INTERSECTORAL CAPITAL FLOWS IN THE ECONOMIC
DEVELOPMENT OF TAIWAN, 1895-1960*

T. H. Lee

In the recent period, the literature on the role of agriculture in
the economic development has been enhanced by a number of essays
on intersectoral capital flows in relation to the transformation of
traditional agriculture in less developed countries (1, 2, 4, 5, 6, 7,
10, 11, 12, 13, 14, 15). Two different viewpoints can be categorized
from these papers. One is that agriculture does not require a large
amount of capital for its transformation. Agriculture, therefore, is a
great contributor of capital to industrialization. The other opinion is
that the investment requirements for agricultural transformation are
so large that capital may have net inflow from nonagriculture to
agriculture. These views are based primarily on different emphases
of how to modernize the traditional agriculture.

Obviously, there are many differences between countries in social­
institutional arrangements with which to mobilize the resources from
the agricultural sector to the nonagricultural sector. According to
the initial level of agricultural productivity and resource endowment,
capital requirement for transforming traditional agriculture will be
different between countries (4). The experiences of successful econo­

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essor John W. Mellor for his instruction and assistance on the thesis re­
search and valuable comments on the draft of this paper.
1/ The following two groups can be roughly classified:
a. Net outflow of capital --B.F. Johnston, K. Ohkawa, John F.C. Fei, Gustab
Ranis.
mic development in nineteenth-century Japan and twentieth-century Soviet Russia have been widely quoted to prove the generalization that agriculture must contribute capital to industrial development. The empirical studies undertaken for the two countries, however, are still partial and inconsistent in method. A comprehensive study of the complex factors influencing the direction and size of intersectoral capital flows in a successful case of agricultural and industrial development will be necessary.

The experience of Taiwan in economic development is an example of a country with a traditional agricultural pattern successfully advancing and transforming its economy as a whole. Therefore, it is important and valuable to undertake the empirical study on the subject with Taiwan's case. Emphasized in this paper are: (a) to prepare concept and method of measurement for study of intersectoral capital flows; (b) to ascertain the nature and amount of intersectoral capital flows between sectors in Taiwan during its period of economic development, 1895-1960; and (c) to add to the theory of agricultural development by providing the appropriate scheme of domestic financing for the contemporary developing countries.

**Conceptual Framework for Intersectoral Capital Flows**

The conceptual framework and statistical method for this study was drawn from the following diagram. In this diagram, the whole national economy of Taiwan is divided into six sectors, agricultural production, agricultural household, nonagricultural production, non-agricultural household, government, and foreign trade. The scope of the agricultural sector was defined in this study as a unified unit of the agricultural production and the agricultural household sectors (including landless farm laborers). Non-cultivating landlords, business

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2/ See the papers prepared by Bruce F. Johnston (5), K. Ohkawa and Henry Rosovsky (3), and Alexander Erlich (1).
traders, money lenders, and nonagricultural activity unit in rural areas are excluded from our definition of the agricultural sector.3/  

**Approach of social income accounting**

To estimate the magnitudes of capital flows and the relation between capital and income in economic transactions between agriculture and nonagriculture, an accounting definition of capital has been developed on the basis of agriculture's social income account.4/ The sectoral accounts of income and capital are logically related to the accounts of income, consumption, and saving-investment in the agricultural sector or the nonagricultural sector. Therefore, the sectoral accounts of capital and income can be derived statistically from the social income accounts with sectoral transactions. This method has two advantages compared with the national capital account; first, it is possible to check the magnitudes of commodity flow directly. Second, the sources and usage of financial contribution from the agricultural sector to the nonagricultural sector can be investigated.

Figure 1 represents the flow chart of commodities and income between sectors. In the agricultural production sector, services of primary production factors such as land and labor flow from the agricultural household in the amount of, Da, and produces output, Ya. The agricultural production sector consumes production goods such as chemical fertilizer, feeds, and other materials manufactured in the nonagricultural production sector to the amount of R_n.

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4/ About the concept and method of social income accounting for the agricultural sector, author, has developed a systematic one in T. H. Lee, "Structural Change of Agricultural Production in Taiwan", Agricultural Economic Seminar Proceedings. National Taiwan University, 1958, pp. 79-89.
Agricultural products used in the agricultural production are provided from the gross agricultural output within a sector. The net agricultural output is partially consumed by the agricultural household sector to the amount $C^a$. The remaining amount of net output is sold to the nonagricultural production sector as raw materials, $R^a$, to the nonagricultural household sector for consumption, $C^n$, and directly to exports, $E_a$. Total selling quantity of agricultural products amounts to the sum of $R^a + C^a + E_a$. In nonagricultural production, total output is divided into two products, consumer goods and capital goods. Consumer goods flow from the nonagricultural production sector to the nonagricultural household sector, $C^n$, to the agricultural household sector, $C^a$, to the government sector, $C^g$, and to exports $E_n$. Capital goods are distributed to the agricultural production sector as the production goods to the amount of $R^a$; as the capital goods for investment, $I_a$; and for investment in its own sector, $I_n$. No capital goods export is assumed in this case. The government sector collects tax $G_a$ from the agricultural household sector and $G_n$ from the nonagricultural household sector and allocates it for consumption of industrial goods, $C^g$, and for savings to the amount $S_g$. In the foreign trade sector, the government exports agricultural products, $E_a$, and industrial consumer goods, $E_n$, for exchange of consumer goods, $M_c$, and capital goods, $M_i$. The balance of international trade is shown as $F$.

**Statistical method of measurement**

Income generation can be seen by tracing in the opposite direction the commodity flows between sectors. Besides the commodity transaction between sectors, income also flows from the agricultural household sector to the nonagricultural sector in the form of government taxes and payment of land rent and interest. The agricultural household also receives income from the nonagricultural household sector.

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National Chung Heung University
Figure 1 constructed by commodity and income flows can be summarized in the following accounting equations:

Inflows
(1) \( D_a + R_a \)
(2) \( D_n + R_n + M_n + M_t \)

Outflows
= \( C_a + C_n + R_n + E_a \)
= \( C_n + C_n + C_n + R_n + I + E_a \)

Figure 1. Intersectoral commodity and income flow chart for Taiwan's economy

Adding the five equations and cancelling out similar terms on both sides of the resulting equality, we have

\[ Sa + Sn + Sg = I + (Ea + En) - (Mc + Mi) \]  

or

\[ I_n = (Sa - Ia) + Sn + Sg + F \]

where \( I = Ia + In \), and \( F = (Mc + Mi) - (Ea + En) \). Equation (6) is the financing equation indicating the relationship between savings and investment for the national economy as a whole. Equation (7) indicates the sectoral interdependence. The investment in the nonagricultural sector depends upon the amount of net capital flow from agriculture, size of savings in its own and government sectors, and also the import surplus. Adding equations (1) and (3) for the agricultural sector, we have:

\[ Sa = C^a_n + R^a_n + E_a - C^g_n - R^g_n - Ga \]

As government taxing on agriculture is not generally made by commodity, the term \( Ga \) in the equation (8) and the term \( (Sa - Ia) \) in equation (7), then we can draw the following three cases, indicating the balance of commodity flows between agriculture and nonagriculture.

\[ C^a_n + R^a_n + E_a - C^g_n - R^g_n = I_a \]

or

\[ C^a_n + R^a_n + E_a - C^g_n - R^g_n - I_a = B \]

The left terms of equation \( 9' \) indicate the commodity transactions between two sectors, and the term \( B \) is the balance showing the physical aspect of capital outflow from agriculture. The term \( B \) is also the balance of capital accounting between two sectors, which was not presented in Figure 1. Generally speaking, it is more effective and common to set up both capital and current operating (income) accounts in order to investigate the sectoral commodity and financial
transactions. Capital account shows the changes in assets and liabilities. The increase in assets or the decrease in liabilities indicates the outflows of capital. The decrease in assets or the increase in liabilities indicates the inflow of capital.

Therefore, the term B can be expressed as follows:

\[ B = R + K \]  \hspace{1cm} (10)

The term \( R \) on the right side is the balance of current financial transaction between sectors, including the net payment of land rent, wages and interest, and government taxes and subsidies. The term \( K \) is the balance of the capital account between sectors, including the net changes in outstanding short-term and long-term loans and investment.

The equations (9') and (10) are generally valued at current prices of commodities and services in the transactions. The effects of changes of price ratio or sectoral terms of trade on sectoral capital flows are not reflected in equations (9') and (10). The term B in the equations, therefore, should be adjusted by the change of price ratio. The equation (9') in real term thus can be expressed:

\[ \frac{(C_a^0 + R_a^0 + E_a)}{P_a} - \frac{(C_a + R_a + I_a)}{P_n} = B' \]  \hspace{1cm} (11)

where \( P_a \) and \( P_n \) are price indices for agricultural products and nonagricultural products bought by the agricultural sector. When capital flows out from the agricultural sector, the term \( B' \) can be expressed:

\[ B' = \frac{B}{P_a} + \frac{(C_a^0 + R_a^0 + I_a)}{P_n(P_n/P_a - 1)} \]  \hspace{1cm} (12)

The first term on the right side of the equation is the financial amount of capital outflow from agriculture in real terms, and second term is the amount of capital outflow caused by the change in the sectoral terms of trade between agriculture and nonagriculture. We call the former the visible net real capital outflow and the latter the invisible net real capital outflow.
Statistical Results Derived from Social Income Accounting of Taiwan’s Agriculture

The statistics for the period 1911-1960 in Table 1 are summarized from the statistical estimate of social income account of agriculture, and the statistics for the period 1895-1910 were estimated from the financial aspects of intersectoral capital flows. To arrive at Item 13, net real capital outflow (B'), in the table, the procedures for calculation are based completely on the equations (9'), (10), (11), and (12) above. The gross outflow of agricultural products (X) minus the gross inflow of nonagricultural products (M) is the net commodity outflow or inflow at current price (B). If there is outflow, it is generally called net agricultural surplus. The difference between gross outflow of fund (F) and gross inflow of funds (G) is the net outflow of funds or inflow of funds (B). It is clear from Table 1 that net commodity outflow (B) is identical with net outflow of funds, indicating that the financial aspect and physical aspect of net capital outflow are all-important to analyze the determinants of net capital outflow. Item 10 in the table is the terms of trade (T), representing the purchasing power of the agricultural price. Items 11, 12, and 13 indicate the visible net real capital outflow (V_1), invisible net real capital outflow (V_2), and net real capital outflow (B'). Furthermore, the net outflow of funds can be divided into balance of current capital (R) and balance of capital transfer (K). Net real capital outflow in Item 13 derived on the basis of some rigorous definition and systematic accounting for capital can be considered the most inclusive and appropriate scale to measure the sectoral capital outflow from agriculture. Therefore, we will attempt to identify the important

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6/ A comparative analysis between our definition and other definitions of the sectoral capital flows has been made in our previous analysis. See T. H. Lee, (8), pp. 29-31.
| Table 1. INTERSECTORAL CAPITAL FLOWS BETWEEN THE AGRICULTURAL SECTOR AND THE NONAGRICULTURAL SECTOR (FIVE YEARS AVERAGE), TAIWAN, 1835-1960 |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1. Total agricultural Production (Ya) | 44,526 1/ | 55,556 1/ | 66,421 1/ | 97,358 | 187,968 | 242,505 |
| 2. Total sale of agricultural products (X) | 54,829 | 105,479 | 154,625 |
| 3. Total sale ratio (X/Ya) | 56.3 | 56.2 | 63.8 |
| 4. Total outflow of agricultural products (X) | 54,829 | 105,479 | 154,625 |
| a. To nonagricultural Production (R^n_a) | 27,664 | 55,903 | 77,888 |
| b. To nonagricultural household (C^n_a) | 17,853 | 29,606 | 40,907 |
| c. To foreign countries (E^n_a) | 9,312 | 19,970 | 35,830 |
| 5. Total inflow of nonagricultural products (M) | 30,563 | 63,376 | 104,736 |
| a. Working capital goods (R^n) | 5,625 | 17,208 | 28,737 |
| b. Fixed capital goods (F^n) | 657 | 2,487 | 8,292 |
| c. Consumer goods (C^n) | 24,281 | 43,681 | 67,707 |
| 6. Net commodity outflow (B=X-M) | 24,266 | 42,103 | 49,889 |
| 7. Gross outflow of fund (F) | 14,779 | 19,938 | 23,272 | 28,678 | 52,549 | 67,859 |
| a. Land rent and interest (Z) | 13,430 2/ | 16,911 2/ | 18,803 2/ | 22,235 | 42,850 | 51,791 |
| b. Taxes and fees (J) | 1,349 4/ | 3,027 4/ | 5,469 4/ | 6,175 | 8,810 | 15,083 |
| c. Transfer of fund through financial institutions (Q) | 268 | 889 | 985 |
| 8. Gross inflow of fund (G) | 776 | 1,616 | 1,946 | 4,412 | 10,446 | 17,970 |
| a. public investment and subsidy (S) | 220 4/ | 967 4/ | 547 4/ | 1,683 | 1,413 | 3,200 |
| b. Investment by nonagricultural sector in agriculture (H) | 556 3/ | 649 3/ | 1,399 3/ | 2,400 | 7,713 | 11,840 |
| c. Income received from the nonagricultural sector (W) | | | | | | |

(continued)
### Table 1. (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>1895-1900*</th>
<th>1901-1905*</th>
<th>1906-1910*</th>
<th>1911-1915</th>
<th>1916-1920</th>
<th>1921-1925</th>
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<tbody>
<tr>
<td>9. Net outflow of fund ( (B=F-G) )</td>
<td>14,003</td>
<td>16,322</td>
<td>21,326</td>
<td>24,266</td>
<td>42,103</td>
<td>49,889</td>
</tr>
<tr>
<td>10. Terms of trade ( (T=P_n/P_a) )</td>
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<td>-</td>
<td>-</td>
<td>121.4</td>
<td>130.2</td>
<td>112.1</td>
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<tr>
<td>a. Agricultural price index ( (P_a:1935-37=100) )</td>
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<td>-</td>
<td>-</td>
<td>59.8</td>
<td>91.8</td>
<td>101.9</td>
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<tr>
<td>b. Nonagricultural price index ( (P_n:1935-37=100) )</td>
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<td>72.6</td>
<td>118.9</td>
<td>114.2</td>
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<td>11. Visible net real capital outflow ( (V_1=B/P_a) )</td>
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<td>-</td>
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<td>47,579</td>
<td>46,115</td>
<td>48,959</td>
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<tr>
<td>12. Invisible net real capital outflow ( (V_2=M/P_n \cdot (T-1)) )</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9,509</td>
<td>16,113</td>
<td>11,070</td>
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<tr>
<td>13. Net real capital outflow ( (B'=X/P_a-M/P_n) )</td>
<td>14,003</td>
<td>18,322</td>
<td>21,326</td>
<td>49,588</td>
<td>62,228</td>
<td>69,029</td>
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<tr>
<td>14. ( X/P_a )</td>
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<td>-</td>
<td>-</td>
<td>91,686</td>
<td>115,530</td>
<td>151,742</td>
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<td>15. ( M/P_n )</td>
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<td>-</td>
<td>42,098</td>
<td>53,302</td>
<td>91,713</td>
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</table>


* Sources and estimation procedure for 1896-1910: (1) Total agricultural production value from 1902 to 1910 was quoted from "Taiwan Agricultural Statistics," annual issue. The data prior to 1902 was estimated by using the growth rates of total cultivated land area and of agricultural population. The per capita agricultural production in unit land area (hectare) in 1932 was used as the basis to extrapolate back by each year’s agricultural population and cultivated land area. (2) For estimate of land rent and interest in each year, the ratios of land rent and interest to total agricultural production was used. Twenty-eight percent was used for the period of 1904-1910 after land reform programs and a proportion of 31 percent was used for the period of 1896-1903. (3) Estimate of non-farm income received by farmers was based on the ratio between non-farm income and industrial production value. Industrial production value was 43,912 thousand yen and non-farm income was 2,587 thousand yen in 1911. The ratio of non-farm income was 5.8 percent of industrial production value. The source of data is "The Commercial and Manufacturing Statistics," the Taiwan Governor General Office, annual issue. (4) Taxes, government subsidy and investment were quoted from "The Reports of Government Budget," annual issue. (5) The figures of agricultural loan and saving deposit in financial institutions were unknown. No financial institutions existed in rural areas in this period.
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<td>1. Total agricultural production (Ya)</td>
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<td>2. Total sale of agricultural products (X)</td>
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<td>3. Total sale ratio ($\frac{X}{Ya}$)</td>
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<td>4. Total outflow of agricultural products (X)</td>
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<td>a. To nonagricultural production ($R_a^n$)</td>
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<td>b. To nonagricultural household ($C_a^n$)</td>
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<td>c. To foreign countries ($E_a$)</td>
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<td>5. Total inflow of nonagricultural products (M)</td>
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<td>a. Working capital goods ($K_a^n$)</td>
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<td>b. Fixed capital goods ($I_a$)</td>
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<td>c. Consumer goods ($C_a^n$)</td>
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<td>6. Net commodity outflow ($B=X-M$)</td>
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<td>7. Gross outflow of fund ($F$)</td>
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<td>a. Land rent and interest ($Z$)</td>
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<td>b. Taxes and fees ($D$)</td>
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<td>c. Transfer of fund through financial institutions ($Q$)</td>
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<td>8. Gross inflow of fund ($C$)</td>
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<td>a. Public investment and Subsidy ($S$)</td>
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<td>b. Investment by nonagricultural sector in agriculture ($H$)</td>
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<td>c. Income received from the nonagricultural sector ($W$)</td>
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<td>9. Net outflow of fund ($B=F-G$)</td>
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<td>10. Terms of trade ($\frac{P_n}{P_a}$)</td>
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<td>a. Agricultural price index ($Pa: 1935-37=100$)</td>
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<td>b. Nonagricultural price index ($P_n: 1935-37=100$)</td>
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<tr>
<td>11. Visible net real capital outflow ($V_1=\frac{B}{P_a}$)</td>
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<td>12. Invisible net real capital outflow ($V_2=\frac{M}{P_n(T-1)}$)</td>
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<td>13. Net real capital outflow ($B'=\frac{X}{P_a} M/P_n$)</td>
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<tr>
<td>14. $X/P_a$</td>
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<td>259,291</td>
<td>381,559</td>
<td>297,795</td>
<td>389,155</td>
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<td>15. $M/P_n$</td>
<td>139,764</td>
<td>169,832</td>
<td>212,463</td>
<td>185,032</td>
<td>292,966</td>
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</table>
components of the net real capital outflow in the case of Taiwan's agricultural development.

**Component analysis on intersectoral capital flows of Taiwan's economy**

The sectoral net real capital flow was all positive for agriculture through the period. The agricultural sector has continuously made a contribution of capital to the nonagricultural sector in Taiwan. The factors determining the net real capital outflow are net real agricultural surplus, or visible net real capital outflow, and change in the sectoral terms of trade. Net real agricultural surplus has a close relationship with the increase in real agricultural production. The relationship between two components is dependent on the changes in the sale ratio of agricultural products. The sale ratio, had three different phases: it increased in the period 1911-1930; it was stable at a higher level from 1930 to 1940; it was unstable at a lower level in the postwar period 1950-1960. Net agricultural surplus has shown correspondingly different shapes of change with fluctuations of agricultural production. The annual alteration of net real agricultural surplus was quite regular in the period 1911-1930. The increasing trend of the sale ratio and the comparatively stable increase in real agricultural production are important relevant factors. In the period 1930-1940, the sale ratio was stable and real agricultural production fluctuated greatly; consequently the net real agricultural surplus showed great fluctuation. The sale ratio showed a declining trend at the lower level and real agricultural production showed great up-and-down movements in the period of 1950-1960. Therefore, net real agricultural surplus changed irregularly. From this observation, we know that the increases in real agricultural production and sale ratio are important factors to increase the net real agricultural surplus. In the total sale of agricultural products during the whole period, sale of agricultural raw materials represented more than half, as seen in
Table 1. Sale to the nonagricultural household was about 33 percent of total sales of agricultural products during 1911-1915, but decreased to about 23 percent during 1935-1940. It increased again to 43 percent in 1956-1960. Percentage of direct agricultural exports in the total sale of agricultural products was about 7 percent in 1911-1915, increased to 32 percent in 1936-1940, and then decreased to 6.5 percent in 1956-1960. These facts show that composite factors of total sale or demand for agricultural products in Taiwan have varied in their importance in accordance with changes in population growth, level of people's income, foreign market conditions, and development of domestic industry. Through the whole period, a small portion of agricultural surplus was consumed by the nonagricultural household sector, but it has become more important in the postwar period.

Of the total inflow of nonagricultural products, consumer goods accounted for 79 percent in 1911-1915, but declined to 65 percent in 1936-1940. In the postwar period, consumer goods made up 65 percent of the inflow in 1950-1955 and 57 percent in 1956-1960. These proportions coincide with the slow increase in per capita consumption. Working capital goods for agricultural production, including chemical fertilizer, feeds, chemicals, and farm implements and tools, were only 8 percent of total inflow of nonagricultural products in 1911-1915, increased rapidly to 32 percent in 1936-1940, and declined to 30 percent in 1956-1960. Consumption in agriculture of fixed capital goods which flowed from the nonagricultural sector was only 2 percent of total inflow of nonagricultural goods in 1911-1915 and increased to 6 percent in 1931-1935 and declined thereafter. In the postwar period, this consumption increased from 3 percent in 1950-1955 to 14 percent in 1956-1960. Demand in the agricultural sector for nonagricultural goods was determined by a mix of the above factors, in which demand for consumer goods was large in the initial period and demand for working capital goods and fixed capital goods became larger in the later period of agricultural development. In particular, demand for
fixed capital goods significantly increased in the period 1956-1960, but its total amount was still small compared with other items.

The terms of trade between the agricultural sector and the non-agricultural sector have shown some up-and-down movements and there is no definite trend through the long period. In the initial period 1911-1915, it was badly against agriculture, but improved gradually through time. In the period 1926-1930, the terms of trade favored agriculture. In the period 1931-1940, the index of prices received by farmers declined initially and went up again later. With the corresponding change in the index of prices paid by farmers, the terms of trade resulted in unfavorable situation for agriculture in this period. In the period 1950-1960, index of prices received by farmers started at a lower base and increased at a higher rate than did the index of prices paid by farmers. Consequently, the terms of trade were badly against agriculture at first and improved later. The extent to which intersectoral capital flows were influenced by the changes in the terms of trade was dependent on the magnitudes of commodities traded between sectors. As seen in Table 1, the total amount of invisible outflow of net real capital showed positive magnitudes except during the period 1926-1930, indicating that the terms of trade were closely related to the direction of invisible capital flow, but not to the magnitudes of invisible capital flow. The impact of changes in the intersectoral terms of trade on intersectoral capital flows will be significant only under conditions of the close relationship between agriculture and nonagriculture.

Gross outflow of fund includes such items as: (a) land rent paid to the resident and absentee landlords and interest paid to financial institutions and money lenders; (b) government taxing and donations, and fees paid to irrigation association and farmers' associations; (c) net savings deposited and invested in nonagriculture through financial institutions. About 78 percent of all funds were paid as land rent and interest in 1911-1915. This percentage declined to about 73 percent in
1936-1940. After land reform in the postwar period, it was only 28 percent of total gross outflow of funds. Taxes and fees in the prewar period remained 17 to 22 percent of gross outflow of funds. This amount increased to 53 percent in 1950-1955 and to 56 percent in 1956-1960. The above items, (a) and (b), are generally considered as entries in the current account. Item (c) is an entry in the capital account. The autonomous flow of capital funds was a very limited amount in the beginning and increased to 16 percent in the period 1956-1960. These facts tell us that there was a specific type of transferring of agricultural funds to the nonagricultural sector in the developing process of this underdeveloped area.

Gross inflow of funds includes (a) public investment and subsidy, (b) investment in the agriculture sector made by landlords and long-term loans from financial institutions, (c) farmers' receipts of non-farm income. Public investment and subsidy to agriculture have exceeded 38 percent of total gross inflow of funds in the initial period and declined to below 4 percent in 1956-1960. Conversely, non-farm income increased steadily from 54 percent in 1911-1915 to 93 percent in 1956-1960. Investment made by absentee landlords and long-term loans borrowed from financial institutions also increased from 7 percent in 1911-1915 to 16 percent in 1936-1940 and declined sharply in the postwar period. Land reform programs and limited amounts of long-term funds for agriculture contributed to this decrease in the postwar period.

**Major Findings of Empirical Analysis**

Findings regarding the empirical examinations of Taiwan's experience may be summarized as follows:

(1) The direction of intersectoral net capital flow was identified as outflow from the agricultural sector in Taiwan through the whole period under review. The amount of net capital outflow roughly showed an increasing trend in terms of real price in the prewar
period, but recently it tended toward a declining trend. Invisible net real capital outflow caused by the terms of trade against agriculture was less important in the prewar period and increased in relative importance more than 50 percent of the total net real capital outflow in the postwar period. Financially, current transfers of land-rent payment and government taxing occupied the most important role in the financial adjustment of net agricultural surplus in the prewar period, and direct capital transfer of farmers' savings became increasingly important in the postwar period.

(2) The size of the intersectoral capital flows is dependent in part on the changes of the terms of trade, but in significant part on the physical and financial measures by which development can be achieved. The following measures and conditions would attribute to the above specific characteristics of intersectoral capital outflow in Taiwan:

(a) Not only was the inherited system of agricultural squeeze never abolished under the Japanese administration, but also in addition a new system of government taxes and levies was imposed. After the land reform program in the postwar period, government taxing and levies by means of both direct and hidden methods have been strengthened.

(b) Despite the above high gross squeeze on the agricultural sector, in the earlier period of development, increase in agricultural productivity in terms of land or labor did not slow down. After transformation of the traditional agriculture in the period 1926-1930, increase in agricultural productivity was accelerated. The initial conditions of resource endowment and the level of agricultural productivity in Taiwan in the period 1895 were not favorable compared with those in countries presently developing. However, the successful transformation of traditional agriculture could be accomplished through

7/ T. H. Lee (8), Chapter 6.
maintaining a continuous net outflow of capital from the agricultural sector. A heavy investment in irrigation was initiated in the transformation period but it did not bring with it a net inflow of capital from the nonagricultural sector.\[10/\] This is the aspect in the story of agricultural development in which economists are mostly interested; we will discuss it in respect to the role of government and technological progress in agriculture in the next section.

(3) In relation to the conventional viewpoints relative to the net capital outflow from the agricultural sector, we tested those hypotheses by means of Taiwan's experience. The empirical tests showed that Taiwan's experience departed appreciably in the following points:

(a) Taiwan has maintained a continuous outflow of net capital from the agricultural sector under the high growth rate of agricultural population and labor force. This fact disproves the broadly held viewpoint that decelerating the rate of population growth is a necessary condition for accelerating the agricultural surplus.\[11/\]

(b) Agricultural wage rate or per capita consumption of farmers has been improved through time at a slow rate, despite the increase of population in agriculture.\[12/\] However, share of labor income has tended to decline relatively in comparison with that in the nonagricultural sector. This means that the relative decline of a share of labor income in agriculture will be a more important concept than that of constant institutional wage rate in agriculture in relation to the net capital outflow from the agricultural sector.

(c) To transform the traditional agriculture in the paddy farming areas, heavy investment in irrigation is one of the necessary conditions. Capital-use innovation has been witnessed in the period of transformation of traditional agriculture. This departs from the conv-

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10/ T. H. Lee (8), Chapter 4, pp. 105-112
11/ Kazushi Ohkawa and Bruce F. Johnston (12)
12/ C. H. John Fei and Gustav Rains (2)
ential viewpoint of complementary relation between capital and labor in agricultural innovation.\textsuperscript{13/}

(d) With respect to the amount of net capital outflow, that the concept of "net agricultural savings" will not be appropriate is clearly understood from our exposition and the statistical comparison.\textsuperscript{14/}

(e) The financial adjustment of net agricultural surplus will be one of the important conditions toward determining the magnitudes of net capital outflow from the agricultural sector. The problem of intersectoral capital flow may be better discussed from the aspects of financial adjustment and the commodity transferring process as well as that of the increase in agricultural productivity.

(4) In conclusion, agricultural development is primarily concerned with the feasibility of increasing net agricultural surplus or net capital outflow from the agricultural sector. In less developed area like Taiwan, mobilization of internal capital must depend on the agricultural development. How to develop agriculture and to squeeze agriculture will be deeply related to government strategies for agricultural development.\textsuperscript{15/} The comparative importance of such strategic factors in the different stages of development will necessarily be weighed and identified.

\textit{Strategic Measures for Agricultural Development and Capital Transfer}

In relation to the intersectoral capital outflow from agriculture, three important government measures toward agricultural development can be derived from our analyses: (a) allocation of capital to agriculture; (b) strategy for technological progress; (c) taxing agriculture and organizational improvements. These three measures were empirically

\textsuperscript{13/} Kazushi Ohkawa and Bruce F. Johnston (12)
\textsuperscript{14/} Bruce F. Johnston (5)
\textsuperscript{15/} S. C. Hsieh and T. H. Lee (3) pp. 101-102
identified. The weight of their comparative importance in the different phases of agricultural development may be described as follows:

(1) In the initial period of agricultural development, 1895-1930

In view of the initial conditions for agricultural development in 1896-1900, net outflow of capital from agriculture was positive even under low land productivity, low average crop yield, and unfavorable man-land ratio. Population increased at the slow rate of one percent annually. Per capita food consumption of agricultural products in total farm income was around 65 to 70 percent including self-produced food as well as purchased food. High squeeze ratio of land-rent payment was the most important mechanism in transferring capital out of agriculture; government taxing did not play a very important role. Efforts for agricultural development started around 1898. Material input and institutional organizations were the most important means. The institutional reform was placed on land tenure system, land registering system, farmers’ organizations, administration system, agricultural experimental stations, and agricultural education. Material inputs were put in survey, inventory, and investment in basic resources.\(^{16/}\)

The ten-year Indica rice improvement program, the government control of the irrigation system, the introduction of a new variety of sugarcane, and the subsidy on chemical fertilizer were the important activities. Capital investment was made at moderate rate in the earlier period, 1900-1920. Government taxing increased rapidly through land survey and registration. Land-rent payment also increased moderately according to the slow increase in crop yield. Increase in land productivity in the earlier period lagged behind the increase in labor productivity.\(^{17/}\) Neither a big push in agricultural productivity nor heavy investment were seen in this earlier period. Net capital outflow

\(^{16/}\) S. C. Haieh and T. H. Lee, (3) pp. 65-87

\(^{17/}\) T. H. Lee, (8) Chapter 4.
from agriculture continued at the positive amount. A transformation in traditional agriculture was not completed but was still on the way until 1920.

From 1918 until after the First World War, the need of more rice and sugar in the Japanese market preconditioned government behavior in pushing a rapid increase in rice and sugar production. Internally, the man-land ratio became worse and a big push of land productivity was necessary. Two objective conditions were determinants for the government’s big investment push in this decade; financial possibility and technological feasibility. Government budget showed a surplus and the landlord class financially supported the government’s heavy investment in irrigation and land improvement. Technically, the new variety of Ponlai rice was expected to be a success and chemical fertilizer was also adopted by farmers. Under such conditions, a big investment push in irrigation and land improvement could be expected to be fruitful. Transformation in traditional agriculture was completed in this decade. More than 50,000 hectares of Tao-yien canal irrigation area and 150,000 hectares of Chia-nan irrigation area were completed in 1925 and a rapid increase in consumption of chemical fertilizer also started in this period. The ratio of total capital goods allocated to agriculture in the decade 1920-1930 was about 14.5 percent on the average, marking an historical record. As the result of heavy investment in irrigation in this decade, the irrigation ratio of total farm land increased to 53 percent, land productivity increased by two times, and the total sale ratio of agricultural products reached to about 70 percent.\textsuperscript{18/} In financing such heavy investment, landlords and farmers still played an important role. They shared a large percent of their additional income with investment. Favorable terms of trade for agriculture and high technological profitability provided incentives for their participation in investment.

\textsuperscript{18/} T. H. Lee, (8) Chapter 4
High government taxing of agriculture, increase in land-rent, and farmers' autonomous savings were factors in maintaining a positive net capital outflow from agriculture. In terms of economic relations it can be interpreted as follows: (a) high squeeze ratio including taxing and land-rent payment in total agricultural production; (b) slow increase in per capita consumption of farmers, (c) moderate rate of population increase in agriculture; (d) rapid growth of agricultural exports; (e) high technological change and investment multiplier.\(^{19/}\)

These five factors simultaneously worked together to cancel the adverse effect on capital transfer of the high rate of capital allocation in agriculture. The organized financial transfer mechanism was the condition for the effective working of the above five factors.

(2) The transformation of agriculture and industrialization in the period 1930-1940.

In this period, the rate of capital growth was negative for agriculture and the ratio of capital goods allocated in agriculture also declined rapidly to about 5-6 percent. Following the successful transformation of traditional agriculture in the later phase of the first period, growth of agricultural land productivity still was at the high rate of 1.9 percent per annum. The technological change amounted to 1.5 percent a year. Rapid increase in the application of chemical fertilizer was accompanied by varieties of seeds. More inputs of working capital and labor were represented by the specific character of technological linkage effect\(^{20/}\) on output in this period. Market-price mechanism and technological profitability acted as persuasive incentives to farmers.

\(^{19/}\) Investment multiplier here is meant by the increase in agricultural income through input of agricultural labor and agricultural products in agricultural investment. A detail explanation on this concept was given in T. H. Lee (8) pp. 110-112.

\(^{20/}\) The term of technological linkage can be defined as that technological changes in terms of resource inputs are not instantaneously happened, but rather continuously shift from one technical improvement to another technical improvement with different emphasis on resource inputs.
Small-scale farming together with organizational help made possible the adoption of the new technology at rapid rate. Autonomous growth in agriculture was systematically established in such a way that the abundant resources of labor and scarce capital funds have well been combined with specific techniques to increase output and to contribute to industrial expansion. Agricultural development in this period constituted not merely the supply of agricultural output and productive resources for industry but also the need for maintaining the momentum of its economic transformation and the use of its scarce resources in two sectors. Net capital outflow from agriculture reached to an historical peak in terms of visible fund. Increases in net savings and government taxing were the dominant factors. Land-rent payment slowed down its increase. High sale ratio of agricultural products marked the successful achievement of agricultural transformation. Also, the system of taxation and financial institutions worked effectively in mobilizing capital out of agriculture.

Therefore, we can summarize the factors contributing a bulk of capital outflow from agriculture in this period, as follows: (a) high technological progress with more inputs of working capital and labor; (b) decrease in fixed capital goods allocated to agriculture; (c) relatively slow increase in land-rent payment; (d) the lagging of increase in per capita consumption of farmers behind increase in per capita income; (e) favorable terms of trade for agriculture; (f) continuously rapid increase in agricultural exports. These factors working together with the organized institutional system displayed the role of agriculture in contributing capital to economic development.

(3) Further development of agriculture in the period 1950-1960.

The basic conditions for agricultural development looked gloomy in the immediate postwar period. Population increased at more than 3.0 percent while farm land area was nearly limited in its expansion. Total agricultural output was set back to the 1910 level, mostly because of the shortage of chemical fertilizer and war damage in irrigation.
facilities. Taiwan suddenly changed from a food surplus area to a food shortage area during the six years between 1942 and 1947. When Taiwan was ceded to China, the most important property was the large number of technically-educated farmers and agricultural organizations. The precondition for government action on choice of development measures was enough. Only if government behavior is purposeful and progress-oriented, a quick recovery and further development of agriculture offers no difficulty. Until 1948, the requirements for forcing the government toward purposeful behavior were not satisfactory. Since the National Government came to power in Taiwan, the Taiwan government has initiated purposeful development measures. Institutional reforms, represented by the land reform program and the reorganization of farmers' associations, first of all were in practice forced in order to create a productive incentive for farmers. Second, scarce materials imported by the U. S. economic aid were allocated to agriculture and industry under the national development plan. Third, the highly developed technology was transmitted to farmers' level through the role of the Joint Commission on Rural Reconstruction.

Price mechanism was not considered as incentive toward adopting the new technology and increasing the agricultural output. Government allocation of chemical fertilizer, pesticides, irrigation water, and production fund to individual farmers plus subsidy comprised important means substituted for the price mechanism. Government collection of rice, sugar, and other important products in addition to the unfavorable terms of trade resulted in a tremendous net capital outflow from agriculture. The forced savings for land price repayment and autonomous savings of farmers were other factors influencing the increase in capital outflow.

In summary, the factors determining the capital outflow from agriculture in this period can be weighed as follows: (a) total output of agriculture increased rapidly at more than 4.0 percent per annum,
of which technological change was as high as 2.4 percent.\textsuperscript{21} This growth rate far exceeded the population growth rate in addition to increasing the rate of per capita consumption; (b) in the rapid industrialization at more than 17 percent per annum in this period, the wage rate in industry was two times higher than in agriculture.\textsuperscript{22} The great requirement for food in industry plus export demand constituted the great demand potential for agricultural products; (c) capital-output ratio in agriculture increased to some extent in this period but still was less than capital-output ratio in the nonagricultural sector; (d) investment in agriculture in this period was accompanied by the large multiplier effect, although the ratio of capital goods allocated in agriculture was only about 5 percent;\textsuperscript{23} (e) government taxing, forced savings on agriculture, and farmers' autonomous savings constituted a large squeeze ratio of agriculture. However, invisible capital transfer occupied more than 50 percent of total net real capital transfer from agriculture throughout the period.\textsuperscript{24}

After all, the rapid technological change of agriculture and high squeeze ratio of the government's direct and hidden taxing of agriculture outweighted the capital and industrial consumer goods flowing into the agricultural sector. The role of landlords in capital transfer mechanism ceased in this period.

\textbf{Implications of Taiwan's Experience}

In considering the implications of the above discussion, it seems to be important to generalize the relationship between determinants of intersectoral capital flow with respect to the strategic measures for agriculture development. The resource endowment and the level of agricultural productivity are the conditions determining the size of

\begin{thebibliography}{99}
\bibitem{21} T. H. Lee (8) P. 125
\bibitem{22} T. H. Lee, ibid, p. 96
\bibitem{23} T. H. Lee, ibid, p. 111
\bibitem{24} T. H. Lee, ibid, pp. 241-242.
\end{thebibliography}
agricultural investment for achieving the given rate of agricultural growth. Fundamentally, land productivity and per capita land area or man-land ratio are the determinants of the level of agricultural productivity in terms of labor. Therefore, under the great increase in population and limited land resource, the large requirement for food supply necessarily requires a big push of agricultural investment in irrigation and land improvement. For this reason, Shigeru Ishikawa and V. W. Ruttan have concluded in reference to the intersectoral capital transfer that the agricultural sector may require a net inflow of capital from the nonagricultural sector for the transformation of agriculture in Asia. A similar situation does not seem likely in the case of Taiwan's experience. A big push of agricultural investments in irrigation and land improvement had not been undertaken in Taiwan before the surplus of government budget and the technological progress were realized. Two important strategies will be observed: (a) purposeful government decision; and (b) technological relation between the fixed capital input and biological technology. The former is related to the basic problem of capital allocation in the whole national economy. As agriculture is generally considered the mainstay of the economy, the better utilization of slack in agriculture will be rather selected to substitute for the additional input of scarce capital goods. The latter is concerned with the availability of new varieties of seeds, with the farmers' skill in application of chemical fertilizer and with the method of cultivation in relation to the heavy irrigation investment. The requirement for heavy irrigation investment seems to be large in the period of transition from extensive to intensive farming in paddy farming areas. Under the high pressure of population, labor intensive cultivation is the general direction. To absorb more labor input in farming, the expansion of productive capacity in terms of land is naturally the due measure. However, the intensity of farming is greatly dependent on the demand for crops and livestock and also on the


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quantitative and qualitative relationships between inputs, Landowners, as receivers of large shares of land-rent in the additional increase of output, will play some role in encouraging such intensive farming. Introducing new varieties of seeds and promoting the application of more chemical fertilizer and contributing to the irrigation investment represented their efforts in Taiwan experience.

Considering the fact that a requirement for heavy investment in agriculture is generally associated with government decision, technological requirement, role of landlords, and demand factors, the amount of capital flow into the agricultural sector probably will not exceed the gross capital outflow from agriculture by the effective capital transfer mechanism and the large investment multiplier schemes. Even if there is a net capital inflow to agriculture, in the short run the case will quickly turn to the net capital outflow.

Strategies for agricultural transformation with respect to maintaining the net capital outflow from agriculture are: (a) that the basic agricultural investment should be accompanied by technological improvement; (b) that an appropriate investment scheme with large multiplying effect on income be selected; and (c) that a capital transfer mechanism be established. According to the different conditions or stages of agricultural development, the above strategic components will change in comparative importance, as the experience of Taiwan has shown.

When we carefully study the problems of agricultural development faced by the countries contemporarily developing in South Asia, it is clear that they suffer from an inability to transform the traditional agriculture and bring about the major, continuous change in productivity associated with a technologically dynamic agriculture. The crucial fact is that, as Mellor has pointed out, introduction of single change in farming practice in such a traditional agriculture will result in a

27/ John W. Mellor, ibid., 136-154.
small effect on increase in productivity. The several empirical studies on the South Asian agriculture indicate that, within the traditional agriculture, increasing agricultural production or crop yield through added labor input seems unlikely to succeed. Considering the available land resources and high population pressure in the contemporary South Asian countries, the possible pattern of land-man ratio in these areas will continue to decrease in the future. The above-mentioned development strategies for transforming the traditional agriculture in 1926-1930 in Taiwan may be useful for these areas. This suggestion is, of course, subject to severe qualification by the institutional or organizational requirements for achieving development strategies.

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