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RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION
AND TECHNOLOGICAL CHANGE

The Ohio State University and the
Joint Commission on Rural Reconstruction/Taipei, Taiwan

Researchers: Dale Adams, T. H. Lee and Marcia Ong*
Date: August 16, 1971
Location: Taipei, Taiwan

No. 9
Subject: Farm-Income Taiwan

Tentative Title of Study: "Farm Level Savings, Investment and Consumption in Taiwan 1960-1970".

Tentative Completion Date: August 1972

These notes report on preliminary findings of a continuing research project. The data analysis and conclusions are tentative and formal reference to them should be cleared with the authors.

I - Objectives -

The main objective of this study is to determine how farmers in Taiwan used their income during 1960 to 1970. This will include directing special attention at the financial savings capacity of farmers during this period. The specific objectives are (1) to document the pattern and growth of farm income in Taiwan during the past 20 years, (2) to identify how changes in farm income influenced farm investment, family consumption, and financial savings during the 1960's, (3) to assess how various farm characteristics relate to different patterns of investment,

* Very helpful comments were received from H. Y. Chen, Y. E. Chen, C. Y. Hsu, and other JCRR staff members.

consumption, and savings, and (4) to draw appropriate policy conclusions, about the possibilities of mobilizing institutional savings from rural areas.

Information on the growth in farm income in Taiwan during the past two decades is reported in this Note. Some of the major issues which will be treated in the study are also briefly presented.

II - Data to be Used -

In 1953 a farm record-keeping project was started by 10 vocational agricultural schools in Taiwan. In 1960 the program was shifted to local Farmers Associations, and the Provincial Department of Agriculture and Forestry (PDAF) began closer supervision of the data collection and tabulation. As can be noted in Table 1 only three agricultural regions, the principal rice producing areas, were covered from 1960 through 1963. Beginning in 1964, however, record-keeping was extended nationwide and an additional five agricultural areas were included. Rather comprehensive information on land use, farm and family income, farm expenses, household expenses, farm receipts, off-farm receipts, farm assets and liabilities, and farm labor use are included in these records. Each year PDAF publishes a summary of the averages from these records. Very little time series analysis has been attempted, nevertheless, on these accounts. A sample of records drawn from the participants in each year will be used as the basis for this study.

Table 1. Number of Farmers' Associations, Agricultural Regions, and Individuals Participating in Farm Record-keeping in Taiwan 1960-1970

Year	Number of		
	Farmers' Associations	Ag. Regions	Individuals
1960	7	3	95
1961	17	3	212
1962	18	3	223
1963	21	3	306
1964	40	8	535
1965	40	8	501
1966	28	8	430
1967	28	8	402
1968	36	8	415
1969	36	8	411
1970	36	8	400*

* Preliminary estimate.

Source: Department of Agriculture and Forestry (PDAF), Provincial Government of Taiwan, Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1969, (Nantou, Taiwan: PDAF, various years).

III - Agricultural Development Background -

In the past two decades agriculture in Taiwan has performed very well. Overall output shot up by two-and-a-third times from 1952 to 1970, the value of agricultural exports more than tripled, and internal food supplies have been ample and inexpensive. Few countries can match the sustained 5 percent agricultural growth rate experienced by Taiwan during

the past 20 years.^{1/}

A number of important changes have been made in the rural area which boosted agricultural development. A very comprehensive land reform in the early 1950's sharply improved farmers incentives to invest, increased the rural areas' labor absorptive capacity, and vastly improved the access of rural people to widening income streams. A broadly based increase in rural effective demand, plus a major build up of farm capital have resulted. Rural education has also been improved; and major investments made in irrigation facilities, rural roads, and agricultural research.

Probably the most remarkable aspect of Taiwan's agricultural experience has been the creation and strengthening of rural institutions which support the developmental process. The Taiwanese have shown a good deal of flexibility and imagination in constructing new organizational rules for linking together and stimulating economic behavior.^{2/} They have been especially successful in generating institutions which allow small farmers to realize development benefits within overall growth.

The growth performance of agriculture in the face of steady and substantial net transfers of capital out of rural areas is a testimony to the effectiveness of Chinese policy. Heavy land and irrigation taxes, forced savings, low administered product prices, high input prices, and rural-to-urban migration of human capital have siphoned off a substantial

^{1/} Council for International Economic Cooperation and Development (CIECD) Taiwan Statistical Data Book - 1971 (Taipei, Taiwan: CIECD, 1971).

^{2/} S. C. Hsieh and T. H. Lee, Agricultural Development and Its Contribution to Economic Growth in Taiwan, Economic Digest Series No. 17, Joint Commission on Rural Reconstruction, Taipei, Taiwan, April 1966, p. 103.

amount of capital from agriculture.^{3/} Taiwan has clearly invested a good deal in its agricultural sector, but it has also clearly taken out much more than invested.

Several recent changes in Taiwan's agriculture are of particular interest. The first is that the rural labor force in Taiwan has reached its peak and is starting an absolute decline. A decreasing population growth rate, an increasing spread between rural and urban incomes, and increased rural education have accelerated occupational and locational movement away from agriculture. In the past couple of years farmers have experienced some serious seasonal labor shortages, rural wages have moved up sharply, and farm mechanization has accelerated. Almost 4 thousand additional power tillers were purchased in 1970, double the number purchased in 1968.^{4/} Policy makers are seriously considering a set of measures which would further stimulate mechanization to replace the fleeing labor.

IV - Farm Family Earnings in Taiwan -

Despite the substantial net capital outflow from agriculture during the past two decades, farm family earnings have shown a steady increase. The data presented in Table 2 suggest the magnitude of this change in earnings. As can be noted, farm family earnings almost doubled in real terms for most farm-size groups from 1952 to 1967. The income growth during the 1962 to 1967 period was especially impressive with an average

^{3/} T. H. Lee, "Intersectoral Capital Flows in Economic Development of Taiwan 1895-1960", Journal of Agricultural Economics (Taiwan) Number 7, June 1969, pp. 69-97; and A. B. Lewis, "The Rice-Fertilizer Barter Price and The Production of Rice in Taiwan, Republic of China", Journal of Agricultural Economics (Taiwan) No. 5, June 1967, pp. 127-188; T. L. Lin and H. H. Chen, "Rural Labor Mobility in Taiwan", Journal of Agricultural Economics (Taiwan) No. 11, June 1971 pp. 123, 147.

^{4/} W. C. Lai, "Current Situation and Problems of Farm Management on The Mechanized Farming in Taiwan", unpublished paper, Joint Commission on Rural Reconstruction, Taipei, Taiwan, August 1971.

change of more than 40 percent.^{5/} Aside from 1969 when adverse weather substantially decreased farm output, price and output indicators for 1968 through 1971 suggest a continued increase in real farm family earnings.

The disposition which farmers have made of their increased incomes will be the focal point of this study. Some preliminary idea of how farmers have generated and used additional income can be drawn from Table 3. Information in this Table comes from the Farm Record-keeping Project described in Table 1. As can be noted, real farm family earnings among this group of farmers increased by 38 percent from 1960 to 1968. Almost 40 percent of this increase, however, came from additional off-farm income.

Additional household expenses from 1960 to 1968 were equal to about one-half of the increase in total farm family earnings. The increase in farm family purchases of items like radios, televisions, bicycles, clothes, household appliances, etc., have been a major factor in providing markets for industrially produced goods in Taiwan.

^{5/} Agricultural output and incomes in 1962 appear to have fallen below the trend line. Thus, the 1957-1962 percentage changes may be somewhat understated and the 1962-1967 figures overstated.

Table 2. Average Family Earnings of Farmers in Taiwan
by Size Group 1952, 1957, 1962, and 1967*

(In 1952 Prices)**

Size Group in Chia***	Y e a r				Percentage Change		
	1952	1957	1962	1967	1952-57	1957-62	1962-67
	NT\$				%		
Average	7,361	8,612	9,682	13,784	17	12	42
0.49 or less	3,765	5,014	5,655	9,920	33	13	75
0.50-0.99	5,097	6,873	7,937	10,754	35	16	36
1.00-1.99	8,010	9,481	11,145	15,297	18	18	37
2.00 or more	14,653	16,606	17,631	25,361	13	6	44

* Farm family earnings are the differences between total family receipts (farm and non-farm) and total farm expenditure.

** Deflated using Index of Prices-received-by-farmers published by the Provincial Bureau of Accounting and Statistics, Taipei, Taiwan; (1952=100, 1957=164, 1962=249 and 1967=293).

*** One Chia = 0.97 Hectares or 2.4 acres.

Source: Joint Commission on Rural Reconstruction (JCRR), Taiwan Farm Income Survey of 1967, with a Brief Comparison with 1952, 1957 and 1962 (Taipei: JCRR, 1970), p. 35. The income surveys were based on a random sample of all farm enterprises in Taiwan. In 1952, 4,000 farmers were interviewed, in 1957, 1,402, in 1962, 1,947 and in 1967, 1,640.

Clearly, however, not all increases in income have been consumed. The sharp growth in cash held and in bank deposits indicate a growing willingness and capacity on the part of farmers to increase institutional savings. The fact that savings institutions in Taiwan have offered incentive rates of interest for time deposits during the 1960's is also

Table 3. Financial Averages for Farm Record-keeping Families in Taiwan 1960, and 1968

(In 1952 NT\$)*

Year	Farm Family Earnings			Household Expenses year	Year End		Net Worth
	Total**	Farm	Off-farm		Cash	Bank Deposits***	
1960	13,307	11,518	1,788	10,722	454	1,271	69,052
1968	18,399	14,731	3,668	13,178	1,406	3,301	106,045
Ratio '68/'60	(1.38)	(1.28)	(2.05)	(1.23)	(3.10)	(2.60)	(1.54)

* Deflated using Index of Prices-received-by-farmers, published by the Provincial Bureau of Accounting and Statistics, 1952=100, 1960=255, and 1968=309.

** May not equal farm earnings plus off-farm earnings due to rounding.

*** Mainly time deposits.

Source: The 1960 and 1968 issues of Provincial Department of Agriculture and Forestry (PDAF), Report of Farm Record-keeping Families in Taiwan, published yearly by PDAF in Nantou, Taiwan. The number of farms included in each year is shown in Table 1.

apparently important in explaining the growth in savings.^{6/}

Farmers have also apparently reinvested substantial portions of their increased income in the farm operations. The fifty-percent-plus growth in farmer's net worth from 1960 to 1968 is an indication of this. Improved irrigation facilities, labor investments in land improvements, the build-up in farm machinery, and investments made in land consolidation have been important features of this net worth increase.

^{6/} Farmers associations are the major factor in institutional rural savings in Taiwan. During the 1960's they paid nominal rates of interest on time deposits of from 6 to 10 percent per year. Taiwan has experienced only modest rates of inflation during the 1960's. This has resulted in positive real rate of interest being paid on savings.

V - Issues for Further Study -

- (1) The individuals who participate in the farm record-keeping project are not a representative sample of Taiwanese farmers. On the average they are larger, may be more progressive, and realize higher farm incomes than a random sample of farmers. An important issue for the study, therefore, will be to document how the farms under study differ from the average, and to qualify aggregate conclusions accordingly.
- (2) Further classification of the growth and distribution of farm families' earnings will also be necessary. How important is off-farm income to various groups of farmers? What farm characteristics are associated with substantial increases in farm income? How is the farmers' responsiveness to changes in product and input price relationships related to their responsiveness to financial incentives to institutionally save? How do earnings data from the Farm Income Surveys compare with data from the Record-keeping Project?
- (3) What have been the economic reactions by various size groups or farmers to increases in income? What have been their average and marginal propensities to consume, invest, and save? Have these coefficients changed during the past ten years? What factors can be identified as explaining differences and changes in propensities?
- (4) What have been the changes in cash and non-cash income and expenditures among the farm record-keeping families. What has been the rate of return on capital by size of farm among these farmers? What can be said about changes in liquidity preferences, liabilities and assets?

- (5) What aggregate policy implications might be drawn from the analysis? Does a substantial financial savings capacity exist in rural Taiwan? What might happen at the farm level if national policy was changed to allow a more rapid increase in farm family earnings? What implications would additional rural income have on demand for industrial goods and industrial labor? Do farms in Taiwan have the financial capacity to auto-finance mechanization? If not, is their credit repayment capacity sufficient to justify a further expansion in institutional credit for agriculture?

RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION
AND TECHNOLOGICAL CHANGE

The Ohio State University
and the
Joint Commission on Rural Reconstruction

Researchers: Dale Adams, Marcia Ong, and I. J. Singh

Date: June 30, 1972

No: 15

Location: Columbus, Ohio

Subject: Rural Savings Propen-
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1960-1970"

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These notes report on preliminary findings of a continuing research project. The data and conclusions are tentative and formal reference to them should be cleared with the authors.

I - Objectives

The main objective of this study is to determine how farmers in Taiwan used their income from 1960 to 1970. Special attention is directed at the determinants of farm level saving and consumption. (See Research Note No. 9 dated August 16, 1971 for further details on the objectives of the study.)

II - Data Used

Farm record keeping information collected by the Provincial Department of Agriculture and Forestry (PDAF) from 1960 through 1970 is used as the basis for this study.¹ Over 3900 farm accounts for the 11 years under study are under analysis. (See Research Note No. 9, dated August 16, 1971 for more details).

III - Preliminary Analysis

The following tables present a preliminary summary of average and marginal propensities to save (APS and MPS) from current income calculated

¹For further background on this data see Marcia Ong and Dale W Adams, "A Summary of Various Economic Data From Accounts of Farm-Record Keeping Families in Taiwan, Yearly Averages Covering 1960 through 1970," Economics and Sociology Occasional Paper No. 65, Department of Agricultural Economics and Rural Sociology, The Ohio State University, March, 1972.

cross-sectionally from the Taiwan farm record keeping data.

Table I displays a summary of APS by year and by various farm sub-groups. The APS is here defined as one minus the average per capita farm family consumption divided by the average per capita income of the farm family.

As can be seen in Table I the APS for the total sample of farms has been remarkably high throughout the decade.² Except for 1969 when farm incomes were depressed due to bad weather, the farmers under analysis have had a savings capacity which ran from about one-fifth to one-quarter of their total income.

As might be expected, the APS increased with increases in farm size, and also increased as farm-generated income became a larger proportion of total family income. No consistent savings pattern emerged with respect to age composition of the family, however. APS's among the different agricultural regions also showed no consistent pattern. Adjustments in income from region to region and year to year appear to be more the result of changes in weather than structural differences in savings-consumption behavior among regions.

Table II presents a summary of the ranges of the marginal propensities to save (MPS) calculated through the use of four statistical functions: linear, quadratic, semi-log, and double log, estimated using cross-section data. (The specific forms of these functions are specified in a footnote to Table II). In each case per capita current farm family consumption was regressed against per capita current farm family income using ordinary least squares. The marginal propensities to consume were calculated at the arithmetic income mean for the group under study. The marginal propensity to save is defined as one minus the marginal propensity to consume.

As with the APS, the MPS's were much higher than we had originally expected. The analysis of the total farm data suggested that between one-third and two-thirds of the income at the margin is saved. These are exceptionally high rates given past evidence on rural saving behavior. The small farmers in the sample also had much higher MPS's than we had expected.

²In general, farmers participating in the farm record-keeping project are better farmers than non-participants. Their incomes, for a given farm size, are generally larger than non-participants. Later analysis of information gathered from island-wide farm surveys in 1962 and 1967 will be used to place the farm record-keeping families in perspective.

TABLE 1
Average Propensities to Save Based on Taiwan Farm Record Keeping Data by Year
and Various Economic Sub-Groups 1960-1970*

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1. Total Farms	.18	.19	.21	.23	.24	.24	.28	.24	.29	.12	.20
<u>By Farm Size (hectares)</u>											
2. 0 - 1.00	.15	.14	.16	.21	.21	.18	.19	.19	.23	.07	.13
3. 1.01-2.00	.16	.21	.22	.21	.25	.26	.28	.25	.27	.10	.23
4. 2.01+	.28	.19	.26	.30	.32	.30	.39	.29	.37	.19	.24
<u>By Region</u>											
5. N. Rice #1	.20	.13	.23	.30	.22	.24	.15	.23	.24	.07	.14
6. M. Rice #2	.19	.19	.18	.20	.24	.20	.24	.20	.20	.06	.18
7. S. Rice #3	.19	.30	.23	.26	.22	.20	.34	.22	.42	-.06	.19
8. Tea #4	**	.11	.21	.05	.15	.15	.16	.14	.25	.12	.20
9. S. W. Mixed #5	**	**	**	**	.27	.33	.32	.24	.25	.20	.25
10. S. W. Cane #6	.07	.11	.25	.23	.23	.23	.28	.28	.27	.09	.19
11. Fruit #7	**	.14	.18	.06	.27	.25	.15	.22	.30	.16	.14
12. E. Mixed #8	**	**	**	**	.27	.30	.45	.37	.40	.32	.32
<u>By Dependency Ratios***</u>											
13. 0 - .5	.20	.19	.24	.24	.24	.23	.27	.22	.30	.10	.20
14. .5+	.16	.18	.17	.22	.23	.24	.29	.28	.27	.15	.22
<u>Ratio of Farm Income*** to Total Income</u>											
15. 0 - .7	.09	.18	.24	.14	.16	.22	.22	.20	.23	.07	.14
16. .7+	.19	.19	.21	.25	.26	.24	.30	.26	.31	.15	.24

* The average propensity to save is defined as one minus the average propensity to consume, which in turn is per capita household expenditures over per capita total family income.

** No observations available from this region for this year.

*** See notes in Table II.

TABLE II

A Summary of Ranges of Marginal Propensities to Save, Using Various Functional Forms, Based on Taiwan Farm Record Keeping Data by Year and Various Economic Sub-Groups¹

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1. Total Farms	.38-.49	.39-.46	.44-.51	.40-.57	.39-.63	.39-.49	.54-.68	.44-.52	.45-.81	.33-.46	.41-.47
<u>By Farm Size</u>											
2. 0 - 1.00	.60-.66	.37-.44	.42-.50	.30-.68	.30-.68	.38-.47	.43-.50	.46-.52	.40-.60	.43-.50	.34-.42
3. 1.01-2.00	.24-.31	.44-.45	.46-.55	.50-.64	.36-.46	.39-.49	.52-.68	.34-.45	.46-.55	.26-.44	.40-.56
4. 2.01+	.77-.79	.37-.51	.37-.50	.37-.50	.57-.61	.34-.65	.71-.79	.45-.62	.59-.93	.19-.53	.33-.46
<u>By Region</u>											
5. N. Rice #1	.44-.46	.27-.29	.45-.53	.51-.81	.41-.52	.34-.48	.23-.74	.33-.48	.37-.51	.22-.45	.20-.34
6. M. Rice #2	.57-.61	.27-.41	.55-.57	.40-.46	.38-.54	.21-.38	.49-.64	.41-.52	.46-.50	.41-.59	.38-.50
7. S. Rice #3	.12-.38	.41-.50	.24-.52	.35-.50	.33-.47	.19-.46	.62-.69	.28-.53	**	.03-.46	.52-.68
8. Tea #4	*	.34-.39	.54-.68	.56-.71	.20-.84	.30-.33	.31-.37	.32-.42	.60-.67	.19-.35	.27-.37
9. S. W. Mixed #5	*	*	*	*	.47-.55	.60-.69	.57-.61	.48-.62	.31-.53	.26-.50	.25-.42
10. S. W. Cane #6	.53-.60	.40-.44	.47-.78	.47-.59	.54-.58	.42-.50	.39-.65	.47-.56	.45-.86	.33-.50	.51-.58
11. Fruit #7	*	.32-.34	.55-.59	.55-.73	.46-.56	.52-.59	.36-.42	.49-.54	.50-.54	.32-.62	.01-.49
12. E. Mixed #8	*	*	*	*	.54-.56	.61-.66	.84-.94	.60-.66	.53-.66	.48-.52	.46-.56
<u>By Dependency Ratios²</u>											
13. 0 - .5	.32-.48	.31-.44	.44-.51	.32-.57	.36-.69	.32-.43	.56-.67	.36-.50	.52-.67	.30-.45	.30-.46
14. .5+	.48-.53	.45-.51	.52-.58	.59-.62	.44-.54	.51-.58	.60-.74	.58-.62	.51-.85	.51-.55	.53-.61
<u>Ratio of Farm Income to Total Income³</u>											
15. 0 - .7	.26-.38	.53-.58	.52-.60	.34-.40	.21-.29	.33-.42	.36-.60	.26-.36	.41-.81	.15-.49	.26-.37
16. .7+	.39-.56	.35-.45	.43-.49	.42-.59	.43-.69	.41-.55	.62-.71	.49-.58	.53-.71	.42-.52	.52-.56

* No observations available from this region for this year.

** Results not significant.

Footnotes for Table II

¹The marginals were computed at the arithmetic income mean for the particular group under analysis. Four functional forms were used to estimate the per capita consumption functions: (a) a linear form, (b) a quadratic form, (c) a double logarithmic form, and (d) a semi-logarithmic form. Only the results of the lowest and highest marginal propensities to save from the four functional forms are presented here. Ordinary least squares procedures were used to estimate the following functional forms:

$$1) \left(\frac{c}{n}\right) = b_0 + b_1 \left(\frac{y}{n}\right), \quad 2) \left(\frac{c}{n}\right) = b_0 + b_1 \left(\frac{y}{n}\right) + b_2 \left(\frac{y}{n}\right)^2$$

$$3) \log\left(\frac{c}{n}\right) = b_0 + b_1 \log\left(\frac{y}{n}\right), \quad 4) \left(\frac{c}{n}\right) = b_0 + b_1 \log\left(\frac{y}{n}\right), \text{ where}$$

c = total household expenses for the year, n = total number of members in the household, and y = total net income of family from farm as well as off-farm sources.

²The dependency ratio is defined as the number of children of less than 15 years of age plus people over 60 years of age who reside in the household divided by the total number of members of the household.

³Farm income is defined as the net farm income derived from on-farm enterprises. Imputed management returns, capital depreciation, and a value for family labor used on farm have not been subtracted from this net income figure. Total net income includes net farm income plus net income derived from off-farm activities.

IV - Issues for further analysis

Past economic analysis has strongly suggested that consumption is more closely related to previous income than to current income. Lagged consumption analysis will, therefore, be an important step in further testing of the data.

The preliminary analysis of the data has also suggested that the goodness of fit of different functional forms changes as we move across various economic sub-groups and years. That is, the scatter of per capita consumption as plotted against per capita income apparently changes substantially through various sub-groups and years. The selection of the functional form will, as a result, receive a good deal of emphasis in future analysis.

There is also some indication that, over time, the farmers under study have proceeded along U-shaped average and marginal consumption curves. We are hypothesizing that during the early 1960's many of the farmers under study were sliding down these curves due to incomes that increased at rates more rapidly than farmers had expected, rates of return to on-farm and off-farm investments which were very attractive, and relatively few attractive consumption alternatives available in the rural areas. Later in the 1960's, farmers may have increased somewhat their average and marginal consumption due to realized and expected incomes coming closer together, a satiation of on-farm investment opportunities, and widespread availability of attractive consumer durables in rural areas.