p. 37.

[20]Economic Bulletin for Asia and the Far East, op. cit.

Information on the number of work days per farm worker in off-farm activities is not available. But as indicated earlier, farm income study shows that farm families received 22 percent of the income from non-farm sources in 1957. This suggests that some of their days off farm were engaged in part-time jobs. Thus the problem of under-employment may not be as serious as it appears.

The confusion and exaggeration of rural under-employment in Taiwan are partly due to the failure of recognizing the part-time jobs outside the farms and the seasonality of agriculture. In discussing the labor movement from agriculture to non-agriculture in Taiwan, Hsing, a well-known economist, critically points out the problem of labor shortage in peak season.[21] He states,

> the outflow of population from agriculture to non-agricultural sectors has caused serious labor shortage in agriculture which has been generally felt in busy seasons. This very fact has made it increasingly difficult for agriculture to release more labor even though part of agricultural labor is under-employed in slack season--'under-employed' only relative to farm work, since a large part of such under-employed agricultural labor has been absorbed by the sideline and off-farm businesses. This shows how vaguely has the term 'under-employed' been associated with the mobility of labor from agriculture to non-agricultural sectors in ordinary discussions.

We have pointed out in Chapter I that it takes two to make a contribution--the contributor, the agricultural sector, and the recipient, the non-agricultural sector. Unless the non-agricultural sector can absorb the transfer of labor, contribution is not made yet. In view of the several studies cited above, there is no conclusive evidence either to

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[21]Mo-huan Hsing, "Relationships Between Agricultural and Industrial Development in Taiwan During 1950-59," Unpublished manuscript, Taipei, (December 1960), pp. 139-140.

Table 6.9. Number of days on farm and off-farm of farm workers; Taiwan, 1953-1960.

Year	Number of farm workers (1,000)	Number of work days on farm (1,000)	Work days on farm per worker per year (2)/(1)	Work days on farm per worker per year at % of 365 days (1 year)
	(1)	(2)	(3)	(4)
1953	1,427	246,238	173	47
1954	1,430	245,837	172	47
1955	1,425	242,519	170	47
1956	1,435	251,416	175	48
1957	1,433	268,141	187	51
1958	1,432	275,056	192	53
1959	1,461	274,136	188	51
1960	1,486	268,998	181	50
Average	1,441	259,042	180	49

Source: Number of farm workers and number of work days on farm were estimated by the Rural Economics Division of the Chinese-American Joint Commission on Rural Reconstruction (to be referred to as JCRR hereafter). Cited from Economic Bulletin for Asia and the Far East, Vol. XIV, No. 1, (June 1963), p. 58.

suggest the existence of disguised unemployment or large extent of rural under-employment in Taiwan. In other words, to a certain extent, we can believe that labor migration from the agricultural to the non-agricultural sectors did take place in the post-war period. Thus this transfer of workers constitutes another sizable factor contribution by the agricultural to the non-agricultural sectors.

CHAPTER VII

SUMMARY AND IMPLICATIONS

Summary

The role of the agricultural sector in Taiwan has been examined primarily in the post-war period by adopting Kuznets' approach. His approach is centered on the product, market and factor aspects (or contributions) of the agricultural sector as they relate to economic growth. These three aspects, simply stated, mean that "if agriculture itself grows, it makes a product contribution; if it trades with others, it makes a market contribution; if it transfers resources to other sectors, these resources being productive factors, it makes a factor contribution."

The product aspect of the agricultural sector was first examined in two different periods: 1901-40 and 1945-62.

Historically, rice, sweet potatoes and sugarcane have been the three most important crops in terms of their percentage of the total planted area as well as their total value of agricultural output. An examination of the production, acres and unit yield of these crops was made in these two periods. It was found that during the period 1901-40 unit yields of rice, sweet potatoes and sugarcane increased 45, 68, and 198 percent respectively. It was also found that this increase in yield, among other things, was a result of the combined use of fertilizers, improvement of varieties and farm techniques. These factors were also most responsible for the Japanese agricultural development. In this sense, "an example of the Japanese approaches applied in a different setting" was demonstrated.

But such achievement was not attained by merely using resources that had low opportunity costs as Johnston claims. Large amounts of imported fertilizers and investment in irrigation in 1920-40 seem to suggest that the rising farm output in this period was achieved at quite high cost.

Due to the Japanese deliberate colonial policy toward Taiwan, the path of economic transformation, in terms of changes in the proportion of labor devoted to agriculture and the urbanization process, was slow. Taiwan's economy under the Japanese rule represents one type of colonizations--substantial development in agriculture but without the concomitant progress in other sectors.

During the post-war period, further progress was made in the agricultural sector. An examination of the three main crops indicates that the unit yields of rice and sweet potatoes rose by 28 and 38 percent respectively, whereas unit yield of sugarcane declined 11 percent, using 1953 as a base period. The decline and instability of the sugar industry was primarily due to the low world price of sugar. One of the challenging tasks during this period was the race between the growth of population and agricultural production. The record shows that total agricultural production increased at an average growth rate of 4.9 percent per year[1] in the period 1953-62, well exceeding the high population growth at an average rate of 3.5 percent per year. The crucial question which needs to be answered is: How did Taiwan improve its agriculture? Our answer is not a simple one. The rapid increase in agricultural output is not accidental. The Government

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[1]It should be remembered that in the United States total farm output rarely has increased more than two percent a year.

"balanced growth" policy embedded in the three Four-Year Development Plans, with the cooperation of JCRR, Farmers' Association, and, last but not least, farmers, seems to be a key variable. Within this framework the factors responsible for the increased agricultural output include irrigation, fertilizers, seed improvement, agricultural extension service, agricultural credit, disease and pest control, land reform, U.S. economic aid, etc. Regression analysis was used to ascertain the relationship between irrigation, fertilizers and the unit yield of rice. It was found that there was a significant relationship between these two factors and the unit yield of rice at the 99 percent level of confidence in the post-war period. A quantitative analysis of the effects of other factors on agricultural output, by the nature of these factors, is difficult, if not impossible.

The market aspect of the agricultural sector was analyzed in terms of selling agricultural products to the domestic and international markets, and purchasing farm inputs and consumer goods from the non-agricultural sector. The whole discussion on this aspect was closely related to the changing structure of the economy as a whole.

It was found that the percentage of marketed surplus of total rice production rose from 43.6 percent in 1953 to 49.3 percent in 1958, despite the high population growth. However, the percentage of net agricultural product in national income has declined from about 40 percent in 1954 to 28.5 percent (excluding forestry and fishery) in 1960. This conforms to Kuznets' generalization, namely, economic growth is generally associated with a decline in the share of the agricultural sector in national income.

In the period 1920-58, five major agricultural commodities, sugar, rice, pineapple, tea, and banana comprised about 80 percent of total foreign exchange earnings. Rice and sugar accounted for about 70 percent

of total foreign exchange until 1957. Since then they have been declining to 34 and 24 percent respectively in 1961 and 1962. Their declining share of total foreign exchange has been steadily replaced by the increasing export of processed farm goods and manufacturing products. Industrial products alone were increased from 12 percent in 1956 to 47 percent in 1962. The record of the past decade shows that the weight of agriculture in over-all exports has been on the decline while that of industrial goods has been on the increase. This phenomena reflects the path of industrialization.

With the expansion of agricultural output, additional farm inputs were needed. The input factors registering the largest expansion were materials (pesticide, etc.), and chemical fertilizers. They increased from an index of 100 in the base period 1953 to an index of 504 and 124, respectively, in 1960. Another study shows that the total increased value of houses and farm building, large implements and tools, and working capital was NT$ 3.5 billion, comparing 1953 and 1960. Due to the nature of these goods, a high proportion of them must be supplied by the non-agricultural sector at home and abroad. The data also show that industry absorbed an increasingly smaller proportion of agricultural products, whereas agriculture absorbed an increasingly greater proportion of industrial goods. This demonstrates a basic change of the structure of farm production--toward a higher degree of commercialization.

As farmers' income increases, their purchases of consumer goods are also expected to rise. Two farm households surveys in 1950/51 and 1958 indicate that farmers' expenditures on food were declining whereas the expenditures on education were rapidly rising. Their general consumption pattern seems to show that more non-food goods would be bought when income

increases. Higher income elasticities of demand for housing and furniture, and recreation, both greater than one, suggest that the percentage of income spent on them will increase as income increases.

Although there are no detailed data available on their quantitative purchase of consumer goods, the evidence cited above reveals the trend toward purchasing non-food goods. The inter-sectoral activities of selling and purchasing between agriculture and non-agriculture intensify the diversification of the economy at home and abroad. Thus agriculture makes it possible for other sectors to grow; just as other sectors make it feasible for the agricultural sector to grow.

The factor aspect of the agricultural sector to development essentially involves a transfer of capital and labor. Our discussion on capital transfer from agriculture to non-agriculture included the government's low purchasing price of rice, the high government exchange price of fertilizer to rice, the land tax, agriculture's share in domestic capital formation and in earning foreign exchange. An estimation of a flow of savings from the agricultural to non-agricultural sectors was also made.

During the period 1951-61, the total loss to the rice farmers as a result of government low purchasing price of rice was estimated about NT$ 6 billion--an incredible forced contribution to the total government revenues. Another loss incurred to the rice farmers is the unfavorable exchange ratio between fertilizers and rice. In the year of 1959, the estimated loss is about NT 400 million.

The land tax is generally considered as a main source of financing development in the early stages of development. Historically, the land tax in Taiwan did not play a prominant role as it did in Japan in the late

nineteenth and early twentieth centuries. The average land tax of the period 1928-41 in Taiwan accounted for about 25 percent of total government revenues. In the post-war period, 1952-57, it further declined to five-eight percent of total government revenues. The other sources of the government revenues are from the monopoly profits, custom tax and defense surtax.

The percentage of the agricultural sector in the total domestic capital formation has been declining from 20 percent in 1952 to 15 percent in 1961. But the amount contributed by the agricultural sector to capital formation in 1962 was about four-fold the value in 1952.

As mentioned above, the percentage of total foreign exchange accounted for by the five major products has been declining. However, a percentage is often an unreliable indicator of the change in the absolute value under consideration. For instance, in comparing 1952 and 1962 for sugar, although sugar in 1952 comprised 59 percent against 21 percent in 1962 of total export value, the absolute value of foreign exchange earning in 1962 was NT$ 961 million more than the value in 1952. The same situation holds true in rice. Both cases seem to indicate that, despite their declining percentage in the total value of export, agricultural exports still remain one of the important means of earning foreign exchanges.

Another type of factor transfer is labor migration from the agricultural to non-agricultural sector. The estimated migrants from agriculture total about 350,000 persons during the period 1951-61. If the past investment in each imigrant is assumed to be NT $5,000, thus such contribution made by the agricultural sector during this period amounts to NT$ 1.75 billion. An effort was also made to study the utilization of agricultural labor force in Taiwan. A population study shows that 40

percent of total agricultural labor force was disguised unemployed. The definition used in that study is vague and the measuring method has great hazards. The result is undoubtedly questionable. Two additional studies on the utilization of agricultural labor force was also discussed. In view of these studies, we find there is no conclusive evidence to suggest either the existence of disguised unemployment or large extent of rural under-employment in Taiwan. We also pointed out that the confusion and exaggeration of rural under-employment are partly due to the failure of recognizing the availability of the off-farm job opportunities and the seasonality of agriculture.

The three contributions of agriculture to economic growth were also measured by using Kuznets' formulas. It should be immediately added, however, that this estimation is purely illustrative because it was based on very limited empirical data and mostly on Kuznets' hypothetical figures which may not be appropriate to Taiwan.

It was calculated that (1) the product contribution of agriculture to the growth of total output was about 19 percent during the period 1953-60. (2) The magnitude of marketization of agricultural product to total marketed product was about 25 percent in 1930-40 and declined to 17 percent in 1953-60. (3) There would be a flow of savings originating in the agricultural sector into capital formation in the non-agricultural sector, accounting for 45 percent in the post-war period. This estimation was particularly uncertain due to the lack of certain key figures. All these estimations seem to conform to our previous summary and Kuznets' conclusion that agriculture, strategic in the early phase, diminished in relative weight in the economy as a whole in the process of development.

Implications

The findings of this thesis enable us to draw two important policy implications: the issue of "balanced growth" and the means of increasing agricultural output for other developing nations. Gerschenkron once warns us that the only generalization one can possibly make about the development of later comers is that they will not follow the sequence of their predecessors.[2] It does not, however, weaken our belief that developing nations are able to draw upon the experience of many countries that have faced similar problems in the past.

Developing nations characterized by poor natural resources and high population pressure in searching for their development strategy should turn to Taiwan to study how this small island with the same characteristics has achieved a substantial increase in agricultural output. The answer, to a large extent, lies in the government policy. Although throughout the whole thesis, the important role of the agricultural sector has been stressed, this should not simply be interpreted that agricultural development should precede or take priority over industrial expansion. On the contrary, the Taiwan experience has demonstrated that it is the policy of "balanced growth" which proves to be a key factor of success. During the post-war period, the key policy-makers in the Chinese Government repeatedly emphasize that the interrelationships between agriculture and industry are so intimate that one cannot proceed without the development of the other.

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[2]Alexander Gerschenkron's essays over the 1951 to 1961 period are reprinted in Economic Backwardness in Historical Perspective, Harvard University Press, Cambridge, Mass., 1962.

The term "balanced growth" is a confusing one. In a recent paper, Witt discusses the difficulties involved in defining this term in a society which is in the process of development.[3] The term used in this thesis refers to the simultaneous development between agriculture and industry, but carries no implication that all sectors must grow at the same rate. This broad definition has been the guideline for the three Four-Year Development Plans in Taiwan.

One confusion of the current debate on the issue of agricultural vs. industrial development arises from the fact that, on the one hand, the "big push" group fails to realize the strategic role of agriculture in the early phase of development, and, on the other, the "agriculture-first" group underestimates the contribution of the non-agricultural to the agricultural sectors in the development process.[4] Another confusion is the lack of empirical evidence to throw light on this issue. The advocated "balanced growth" approach in stimulating economic development not only can reconcile these two extreme versions, but also has proved its empirical success in Taiwan.

In discussing the means of increasing agricultural output for developing nations, Taiwan experience suggests that agricultural output can be substantially increased if, among other things, these factors, fertilizers, irrigation, agricultural credit and extension services, pest control, land reform, United States aid, etc., are properly used. We are not saying,

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[3]Lawrence Witt, "The Role of Agriculture in Economic Development," Paper presented at Purdue University, op. cit., p.8.

[4]This aspect, seldom discussed in the literature, has been recently examined in some length by Witt. Ibid.

however, that these factors are "prerequisites" or "preconditions" for increasing output in developing nations. Probably in few advanced countries were these factors realized prior to their industrialization.[5] But we do suggest that a careful consideration of these factors, taking the indigenous conditions into account, would be essential in their effort to increase agricultural output.

It is generally recognized that there are large potentials for improving productivity in agriculture in many developing nations by either applying known methods or the introduction of non-conventional inputs. The effectiveness of the introduction of some of non-conventional inputs, i.e., research, investment in human agent, extension, has been demonstrated in Taiwan. The favorable impact of agricultural research has been witnessed in the pre- and post-war periods. One major problem in agricultural research for developing nations is that it cannot be imported as such in most cases.

The importance of education and investment in human agent has been emphasized in recent years. It was estimated that the development and diffusion of knowledge about agricultural technology accounts for about half of the five-fold increase in American agricultural output since 1870. A well-established educational system (including rural education) in Taiwan is certainly an indispensible complementary input for increasing agricultural output.

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[5]The argument was essentially borrowed from Hirschman, see his article reprinted in Eicher and Witt, Agriculture in Economic Development op. cit., pp. 393-398.

Another non-conventional input is the extension services, which can perform a major role in dissemnating information and increasing the overall knowledge of the rural population. The post-war experience in Taiwan also proved its usefulness.

It is also argued that "increased crop production per acre probably ranks as one of the most important ways of increasing farm output for low income countries."[6] Rice yields in Taiwan, for instance, average more than two times higher than they do in Thailand, India, Philippines, and Pakistan. These other countries have the potential for increasing crop yield. Needless to say, careful adaption and testing of borrowed agricultural technology will be necessary before applying them in different conditions.

The cost of any program for raising unit yields of farm crops should not be underestimated. Oshima comments that without an all-out project, the rise in per acre yields is likely to be slow. He suggests a whole range of programs which include agricultural research, credit for fertilizers, irrigation work, community development, land reform, etc.[7]

Since land is often a relatively scarce factor, and labor is an abundant factor in developing nations, any strategy to increase output then should necessarily concentrate on the land-saving, labor-intensive methods. The Japanese and Taiwanese experiences both show that the increase in yields per harvested acre was obtained largely through labor-intensive

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[6]Raymond P. Christensen, Et. Al, How United States Improved Its Agriculture, op. cit., p. 25.

[7]Oshima, "A Strategy for Asian Development," op. cit., pp. 305-306.

methods, deeper plowing, more weeding and cultivating, better seedlings, more fertilizers, etc. The use of such methods in India testifies yields can be sharply increased and quickly with greater inputs of labor, fertilizers, etc.[8]

In addition to the intensive use of labor on the farms, the agricultural labor force could also be used for improving and building social overhead capital, i.e., roads, schools, dams, etc., provided agricultural output will not be reduced. If a large extent of rural under-employment did exist, the Government should provide or induce alternative employment opportunities in the non-agricultural sector to make the actual transfer of rural labor possible.

Economic incentive is another important factor. Economic incentives were weakened in Taiwan by the government low purchasing price of rice, unfavorable exchange ratio between rice and fertilizer and the unstable price of sugar, but strengthened by land reform, production loans, and other services provided by Farmer's Associations and government. Public programs that assure markets for farm products at stable and reasonable prices will be a great stimulus to agricultural development.

The pattern of agricultural development in Taiwan also demonstrated the vigorous efforts on the part of agricultural administrators, individual farmers, and research workers. Developing nations, while emphasizing the technical aspects of increasing agricultural output, should not neglect these institutional factors.

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[8] Ibid.

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