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INCOME INSTABILITY AND CONSUMPTION BEHAVIOR:

A STUDY OF TAIWANESE FARM HOUSEHOLDS

1964 - 1970

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Truong Quang Canh, B.S., M.S.

* * * * *

The Ohio State University
1974

INCOME INSTABILITY AND CONSUMPTION BEHAVIOR:
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1964-1970

By

Truong Quang Canh, Ph.D.
The Ohio State University, 1974
Professor Dale W Adams, Adviser

The objectives of this study are: (1) to investigate the effects of income instability on the consumption behavior of Taiwanese farm households, (2) to measure the impact which short-run changes in household income and farm investment profitability have on household expenditures, and (3) to draw possible policy implications for less developed countries from the analysis.

The study was mostly based on data from 53 Taiwanese farms covering the seven-year period 1964 through 1970. A linear model was used in the analysis to describe the consumption function, first for total expenditures and subsequently for other sub classes of consumption: food, clothing, household operations, and health and education.

An income instability index was computed for the households under analysis. This index is the average

deviation of the annual percentage rates of income growth and was used to measure the overall instability of income of each farm household. Over the seven-year period 1964-1970 almost two-thirds of the income of Taiwanese farm households was derived from farming operations. The analysis showed that farm incomes were more stable than non-farm incomes. Further, that there was a faster rate of growth in income among farms with highly unstable income and among large farms.

The linear regression analysis indicated that income and size of family yielded positive consumption responses, but that the rate of return on equity was negatively related to consumption expenditures. The analysis also showed that income changes due to adverse weather conditions and other income destabilizing factors did not alter the consumption patterns of Taiwanese farm households.

The results of this study further confirm the permanent income hypothesis. Taiwanese farm households have apparently correctly anticipated the variability in their future income streams. Their consumption decisions are more or less insulated from income instability. The results also suggest that consumption behavior of rural households is affected by attractive rates of return on

investment possibilities. One might also conclude that well developed financial markets may be able to provide very important loan and deposit services in unstable income areas.

To my wife, N. T. Thao, and children
Nguyet Anh and Hoang Anh

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CHAPTER I

INTRODUCTION

Statement of the Problem

There is a close relationship between the process of economic growth and capital accumulation. An accelerated rate of growth is usually accompanied by a high rate of capital formation. This process requires that each nation divert a part of its output from consumption to further investments. Consumption studies have, therefore, assumed an important role in economic growth analysis. The consumption function is now almost universally accepted as one of the most important parts of economics and it is a cornerstone of most growth models.

Since J. M. Keynes formulated the consumption function in the General Theory of Employment, Interest and Money, an increasing number of economists have paid attention to the functional relationship between consumption and income at the micro as well as at the macro level.¹ In the

¹J. M. Keynes, The General Theory of Employment, Interest and Money, New York: Harcourt, Brace and Co., 1936, p. 96.

developed countries, consumption functions have been estimated from time-series data mostly for the period after World War I, and from numerous sample surveys made during the past century and a half.² The identification of causal factors affecting consumption behavior has been extended from a few primary determinants like income, family size and other related family characteristics to additional variables such as types of assets, wealth or some combination and variation thereof.

Interpreting results from studies of household consumption behavior determinants is not without difficulty. Frequently economists estimate quite different models. Some use time-series data, others look at cross-section data. Some incorporate independent variables into the consumption function which are not included by others, and thus make comparisons between different studies difficult. Nevertheless, the present state of knowledge about the theory of consumption, based on these empirical works in developed countries, represents a vast improvement over that of a few decades ago.

But when one comes to research on consumption and savings in the less developed countries (LDC's), especially

²Milton Friedman, A Theory of the Consumption Function, Princeton: Princeton University Press, 1957, p. 3.

in rural areas, one is generally handicapped by the lack of statistical data and empirical results. This is regrettable because in most LDC's a major part of the capital accumulation must occur in the rural sector, a process that occurs largely through the deferred consumption decisions made by the farm household.

Justification of the Study

Additional inquiries into the factors which affect the farm household's decisions to defer consumption in less developed countries are needed to shed further light on the nature of rural capital formation. Research on consumer response to variations in income in the short run and the trade-off between consumption and farm investment is especially needed. It has often been asserted that there are marked differences in the consumption-saving patterns between farm and non-farm households. Income instability has been cited as one of the factors that cause these differences. Since income instability is a common characteristic of farm family income, it would be useful to study how farm family income instability affects the consumption behavior of the farm household. Almost no work has been done on the consumption impact in rural areas of LDC's of short run change in income and income instability. An understanding of the short run and long run

dynamics of change should contribute significantly to the analysis of the capital formation process in the LDC's.

The Setting of the Study

Taiwan provides an excellent setting for studying the problems mentioned above. It is a country that has often been cited as a successful development case. Agriculture in Taiwan has not only been able to increase its own productive capacity but has also contributed substantially to the industrial sector.³ At the same time, capital formation in the rural areas of Taiwan has also been impressive. Another advantage of studying Taiwan is that rice farming and the small-size holdings found there are typical of the agricultural conditions found in many parts of Asia. Also, agricultural production in Taiwan, as in many parts of Asia, is carried out under a great deal of risk and uncertainty which result in a good deal of income instability. In part this is due to the vagaries of weather: too much or too little rain and typhoons. The farmer always has some doubt about the way the crop will turn out in a given year. The second reason is what may be called market uncertainty. The farmer is often at the

³Teng-hui Lee, Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960, Ithaca, New York: Cornell University Press, 1971.

mercy of a fluctuating price system in which variations are caused by changes in supply and demand situations. The third reason is technological uncertainty. The farmer faces this risk when he has to choose in what way to commit resources over the long run. Finally, farm household income often includes off-farm earnings which may also be quite unstable.

The main question to be treated in this study is how this income instability has affected the savings-consumption decisions of farm households in Taiwan.

The availability of detailed household data and some previous consumption studies done at the micro level in Taiwan provide a sound base for the further study of this subject. The need to study the dynamics of consumption behavior requires time-series data. A single survey at some point in time may provide some data on previous income experience through questions about past activities. These types of data, however, are often subject to recall errors and biases. Panel data obtained over a period of years from the same families usually provide a stronger foundation for this type of analysis.

Fortunately, panel data from a record keeping project is available for 53 farms in Taiwan covering the period from 1964 through 1970. This farm record keeping project data is used in the analysis which follows. Farmers have

participated voluntarily in the project and information is recorded weekly.⁴

Specific Objectives and Hypotheses

A. Objectives of the Study

The main objective of this study is to investigate the effects of income instability on the consumption behavior of Taiwanese farmers. This will include an attempt to measure the impact that short run changes in income, income instability and farm investment profitability have had on household consumption expenditures. It is also hoped that this study will yield results which might be relevant and helpful in the formulation of economic policies in other LDC's.

B. The Hypotheses

The consumption behavior of Taiwanese farm households might be explained by a linear model relating current net household income, short-run change in net household income, an index of income instability, farm investment profitability, farm size, with consumption expenditures.

The hypotheses to be tested in this study are as

⁴Further information on this data can be found in the Department of Agriculture and Forestry, Provincial Government of Taiwan (PDAF), Report of Farm Record-Keeping Families in Taiwan, yearly reports running from 1964 to 1970, Nantou, Taiwan: PDAF, 1965 through 1971.

follows:

Total household consumption expenditures are hypothesized to be

1. positively related to the current net household income, short-run change in net household income, and the size of family;
2. negatively related to the instability of net household income in preceding periods and the rate of farm investment profitability.

These two main hypotheses will also be tested for several sub-categories of household expenditures: food consumption, clothing, household operations, and health and education.

Organization of the Study

This study is organized into six chapters. The second chapter presents a brief review of literature on consumption studies. The methodology used in the study is presented in Chapter III. Of crucial importance here is the mathematical definition of income instability and the introduction of the instability index into the arguments. The fourth Chapter provides some background information on the agricultural growth in Taiwan and describes the data used in the analysis. Chapter V presents the results of the study and the statistical analysis of the estimates of

the relevant variables. The last chapter summarizes the findings and draws some policy implications from the research findings.

CHAPTER II

REVIEW OF LITERATURE

This chapter presents an overview of consumption studies in some developed countries and in some Asian countries. Most of the studies in developing countries have been concerned with the Keynesian view of consumption which is focused on the relationship between consumption and income. Consumption studies in Asia have generally been based on the theories and hypotheses formulated in the West.

The main focus of this review of literature will be on the major determinants of consumption behavior, namely the income level which may be current, lagged, transitory or permanent, and some form of wealth, assets or net worth.

Overview of Consumption-Savings Analysis

In his recent book, U Tun Wai attempts to synthesize consumption and savings theories into an integrated theory of savings. He suggests the following formulation:¹

$$S = \phi (A, W, 0) \quad (1)$$

¹U Tun Wai, Financial Intermediaries and National Savings in Developing Countries, New York: Praeger Publishers, 1972, p. 85.

where S is savings, A is ability to save, W is willingness to save, and O is opportunity to save. Each of the independent variables of equation 1 are further specified to be functions of other economic and noneconomic variables. Ability to save depends on such factors as income (Y) structure of population or dependency rates (N), and wealth (K).

$$A = \gamma(Y, N, K \dots) \quad (2)$$

The willingness to save depends on such factors as the level of the interest rates paid on deposits (i), the stage that an individual is in in the life cycle (L), and cultural factors such as the relative position of an individual in the social ladder, (C).

$$W = \beta(i, L, C \dots) \quad (3)$$

Finally, the opportunity to save depends on such factors as the extent of financial intermediation (F) available to the individual and on the possibility of using self-generated funds for financing one's own investment (I_r):

$$O = \lambda(F, I_r \dots) \quad (4)$$

In the economic literature there are two broad areas of consumption behavior that have been most studied. One stems from the classical and neoclassical schools which stress the rate of return on savings, the other stems from Keynes and other modern economists such as Modigliani and

Friedman, who place more emphasis on the importance of income. In terms of the equations formulated by Wai, these studies have mostly dealt with the factors present in equations (2) and (3).

The following review of literature presents the Keynesian view and other modern economists' works which stress income and wealth as the main determinants of consumption.²

Consumption Studies in Developed Countries

The present knowledge of consumption and savings in developed countries (DC's) is well documented in Evans, Suits, and Somermeyer.³ The main concerns which have

²For detailed discussion on other variables mentioned by Wai in his integrated theory of Savings, see Irving Fisher, The Theory of Interest - As Determined by Impatience to Spend Income and Opportunity to Invest It, New York: Kelley and Millman, 1943, p. 505, Ragnar Nurkse, Problems of Capital Formation in Underdeveloped Countries, New York: Oxford University Press, 1967, pp. 56-81, and John Gurley, "Financial Structures in Developing Countries," in David Krivine, ed., Fiscal and Monetary Problems in Developing States: The Proceedings of the Third Rehovath Conference, New York: Praeger Publishers, 1967, p. 108.

³Michael K. Evans, Macroeconomic Activity: Theory, Forecasting and Control, New York: Harper & Row, 1969; D. B. Suits, "The Determinants of Consumer Expenditure: A Review of Present Knowledge," in Impacts of Monetary Policy, ed. by the Commission on Money and Credit, Englewood Cliffs, New Jersey: Prentice-Hall 1963; W. H. Somermeyer and R. Bannik, A Consumption Savings Model and Its Applications, Amsterdam: North Holland, 1973.

prompted consumption research in DC's have been related to economic stability rather than capital formation process and economic growth considerations. Most of the studies have been based on cross-sectional consumer surveys and very few of them have been carried out at the micro level.

Consumption and Various Forms of Income

Since Keynes introduced the concept of the consumption function in "The General Theory" and suggested that consumption expenditures are primarily determined by income, economists have done numerous studies which showed that variations in consumer expenditures were mainly explained by the variation in income. Despite these empirical results, it was observed by Duesenberry that the consumption function is a more controversial subject today than it was ten years ago.⁴ The empirical results of consumption research revealed that a satisfactory explanation of consumer behavior requires a more complex formulation than the one originally suggested by Keynes.

In a study of 1941-1942 budget figures, Duesenberry came to the conclusion that consumption varied with the trade cycle as well as with income. He then suggested that

⁴J. S. Duesenberry, "Income-Consumption Relations and Their Implications," in Harrod R. Williams and John D. Huifnagle (ed.), Macroeconomic Theory: Selected Readings, New York: Meredith Corporation, 1969, pp. 79-98.

consumption also depended on the absolute level of income. In his book Duesenberry fitted a savings function with the ratio of personal-savings-to-disposable-income as the dependent variable and the ratio of disposable-income-in-current-year-to-the-highest-previous-disposable-income as the independent variable.⁵ From his analysis he concluded that the savings ratio is dependent on the ratio of income to previous peak incomes.

The notion that income plays an important part in explaining the variation in consumption has become uncontroversial, but the question is whether income should be regarded as past, current or expected, or as some combination of these three. In her study, Ruth Mack included among her independent variables not only disposable income but also the change in disposable income.⁶ She made the following observations:

1. Individuals or families typically do not instantaneously adjust their expenditures to a new level of income.
2. Expenditures on various commodities and services

⁵J. S. Duesenberry, Income, Saving and the Theory of Consumer Behavior, Massachusetts: Harvard University Press, 1952.

⁶Ruth Mack, "The Direction of Change in Income and the Consumption Function," The Review of Economics and Statistics, Vol. XXX, No. 4, August 1948, pp. 239-257.

seem to differ for families whose incomes have recently changed in different directions.

3. Consumption functions that are built up from observation of income and expenditures of different people (such as the Engel curves) or of the same people at different times (such as the Keynesian function) are likely to reflect among other things differences in the incidence of income changes.

A sharper perception of the underlying structural relations involving consumption was advanced by Milton Friedman. His "permanent income" hypothesis was based on a division of both consumption and income into permanent and transitory components. Permanent income was defined to be the revenues which a person expects to receive during a period of time. Permanent consumption is based on the belief that consumers do not react on a day-to-day basis. Their behavior and the determinants of this behavior have a relatively long time dimension. The transitory component (Y_t) consists of unforeseen additions and subtractions to income, which cancel out over the period considered and are uncorrelated with permanent income. Operationally, permanent income has been defined as a weighted average of past incomes.⁷ In its most general form,

⁷Milton Friedman, A Theory of the Consumption Function, op. cit.

Friedman's hypothesis about the consumption function is given by the following three equations:

$$C_p = K(i, w, u)Y_p \quad (1)$$

$$Y = Y_p + Y_t \quad (2)$$

$$C = C_p + C_t \quad (3)$$

Equation (1) defines a relation between permanent income (Y_p) and permanent consumption (C_p). It specifies that the ratio between them is independent of the size of permanent income and depends on (a) that rate of interest or sets of interest (i) at which the consuming unit can borrow (i), (b) the relative importance of property and non-property income, symbolized by the variable (w) which determine the consuming unit's tastes and preferences for consumption versus additions to wealth. The variable (u) is in turn a function of the number of members of the consumer unit and their characteristics, particularly their ages, and the importance of transitory factors affecting income and consumption. Friedman's hypothesis asserts that some of the most strikingly uniform characteristics of computed regressions between consumption and income are simply a reflection of the inadequacy of measured income as

an indicator of long-run income status.⁸

With regard to the consumption differences between farm and non-farm families, Friedman pointed out that "consumption expenditures of farm families (1) are lower at any absolute income level except perhaps at the lowest levels of income observed in farm samples, (2) increase less rapidly with measured income--both the marginal propensity to consume and the income elasticity of expenditures are decidedly lower and (3) are on the average a smaller fraction of average income."⁹

Friedman suggested two reasons for the lower ratio of average consumption to average income for farm families. One reason is that farmers have a greater need for a reserve against emergencies and another is the possibility that a farmer may earn a higher average rate of returns by direct investment in his own enterprise than non-farm households can by indirect investment through financial intermediaries.¹⁰

⁸For a complete discussion of the permanent income hypothesis, see Milton Friedman, "The Permanent Income Hypothesis," in Harrod R. Williams and J. P. Hufnagle, (Ed.), Macroeconomic Theory: Selected Readings, New York: Meredith Corporation, 1969, pp. 144-158.

⁹Milton Friedman, op. cit., pp. 61-62.

¹⁰Milton Friedman, op. cit., pp. 68-69.

Consumption and Long-run
Expectations

A more radical departure from the Keynesian formulation is Modigliani-Brumberg's approach, which makes current consumption depend essentially on wealth, current income, expected future income and expected remaining life. On the basis of the theory of consumer's choice, these authors distinguished some additional motives for less consumption and for more saving:

The first motive is the desire to add to one's estate for the benefit of one's heirs. The second motive arises out of the fact that the pattern of current and prospective receipts will generally not coincide with the preferred consumption. The rate of consumption in any given period is a facet of a plan which extends over the balance of the individual's life, while the income occurring within the same period is but one element which contributes to the shaping of such a plan. The third motive is the desire to accumulate assets through saving to meet emergencies, whose occurrence, nature and timing can not be perfectly foreseen.¹¹

Harold W. Watts developed the "expected" income

¹¹Franco Modigliani and Richard Brumberg, "Utility Analysis and the Consumption Function," in Harrod R. Williams and J. D. Huffnagle, (ed.), op. cit., pp. 69-140.

hypothesis and attempted to analyze cross-section surveys to determine how the household decision making units alter their saving decisions on the basis of expectations of future income over a relatively long time horizon.¹² Since it is impossible to have direct measurements of long-run expectations, he assumed that such expectations are systematically related to current income, age, occupation, education, race, and location. The fundamental hypothesis in Watts' study is that spending units form long-run expectations that are both different from current income and certain enough to affect consuming and saving decisions.

Using data obtained from the Annual Survey of Consumer Finances¹³ and the gross money income data reported from the Survey Research Center,¹⁴ Watts tested his hypothesis and found that the results supported his hypothesis. The demographic variables of age, occupation, race, education and location which determine the relation between current and

¹²Harold W. Watts, "Long-run Income Expectations and Consumer Saving," In Studies in Household Economic Behavior, New Haven: Yale University Press, 1958.

¹³Conducted by the Survey Research Center, University of Michigan, for the Board of Governors of the Federal Reserve System. For a full description of the survey methods, see "Methods of the Survey of Consumer Finances," Federal Research Bulletin, 36, July 1950, pp. 795-809.

¹⁴For the details of this calculation, see "Distribution of Consumer Income in 1959," Federal Reserve Bulletin, 36, August 1950, Appendix 961-965.

expected income, were closely associated with savings behavior. However, he noted that the results suggested that the adoption of the simplifying assumptions made in similar contexts by Friedman, Modigliani and Brumberg would have been unfortunate. There may be no equally convenient assumption that will adequately represent the behavior of individual decision makers. He argued that more complicated theories which combine parts of the 'absolute,' 'relative', and 'expected' income hypothesis must be formulated.

Consumption and Wealth Accumulation

The role of assets in explaining variations in consumption was treated by Tobin in 1951. He modified the absolute income hypothesis by introducing the amount of non-income financial resources as an additional variable which affects consumption. He further suggested that changes in wealth may explain the rough constancy over time in the fraction of income saved.¹⁵ Crockett and Friend noted that the effect of assets on consumption vary depending on the liquidity of assets, on whether assets are the result of windfalls or of past savings decisions and, in

¹⁵James Tobin, "Relative Income, Absolute Income, and Savings," in Money, Trade, and Economic Growth, in honor of John Henry Williams, New York: MacMillan Co., 1951, pp. 135-156.

the second case, on the particular savings motives involved. They also suggested that liquid assets permit families to consume in excess of income when for any reason they wish to do so. Further, that the holding of assets, liquid or otherwise, lessens the motivation for saving since the marginal utility of acquiring assets presumably decreases with the amount held.¹⁶

Duesenberry agreed with the proposition that the greater one's assets the less his disposition to save, and gave reasons why spurious correlations may arise between asset holdings and saving.¹⁷ Tobin noted that dissaving is easier if one has liquid assets, so it may be argued that the more liquid a country's assets the lower its net saving ratio.¹⁸ Morgan, on the contrary, suggested that assets may be correlated with the marginal propensity to save and that one must take into account the growth of people's goal with respect to asset accumulation as asset

¹⁶Jean Crockett and Irwin Friend, "A Complete Set of Consumer Demand Relationship," in Irwin Friend and Robert Jones, (ed.), Proceedings on the Conference on Consumption and Saving, Vol. I, Philadelphia: University of Pennsylvania Press, 1960.

¹⁷J. S. Duesenberry, "The Determinants of Saving Behavior: A Summary," in Walter W. Heller, (ed.), Savings in the Modern Economy, Minneapolis: University of Minnesota Press, 1953, pp. 195-203.

¹⁸James Tobin, "Savings, Capital Gains, and Asset Values," Ibid. pp. 223-225.

holdings rise.¹⁹

Watts and Tobin focused on household economic behavior and the role of capital accounts and investment consideration in consumption decisions. They contended that the over-all division of income between saving and consumption is conditioned by the household's current net worth and its goals of wealth accumulation.²⁰ W. H. Somermeyer and R. Bannick made substantial contributions to consumption analysis in the Netherlands.²¹ From the original micro-model, the authors derived a macro savings function for a time-series analysis of aggregate savings in the Netherlands. Their objectives were (1) to construct a general savings theory which encompassed special theories and rehabilitated the role of the rate of interest, (2) to narrow the gap between theory and empirical analysis by adapting theory to available data, and (3) to bring out the importance for savings analysis of biological and demographic factors.

¹⁹James Morgan, "The Motivation of Savers," Ibid. pp. 213-217.

²⁰Harold W. Watts and James Tobin, "Consumer Expenditures and the Capital Account," in Irwin Friend and Robert Jones (ed.), Proceedings of the Conference on Consumption and Saving, Vol. II, University of Pennsylvania, 1960, pp. 1-48.

²¹W. H. Somermeyer and R. Bannink, A Consumption-Savings Model and Its Application, New York: American Elsevier Publishing Company, Inc., 1973.

Consumption Studies in Some Asian Countries

Traditional economic theory has been widely applied in research aimed at understanding the consuming and saving behavior of households in underdeveloped economies. An excellent review of the present knowledge of the nature of the consumption-savings functions in LDC's is presented by Mikesell and Zinser.²² Many of the empirical LDC studies have been done in Asia, especially in Japan, India and Taiwan. None of these studies have focused on the income instability issue, however.

Consumption-Savings Studies in Indonesia and India

In the study of Indonesian household saving behavior, Kelley and Williamson distinguished conceptually the entrepreneur (self-employed) households from other households.²³ They believed that this distinction was important in LDC's. They assumed that agricultural entrepreneurs play an important role because of the relative size of the agricultural

²²Raymond F. Mikesell and James E. Zinser, "The Nature of the Savings Function in Developing Countries: A Survey of the Theoretical and Empirical Literature," Journal of Economic Literature, Vol. XI, No. 1, March 1973, pp. 1-26.

²³Allen C. Kelley and Jeffrey G. Williamson, "Household Saving Behavior in the Developing Economies: The Indonesian Case," Economic Development and Cultural Change, Vol. 16, No. 3, April 1968, pp. 385-403.

sector and the relative backwardness of the corporate movement in the non-agricultural sector. This study was based on a sample of 490 households in Indonesia. They used a simple linear saving function of the following form:

$$(S/N)_{ij} = a_j + b_j(Y/N)_{ij}$$

where Y = the income variable, S = a measure of saving, N = family size, and each variable was related to an i^{th} household whose head is employed in the j^{th} occupation. They suggest in their study that both the marginal and average saving rates increase with increasing degrees of landownership. They also attempted to use their data to test the life-cycle hypothesis or the Modigliani-Brumberg-Ando formulation. They expressed doubt, however, about the applicability of the life-cycle hypothesis to LDC households and suggested the need to analyze larger LDC samples drawn in order to explore adequately the impact of age and education on family savings decisions.

Attempts have also been made to study the functional relationship between income and savings in India. Using the national income data over a period of thirteen years (1950-51 to 1962-63), V. H. Joshi estimated that, ignoring the abnormal period (1957-58), the urban household savings increased at a rate higher than that of the other sectors

of the India economy.²⁴ He suggested that financial savings schemes have not yet been effective in the rural areas, where the bulk of savings is partly hoarded in gold and partly invested in building activities.

From an analysis of family budget studies in three widely dispersed regions of India, Panikar found that gross rural savings ranged in excess of 8 percent of gross family income, that rural families have a higher propensity to save than their urban counterparts in the same income strata, and that the bulk of rural savings was invested directly in household enterprises.²⁵

Gupta also suggested that the simple Keynesian function provides a satisfactory explanation of rural saving in India, and that the marginal propensity to save out of transitory income is significantly different from zero for the rural sector but not for the urban sector. He also argues that incentives in the form of higher real interest rates can lead to greater savings.²⁶

²⁴V. H. Joshi, "Saving Behavior in India," Indian Economic Journal, Vol. 17, April-June, 1970, pp. 575-528.

²⁵P. G. K. Panikar, Rural Savings in India, Bombay: Somaiya Publications Ltd., 1970, pp. 163-164.

²⁶K. L. Gupta, "On Some Determinants of Rural and Urban Household Saving Behavior," The Economic Record, Vol. 46, No. 116, December 1970.

Consumption-Savings
Studies in Japan

Tsutomu Noda used the 1957-1962 data available from the Japanese "Farm Household Economy Survey" and fitted Keynesian savings functions. He found that the differences in the propensity to save by farm size are mainly explained by differences in income composition. He also suggested that the marginal propensity to save from agricultural income appears higher than that from non-agricultural income, and that the propensity to save among full-time farmers is higher than for part-time farmers.²⁷

Instead of using a Duesenberry type saving function $S_t/Y_t = a + b(Y_t/Y_0)$, where Y_0 = preceding peak income, Mihohei Shinohara used his own formulation $S_t/Y_t = a + b(Y_t/Y_{t-1})$, where Y_{t-1} = real disposable income in the preceding period. He applied this model to war and postwar saving-consumption pattern. His conclusions are as follows:²⁸

1. It is a bad procedure to extrapolate the saving function for a given time period, say for the years 1951-1956 in Japan, into the future.

²⁷Tsutomu Noda, "Savings of Farm Households," in Agriculture and Economic Growth, Kazushi Ohkawa and others, (ed.), Tokyo: University of Tokyo Press, 1970, pp. 352-373.

²⁸Miyohai Shinohara, "The Structure of Saving and the Consumption Function in Postwar Japan," The Journal of Political Economy, Vol. LXVII, No. 6, December 1959, pp. 589-603.

2. The saving ratio from individual proprietors and property owners has been extremely high in Japan. This may be due either to their high internal investment or the high transitory-to-permanent-income ratio as suggested by Friedman's hypothesis.

3. Using time-series data, a function of the type $S_t/Y_t = a + b(Y_t/Y_{t-1})$ fits better than the type $S_t/Y_t = a + b(Y_t/Y_0)$ as an estimate of the farmers' time savings function.

4. In the data for rural farmers, the time-series marginal propensity (MPS) to save is lower than the cross-sectional MPS.

Consumption Studies in Taiwan

Two recent studies have focused on rural consumption behavior in Taiwan.²⁹ Prior to these studies there were a number of studies carried out on Taiwanese food consumption, income distribution, and general consumption patterns.³⁰

²⁹Marcia Min-Ron Lee Ong, "Changes in Farm Level Savings and Consumption in Taiwan 1960-1970," unpublished Ph.D. dissertation, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio, 1972. Lien-In Amy Chin, "Changes in Rural Consumption Patterns in Taiwan 1960-1970," unpublished M.S. thesis, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio, 1973.

³⁰For example see: Chung-li Chang and A. F. Hinrichs, "Personal Income Distribution and Consumption Pattern in Taiwan, 1964," Industry of Free China, Taiwan, Vol. 28, No. 5-6, 1967; Shih-Yih Liao, "Survey and Research of Basic Food Consumption in Taiwan, 1969," Taiwan Provincial Chung Hsing University, April 1970.

Hime-Yu Chang noted in his study that expenditures for major food items in Taiwan decreased but food expenditures on other than main food increased over time.³¹ He also found that Taiwanese consumers increased their intake of protein and calories over time and argued that changes in consumption patterns stimulated changes in agricultural production.

Another study of consumption was carried out by Mow-in Chou and Woo-hsun Chen in 1971.³² They found that increases in family incomes are the most crucial determinant of changes in consumption patterns in Taiwan, and that expenditures for durable goods increased over time. The implication in their report was that changes in the availability of new consumer goods alters consumption patterns.

In a study on changes in farm level savings and consumption in Taiwan 1960-1970, Ong found that income, lagged consumption, net worth, and the rate of return to operating assets yielded positive consumption responses.³³

³¹Hime-Yu Chang, "Expectations and Changes in Food Consumption Patterns during the Process of Economic Development in Taiwan," unpublished report, Department of Economics, National Taiwan University, Taipei, Taiwan, 1971 (in Chinese).

³²Mow-in Chou and Woo-hsun Chen, "Long Term Expectation of Electric Appliances in Taiwan," unpublished report, Department of Economics Provincial Chung-Hsin University, Taichung, Taiwan, 1971 (in Chinese).

³³Marcia Min-ron Lee Ong, op. cit.

She also found that the return to total assets and the ratio of farm-income-to-farm-family income were negatively related to consumption expenditures. The overall results of her study suggested that there was a surprisingly high savings capacity among Taiwanese farmers during the 1960's.

Chin showed in her study that rural consumption patterns have experienced substantial changes in Taiwan over time and that income was the most crucial factor affecting consumption patterns during this period.³⁴

The review of literature so far shows that no studies have been made on the following effects on the consumption behavior of farm household: (1) the income instability of the farm household, and (2) the rate of return from the farmer's direct investment in his own farm enterprise. In her study of consumption of Taiwanese farm families, Ong used the rate of returns to operating assets and to total assets as measures of the rate of returns on capital, but the results of her study on this aspect were not consistent.³⁵

The following study will focus on the factors income (Y), dependency rates (N) and the possibility of using self-generated funds for financing one's own investment (I_r)

³⁴Chin Lien-In Amy, op. cit.

³⁵Marcia Min-ron Lee Ong, op. cit.

as formulated in the equations presented by Wai in his integrated theory of savings.

CHAPTER III

METHODOLOGY AND VARIABLE DEFINITIONS

As has already been pointed out, consumption is a complex process influenced by a number of economic, sociological and cultural factors. Household expenditures for consumption are also influenced by numerous current and past decisions made by the family. In recent years there has been a great increase in the number of economists attempting to cast various aspects of consumption behavior into the framework of mathematical models. The most important advantage that is generally claimed for the mathematical approach is the precision of expression. The use of models does achieve economy, efficiency, and rigor in the analysis, however it can never eliminate the necessity for insights, observations and judgement.¹ Through use of models economists can identify certain variables as being important determinants of consumption behavior, and at the same time determine the signs of the relationships that consumption might be expected to have

¹K. C. Kogiku, An Introduction to Macroeconomic Models, New York: McGraw-Hill Book Co., 1968, p. 5.

with various variables.

I. Formulation of Models

A. The Model

As was previously suggested, economists have made numerous studies of the consumption function and have found that a good deal of the variation in consumer expenditures was explained by variations in income. Recent empirical works by Marcia Min-ron Lee Ong² and Lien-In Amy Chin³ on the consumption patterns of Taiwanese farm households during the 1960-1970 period further confirm the importance of the income variable in the determination of consumption. The review of literature and observations of the Asian farmer's economic behavior, however, suggest that other variables may contribute to changes in consumption. Of particular interest in this study is the role that the instability of income plays in the determination of the current level of household consumption. Income instability can be best recorded and estimated through use of time series panel data. As was suggested earlier, a major objective of this study is to explicitly incorporate the influence of income instability into a model of

²Marcia Min-ron Lee Ong, op. cit.

³Lien-In Amy Chin, op. cit.

consumption behavior. Other important variables that are considered in the model are the rate-of-return on farm net worth or a measure of profitability of farm investment and the short-run change in income.

In this study the degree to which the past changes in income and income instability affect farm household consumption in 1970 is tested. The short-run change in income and in income instability of each farm household are computed from panel data for 53 farm households spanning the 1964-1970 period.

The consumption behavior of Taiwanese farm households might be explained by the mathematical model assuming the following functional form:

$$C_{(T)it} = b_0 + b_1 Y_{it} + b_2 (Y_{it} - Y_{it-1}) + b_3 I_i + b_4 r_{it} + b_5 S_{it} + e_{it} \quad (1)$$

where:

- $C_{(T)it}$: Total consumption expenditures for i^{th} farm in year t .
- Y_{it} : Total net farm household income of i^{th} farm in year t .
- $Y_{it} - Y_{it-1}$: Short-run change in net farm family income of i^{th} farm from year $t-1$ to year t .
- I_i : The income instability or the average variation of income growth of i^{th} farm over the period under study.
- r_{it} : The return on farm net worth or a measure of farm investment profitability of i^{th} farm in year t .

S_{it} : The Size of family.

e_{it} : The error term.

The above mentioned consumption function is also fitted for sub-categories of household consumption: food consumption, expenditures for clothing, costs of household operations, health costs and education expenditures.

B. Description of the Variables Used:

1. Total Consumption Expenditures

Function 1 is used to describe the total consumption expenditures $C_{(T)}$ of farm households. $C_{(T)}$ is composed of consumption expenditures for food plus those of the following items:

- a. Clothing: This includes clothes, blankets, shoes, and hats, etc...
- b. Household operations: ornaments and decorations, rent or repair on dwelling, furniture, cooking instruments, chinaware, interest on household borrowings, taxes and assessment.
- c. Utilities: all fuel, light and water expenses.
- d. Human agent: all educational expenses, sanitary expenses and medical treatments.
- e. Other: All other expenditures on social activities, festivals, and postage. Expenditures for consumer durables make up a

large part of this item.⁴

2. Net Household Income

Total net household income of the household, hereafter referred to as income, is composed of net farm income and net income derived from off-farm operations. Imputed management returns, capital depreciation, and the value of family labor used on farm are included in this net income figure. Off-farm income is composed of income earned from family labor employed outside the farm and from side-line activities. As with the consumption figure, the net farm family income is estimated for a given t.

3. Income Instability

There are several possible measures of income instability. One might use the variance or the coefficient of variation of income over time. A major disadvantage of using the variance formula is that one has to assume that income be normally distributed over time. Since it is implausible that the income of farm households is normally distributed over time, it appears preferable to use the index developed by Lundberg⁵ which does not require any assumption about income distribution. This index was

⁴Lien-In Amy Chin, op. cit., p. 21.

⁵Erik Lundberg, Instability and Economic Growth, New Haven: Yale University Press, 1968, pp. 114-116.

evolved through his studies of the variation in the gross national product (GNP) of nations. He developed an index of instability of GNP by using a measure that takes the average deviations of the annual percentage rates of growth of GNP and its expenditure components around their respective mean rates of growth. He argues persuasively that this index serves as an useful measure of overall economic instability.

The instability index (I_i) used in this study measures the average variation of the income growth rate around its mean for each farm household. This represents a convenient summary of some of the most basic manifestations of income instability in an individual household and moreover this index greatly facilitates the analysis by incorporating instability explicitly in the model.

In the analysis which follows an income instability index is calculated for each farm household. The index is based on income information for a seven-year period 1964 through 1970. As can be noted clearly in the formula below, the index indicates the average deviation of income around a particular income growth path for a particular household. That is, the index is computed by netting out the average income growth rate.

Mathematically, income instability is defined as follows:

$$I_i = \frac{1}{T} \sum_t |x_{it} - \bar{x}|$$

where

$$x_{it} = \frac{Y_{it} - Y_{it-1}}{Y_{it-1}} \times 100$$

and

$$\bar{x} = \frac{1}{T} \sum_t x_{it} \quad \text{or}$$

the average annual percentage rate of growth.⁶

All Y_{it} 's are expressed in real terms. The prices received by farmers in 1970 are used as the base. 1970 was selected as the base year for computing the indexes mainly to provide conformity and consistency with the work previously done by Ong and Chin.

4. The Rate of Return on Equity

The rate of return on farm equity is a measure of on-farm investment profitability. It is defined as the ratio of net farm income in year t to the average value of farm equity at beginning and end of year. The net worth, or farm equity figure, represents the total net amount of assets owned by the farm. It is the difference between total assets and total liabilities. Total assets of the farm household include liquid assets and fixed assets. Liquid assets are composed of cash on hand, bank deposits,

⁶A relative income instability index, a ratio of income instability to income growth, was also constructed. Although not used in the text, these relative instability indexes are reported in Appendices B through G.

receivables, prepaid accounts and bonds, farm products in store, value of growing products in field, livestock and poultry by-products and processing products, and other current assets. Fixed assets are composed of land owned and land being acquired under the land-to-tiller program, buildings, furniture and household equipment, orchard and trees, and farm machinery.

Total liabilities of the farm household include liquid liabilities and fixed liabilities. Liquid liabilities are composed of short term borrowings, accounts payable and pre-received accounts. Fixed liabilities are composed of lend-to-tiller borrowings, and other fixed liabilities.

5. Total Food Consumption

Total food consumption is composed of two components: (1) all cash outlays that occurred during the year t for principal food items and other than main food items, and (2) the value of on-farm goods directly consumed by the family.

6. Expenditures for Clothing

These expenditures include clothes, blankets, shoes and hats, etc.

7. Household Operating Expenditures

These expenditures include ornaments and decorations,

rent or repair on dwelling, furniture, cooking instruments, chinaware, interest on household borrowings, taxes, assessment, and expenses for fuel and energy (electricity, water).

8. Health and Education Expenditures

Health and education expenditures include all educational expenses, sanitary expenses and medical treatments.

C. Model Estimation

The ordinary least-square method of estimation will be used to estimate the regression coefficients. The signs and significance of independent variables are to be tested by the t statistic.

A major assumption of the linear regression technique is that there are n observations of a dependent variable Y_i which are determined by a linear combination of k determining variables, X_i , and an additive error term e_j . The relation between Y_i and X_i is assumed to have the following form:

$$Y = Xb + e$$

where b is a column vector of k parameters, Y and e are column vectors of order n , and X is a matrix of order $n \times k$.

It is further assumed, (1) that the expected value of the error term is zero for each observation, (2) that the error terms are the same for all observations and are

independent, and that their variances are the same for all observations and equal to σ^2 , (3) that the determining variables are either fixed in repeated samples or, alternatively, are random variables whose joint distribution is independent of the error term, and (4) that there are as many independent observations as there are parameters to be estimated and that no exact relationship exists between the determining variables.

On the basis of these assumptions, it can be shown that the regression coefficients b , given by $b = (X'X)^{-1}X'Y$, are unbiased estimates of β and have a smaller variance than any other linear estimate.⁷ The variance matrix of b is given by $E(b-\beta)(b-\beta)' = \sigma^2(X'X)^{-1}$

By making use of the least-squares multiple regression technique, the analysis can separate out the interrelationship between the variables. This method of analysis is helpful in pointing out variables that play an important part in causing the variation in the level of consumption.

D. Coefficients' Sign Specifications

The model presented above serves as a useful guide for testing the hypotheses presented in the introduction chapter.

⁷Norman Draper and Harry Smith, Applied Regression Analysis, New York: John Wiley and Sons, Inc., 1966, Chapter 2.

The empirical investigation will enable the researcher to determine whether the relationships between consumption at the household level, and the determining variables are important ones.

The specific statistical hypotheses to be tested are as follows:

1. Total Consumption Expenditures

The following function will be estimated by the ordinary least-square method:

$$C_{(T)it} = b_0 + b_1 Y_{it} + b_2 (Y_{it} - Y_{it-1}) + b_3 I_i + b_4 r_{it} + b_5 S_{it} + e_{it}$$

Hypotheses:

The total consumption expenditures of Taiwanese farm households are hypothesized to be positively related to (a) current net household income, (b) short-run changes in net household income, and (c) the size of the farm family, and negatively related to (d) the income instability, (e) return on farm equity or net worth.

Symbolically, the hypotheses are represented as follows:

Hypothesis a

$$\frac{\partial C(T)}{\partial Y} = b_1$$

$$H_0: b_1 = 0$$

$$H_1: b_1 > 0$$

Hypothesis b

$$\frac{\partial C(T)}{\partial (Y_t - Y_{t-1})} = b_2$$

$$H_0: b_2 = 0$$

$$H_1: b_2 > 0$$

Hypothesis c

$$\frac{\partial C(T)}{\partial s} = b_5$$

$$H_0: b_5 = 0$$

$$H_1: b_5 > 0$$

Hypothesis d

$$\frac{\partial C(T)}{\partial I} = b_3$$

$$H_0: b_3 = 0$$

$$H_1: b_3 < 0$$

Hypothesis e

$$\frac{\partial C(T)}{\partial r} = b_4$$

$$H_0: b_4 = 0$$

$$H_1: b_4 < 0$$

2. The same hypotheses are also tested for various expenditure subclasses: food consumption, expenditures on clothing, household operations, and health and education.

CHAPTER IV

THE SETTING OF THE STUDY AND DESCRIPTION OF THE DATA

A. Agricultural Development in Taiwan

The setting for this study is the Republic of China (Taiwan). Taiwan is an offshore island in the Western Pacific. Mountains dominate the central part of the island. Half of the area of Taiwan is composed of mountainous regions. In the east, the mountains rise abruptly with steep precipices and cliffs and the plains in these regions are so narrow that cultivation can hardly be carried out. In the west, the rolling plains are fertile and watered by streams and rivers.¹ There are about two million hectares of forestry land which occupied about 55 percent of the total land of Taiwan and more than one million hectares of agricultural land which occupy 29 percent of the area. The total area of paddy land is 560,000 hectares. About 55 percent to 60 percent of the total cultivated land has

¹Kowie Chang, (ed.), Economic Development in Taiwan, Taipei: Chen Chung Book Company, 1968, p. 11.

irrigation and drainage facilities.² The main crops in Taiwan are rice, sweet potatoes and sugar cane. The major fruit crops are bananas, pineapple and citrus fruits.

Over the past two decades, agricultural development in Taiwan has been remarkable. Agricultural production is not only sufficient for domestic consumption but also provides considerable export surplus. During the period from 1952 through 1971, the growth rate of Taiwan's agriculture averaged about 4.8 percent annually.³

Agricultural development in Taiwan may be divided into two periods:⁴ the period during the colonial occupation, and the period after World War II. The period before the War, from 1900 through 1940, represented an initial development stage in which the Japanese supplied the necessary agricultural capital and production techniques to enlarge cultivated land and increase production. Taiwan's agriculture during this period initially increased production in rice, sugar cane, and sweet potato and later expanded tea, pineapple and banana production. In order to

²You-tsao Wang, "Agricultural Development," in Kowie Chang (ed.), Ibid., p. 170.

³Sing-min Yeh, "Learning from Taiwan's Agricultural Development Experience," A/D/C Teaching Forum, Development Processes and Planning No. 23, The Agricultural Development Council New York, New York, December, 1972.

⁴You-tsao Wang, op. cit., pp. 143-145.

enhance development, there were considerable improvements in irrigation facilities, fertilizer application, varieties used and cultivation methods. The average annual growth rate of agricultural production was 4.2 during the 1920-1939 period.

During the 1940-1945 period, the agriculture of Taiwan suffered serious war damage and as a result, agricultural production at the end of World War II had fallen to the 1910 level. Taiwan's agricultural production recovered during the period of reconstruction and rehabilitation after the War and attained its pre-war peak level in 1952. Since 1952 agricultural development in Taiwan has sharply increased.⁵

The major factors contributing to the success of Taiwan's agriculture appear to be the following:⁶

⁵For the detailed discussion of these stages and general agricultural development, see You-tsao Wang, op. cit., and United States Department of Agriculture, "Taiwan's Agricultural Development: Its relevance for Developing Countries Today," Foreign Agricultural Economic Report No. 39, Washington, D.C., April 1968, p. VII; S. C. Hsieh and T. H. Lee, "Agricultural Development and Its Contributions to Economic Growth," Joint Commission on Rural Reconstruction in China, Taipei, 1966; and D. W. Adams, H. Y. Chen and C. Y. Hsu, "Rural Capital Markets and Small Farmers in Taiwan, 1952-1972," AID Spring Review of Small Farmer Credit, Vol. XI, February, 1973, pp. 2-7.

⁶Sing-min Yeh, op. cit.

1. Successful changes in institutional set-up. In 1949 the Chinese Government initiated a comprehensive land reform program. Before the land reform program, more than 40 percent of the farm land was operated by tenants. The land reform program has improved the economic conditions of tenant farmers and stimulated production.

Following the successful implementation of the land reform program, the Government in 1953 started the reorganization of farmer associations. There is now a farmer association in almost every rural township and nine out of ten farm families belong to these organizations.

2. Introduction of technological advances. Agricultural experiment stations in Taiwan have developed better methods of cultivation and more effective use of fertilizers and irrigation water. Multiple cropping has been adopted with three, or in some cases, five harvests a year.

3. Increased use of modern scientific inputs. Chemical fertilizer, agricultural chemicals, and farm machinery are prominent inputs being used on Taiwan farms. Total fertilizer use in Taiwan increased almost threefold over the 1959-1972 period. The present use of the three major plant nutrients averages about 310 kg per hectare. Recently, farmers in Taiwan have increasingly turned to farm machinery. Widespread use is made of water pumps.

Power tillers, transplanting machine and power harvesters are also becoming more common in rural areas.

4. Provision of basic infrastructure. Increased yields of rice and other annual crops along with increased output of citrus and bananas have been closely related to irrigation improvements. In addition to irrigation, roads and other basic infrastructures have been created to promote economic development. Owing to a well developed road system, most of the rural areas in Taiwan have easy access to most city markets and export-import harbors.

5. Human resources. A stable progress-oriented government, a group of agricultural leaders with advanced training and long experience, a large number of graduates from agricultural colleges and vocational schools, and an intelligent and literate farming population are important human forces in the development of Taiwanese agriculture.

The most significant and distinctive feature of Taiwan's experience in developing its agriculture is that remarkable accomplishments were made in the agricultural sector within the small holding system. The experience of Taiwan's achievements in increasing its agricultural productivity has much to offer to other LDC's in their development efforts. The growth pattern of Taiwan's agriculture largely duplicates the Japanese experience and supports the view that an agriculture of low productivity

can be transformed into a productive one through land-saving and land-intensive methods of cultivation. It also suggests that consolidation of small farming units into large ones is not a necessary precondition for transforming a traditional agriculture into a modern and efficient system of agriculture.⁷

B Description of the Data

The data to be used in this study were drawn from a farm record-keeping project in Taiwan. This project was started in 1953. At first, farm record-keeping was done with the assistance of senior students from ten agricultural vocational schools, but since 1960 it has been recorded by the farmers themselves, and the posting of records has been handled by the employees of the Provincial Department of Agriculture and Forestry in Nantou, Taiwan. By 1972 there were 452 farm families from 36 local farmer associations participating in this project.

Table 1 shows that over the period of thirteen years (1960-1972), the total number of farmers participating in the project ranged from a low of 95 in 1960 to a high of 535 in 1964. After 1963 the project expanded its coverage

⁷ Yhi-Min Ho, Agricultural Development in Taiwan 1903-1960, Nashville: Vanderbilt University Press, 1966, pp. 121-123.

TABLE 1.--Number of Farmers' Associations, Agricultural Regions, Individual Farmers in Farm Record-keeping Project in Taiwan, 1960-1972

Year	Farmers' Associations	Agricultural Regions	Total Number of Participating Farm Households
1960	7	3	95
1961	17	3	207
1962	18	3	223
1963	21	3	277
1964	40	8	535
1965	40	8	501
1966	28	8	430
1967	28	8	402
1968	36	8	416
1969	36	8	411
1970	36	8	404
1971	36	8	387
1972	36	8	452

SOURCE: Department of Agriculture and Forestry, Provincial Government of Taiwan (PDAF), Report of Farm Record-Keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

from three regions to all eight agricultural regions of Taiwan. Over the 1964 through 1970 period there were 53 panel farms having data available for every single year. The number of panel farms is, however, reduced to 40 farms if the period of time is extended from 1964 to 1971.

As was mentioned in the Introduction Chapter, farmers participating in the record-keeping project may not be representative of Taiwanese farmers as a whole because they are usually more progressive and prosperous and operate larger farms than other farmers in the same locality. It is reasonable to believe that the directions of changes are not unrepresentative of rural Taiwan, however, and if there are problems of representativeness, they should be minor due to the relatively small size and homogeneity of farming within each major agricultural region in Taiwan.⁸

Table 2 gives a distribution of the 53 panel farms in the eight agricultural regions of Taiwan. There are 12 and 15 farms found in the Tea Region and the Southern Sugar

⁸Dale W Adams, Y. H. Chen and C. Y. Hsu, op. cit., p. 23; and Marcia Ong and Dale W Adams, "A Summary of Various Economic Data Farm Accounts of Farm Record-keeping Families in Taiwan, Yearly Average Covering 1960 through 1970," Economics and Sociology Occasional Paper No. 65, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio, March, 1970.

Cane and Rotation Region respectively, the rest are located in the Northern Hill Region (2), the Middle Rice Region (7), the Southern Rice Region (6), the Southern Mixed Farming Region (4), the Banana and Pineapple Region (6), and the Eastern Mixed Farming Region (1).

TABLE 2.--Number of Panel Farms (1964-1970) in the Taiwan Farm Record-Keeping Program by Agricultural Region

Agricultural Region	Number of Farms
Northern Hill Region	2
Middle Rice Region	7
Southern Rice Region	6
Tea Region	12
Southern Mixed Farming Region	4
Southern Sugar Cane and Rotation Region	15
Banana and Pineapple Region	6
Eastern Mixed Farming Region	<u>1</u>
TOTAL	53

SOURCE: Taiwan Farm Record-Keeping Accounts.

1. Changes in Income Among All Farm Record-Keeping Families, 1960-1972

Table 3 indicates that the net farm family income of Taiwanese farmers has increased substantially over the thirteen year period 1960-1972. The income of an average record-keeping farm family increased from NT\$ 41,763 in 1960 to NT\$ 70,780 in 1972 or an increase of 69 percent in

TABLE 3.--Income and Consumption Expenditure Classes of Farm Record-keeping Families, Average Value Per Family in 1970 NT\$, 1960-1972

Year	Expenditure Classes							
	Income	Total	Food	Clothing	Household Operations	Utilities	Human Agent	Other
1960	41,763	33,762	21,878	1,423	1,599	1,875	2,621	4,365
1961	45,449	38,367	23,255	1,583	2,086	2,316	3,279	4,698
1962	48,062	38,405	22,699	1,709	2,414	2,400	3,605	5,579
1963	48,330	37,134	22,043	1,768	2,278	2,010	3,936	5,972
1964	44,698	35,579	19,975	1,901	2,712	1,634	3,533	4,514
1965	48,334	37,905	20,753	1,807	2,851	1,970	3,623	6,091
1966	54,737	39,574	21,810	1,836	3,209	2,565	4,310	5,845
1967	54,500	40,673	21,640	2,001	2,919	2,225	4,800	7,170
1968	57,896	41,466	22,291	1,997	3,124	2,102	4,903	7,049
1969	50,155	44,385	22,416	2,084	3,658	2,335	5,141	8,751
1970	52,500	42,133	21,525	1,896	3,902	2,238	4,783	7,789
1971	58,451	46,859	22,675	19,670	3,610	2,454	5,900	10,192
1972	70,780	54,607	24,959	2,372	4,471	2,534	8,172	12,099

SOURCE: Calculated from Department of Agriculture and Forestry, Provincial Department of Taiwan (PDAF), Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

1970 NT\$.⁹ The average household in the project in 1972 had an increase of 37 percent in income as compared to the income of an average farmer participant in 1964. There was a sharp drop in the income of an average participant in 1969 (NT\$ 50,155), which is the lowest income figure for the period of 7 years (1966-1972). This was due to the adverse weather conditions in 1969. Strong typhoons swept Taiwan in September and October and destroyed part of the crops in the second half of 1969.¹⁰

2. Consumption Patterns Among All Farm Record-Keeping Families, 1960-1972

It can be noted in Table 3 that total consumption expenditures have increased 102 percent in real terms over the period 1960-1972. Expenditures for foodstuff in cash and in kind increased by 14 percent in real terms over the same period. All other types of consumption expenditures also increased considerably, clothing expenditures increased by 67 percent, household operations 180 percent, utilities 35 percent, human agent 212 percent, and

⁹See Appendix A for the U.S. dollar exchange rate for the New Taiwanese Dollar.

¹⁰Department of Agriculture and Forestry, Provincial Government of Taiwan, Taiwan Agricultural Year Book, 1970 Edition, Nantou, Taiwan: PDAP, June, 1970, p. 2.

"other" 177 percent.

Of special interest are the figures on food, household operations and human agent expenditures. Over a period of thirteen years (1960-1972), average household food consumption expenditures increased by 14 percent, but dropped from two-thirds of the total consumption in 1960 to less than half in 1972. Household operations and human agent expenditures increased by 180 percent. The rate of increase in housing, education and health expenditures of an average farm family participant in the project was three times as much as its rate of increase in food consumption expenditures over the period from 1960 to 1972.

Expenditures on various types of food (shown in Table 4) indicate that there was a shift in emphasis from the consumption of staple food (rice and flour) to the consumption of food other than staples. While the expenditures for staple food decreased in real term, expenditures on foodstuff other than staple food increased from NT\$ 8,640 in 1960 to NT\$ 14,331 in 1972 or an increase of 66 percent in real terms.

As the economy grows and degree of monetization in the rural areas of Taiwan increases, Taiwanese farmers consume relatively less on-farm produce and engage more and more in product exchange and in cash transactions. This process is shown clearly in Table 5. Data in this table

TABLE 4.--Household Consumption Expenditures on Various Types of Food Classes by Farm Record-keeping Families, Average Value per Family in 1970 NT\$, 1960-1972

Year	Staple Food	Food Other than Staple Food	Tobacco, tea, Wine, etc.
1960	11,686	8,640	1,552
1961	12,503	9,158	1,594
1962	11,828	9,184	1,686
1963	14,884	9,264	1,753
1964	9,553	8,846	1,612
1965	10,030	9,102	1,621
1966	9,902	10,178	1,740
1967	9,693	10,206	1,740
1968	9,702	10,766	1,824
1969	9,382	11,021	2,014
1970	9,034	10,885	1,606
1971	9,230	11,679	1,766
1972	8,570	14,331	2,058

SOURCE: Calculated from Department of Agriculture and Forestry, Provincial Department of Taiwan (PDFA), Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

TABLE 5.--Household Consumption Expenditures of Farm Record-keeping Families, Average Value per Family in 1970 NT\$, 1960-1972

Year	Consumption			Percent of Total Consumption In Kind
	Total	In Cash	In Kind	
1960	33,762	19,741	14,021	41.53
1961	38,367	21,353	17,014	42.62
1962	38,405	22,934	15,471	40.28
1963	37,134	23,711	13,423	36.15
1964	35,579	23,296	12,283	32.02
1965	37,095	25,556	11,539	31.11
1966	39,574	27,567	12,007	30.34
1967	40,763	29,058	11,615	28.56
1968	41,466	29,926	11,549	27.83
1969	44,385	32,840	11,545	26.01
1970	42,133	30,620	11,508	27.31
1971	46,859	35,079	11,780	33.58
1972	54,607	43,393	11,214	25.84

SOURCE: Calculated from Department of Agriculture and Forestry, Provincial Department of Taiwan (PDFA), Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

show that there was a marked decrease in the percentage of total consumption in kind over time, from 42 percent in 1960 to 26 percent in 1972.

The average propensity to consume (APC) is presented in Table 6. There was a gradual decrease in the APC over the period of 1960-1968. However, from 1969 to 1971 there was an upturn in APC, which may be partially attributed to changes in consumption patterns due to the availability of a variety of consumer goods by the mid-1960's in Taiwanese rural areas.¹¹ The APC in 1972, however, dropped to the 1963-1965 level.

3. Consumption, Total Assets, Total Liabilities, Net Worth and the Rate of Return on Equity of All Farm Record-Keeping Families

As can be noted in Table 7, since 1966 there has been an upward trend in the consumption expenditures and the value of total assets of an average farm participant in the farm-record keeping project. Net farm worth has also appreciated considerably over the period. This may be due to increased on-farm investment and capital gains

¹¹Marcia L. Ong, Dale W Adams and I. J. Singh, "Voluntary Saving Capacities in Taiwan 1960 to 1970," Economics and Sociology Occasional Paper No. 175, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio, February 8, 1974.

TABLE 6.--Income, Total Consumption and Average Propensity to Consume (APC) of Taiwan Farm Record-keeping Families in 1970 NT\$, 1960-1972

Year	Income	Total Consumption	APC ($\frac{\text{Consumption}}{\text{Income}}$)
1960	41,763	33,762	.81
1961	45,450	37,218	.82
1962	48,087	38,405	.80
1963	48,323	37,134	.77
1964	44,698	34,270	.77
1965	48,334	37,095	.77
1966	54,737	39,574	.72
1967	54,501	41,635	.75
1968	57,896	41,446	.72
1969	50,155	45,431	.88
1970	52,550	42,133	.80
1971	58,451	46,859	.80
1972	70,780	54,607	.77

SOURCE: Calculated from Department of Agriculture and Forestry, Provincial Department of Taiwan (PDFA), Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

due to change in land values. The value of land owned by the farmer participant accounts for almost three fourths of his total farm assets and during a period of the last five years (1968-1972) the value of farm land owned by each farm family increased by over 100 percent in current NT\$, from NT\$ 161,592 in 1968 to NT\$ 325,239 in 1972, or NT\$ 109,926 per hectare of land in 1968 to NT\$ 215,450 per hectare in 1972.¹² Considering the low rate of inflation in Taiwan and the lack of change in farm size of the units in the project (the total average size of farm per family in 1968 was 1.47 hectare and in 1972 was 1.51 hectare) this was a significant increase in the value of farm land.¹³

The rate of return on equity, a measure which can be meaningfully used to analyze the profitability of a firm over time and to make interfirm comparisons, was lower over the period 1968-1972 as compared to that of the previous period of 1963-1968 (Table 7). Because of adverse weather, it was lowest in 1969. Concomitant with the growing value of total farm assets and farm net worth, has been the decline in the rate of return on equity over the

¹²Department of Agriculture and Forestry, Provincial Government of Taiwan, Report of Farm Record-Keeping Families in Taiwan 1968, 1969 ... 1972, Nantou, Taiwan.

¹³Ibid.

TABLE 7.--Year-end Balance Sheet and Net Farm Income of Farm Record-keeping Families 1960-1972, in 1970 NT\$^a

Year	Total Consumption	Total Assets	Total Liabilities	Net Worth	Net Farm Income	Return on Equity ^b
1960	33,762	229,744	12,360	217,385	36,347	-
1961	37,218	264,038	11,154	252,884	39,279	.17
1962	38,405	269,378	12,830	256,549	40,672	.16
1963	37,134	260,249	12,038	248,211	41,655	.16
1964	34,270	214,860	12,291	202,569	36,580	.16
1965	37,095	244,291	12,762	231,529	38,942	.18
1966	39,574	311,826	17,958	293,867	44,709	.17
1967	40,673	310,083	19,982	290,102	44,335	.15
1968	41,466	369,539	19,475	350,114	46,354	.14
1969	44,385	386,908	21,205	365,703	35,637	.10
1970	42,133	346,435	20,970	325,465	37,979	.11
1971	46,859	354,004	21,069	332,937	41,028	.12
1972	54,607	428,097	21,042	407,054	42,883	.12

^aDeflated using Index of Prices-received-by-farmers, see Appendix A.

^bThe ratio of net farm income to the mean of net worth valued at beginning and year end, expressed in percentage.

SOURCE: Calculated from the Department of Agriculture and Forestry, Provincial Department of Taiwan (PDAF), Report of Farm Record-keeping Families in Taiwan, yearly reports running from 1960 to 1972, Nantou, Taiwan.

period of five years (1968-1972). The rather stagnant level of income derived from on-farm enterprises and higher land values are responsible for this decline.

4. Income and Consumption Expenditures of 53 Panel Farm Families 1964-1970

It is useful to remember here that there was a sharp drop in the income of Taiwanese farmers in 1969 when typhoons swept over the island. It would therefore be more desirable to have data for several years beyond 1969 in order to allow for more normal behavior among the panel farms. Unfortunately, out of the 53 panel households that had participated in the farm record-keeping project from 1964 through 1970, thirteen farm families dropped out in 1971 and fifty-one farm families dropped out in 1972. Panel data were missing for one whole agricultural region in 1971.¹⁴

Due to the decrease in number of panel units in 1971, no discussion or analysis of the 40 panel farms in 1971 are presented in the text of this study. However,

¹⁴According to Mr. Hung-Yu Hu, Section Chief of the Agricultural Economics Division, Provincial Department of Agriculture and Forestry, beginning in 1972 there was a change in the procedure of selecting participants for the farm record-keeping project. Formerly this project was sponsored by the farmer associations but in 1971 it was sponsored by the local government and redesigned as a production survey.

the income stability and relative income instability indexes of these 40 panel farms covering the period 1964-1971 are presented in Appendix E.

Table 8 presents income and consumption expenditures of the 53 panel farm families over the period 1964-1970 in 1970 NT\$. Net family income on the average increased 15 percent from NT\$ 47,249 in 1964 to NT\$ 54,128 in 1970. Of all types of expenditures, food consumption remained rather stable over this period, hovering around the NT\$ 22,000 to NT\$ 23,000 level except the low level of NT\$ 19,000 level per family in 1964. Expenditures for housing and utilities, and for clothing did not change much over the period 1964-1970. Expenditures on education and health, however, increased substantially from NT\$ 3,856 in 1964 to NT\$ 6,016 in 1970, an increase of 56 percent.

Over this period there was an upward trend in the average propensity to consume (APC) for the panel households. The APC for 1968 and 1969 were low and high respectively because of a sharp increase in household income in 1968 and a sharp decline in household income in 1969.

In comparing the figures obtained from the 53 panel farms and from all the farms participating in the farm record-keeping project, it can be noted that the 53 panel farms had an average annual income higher than that of all farms included in the project. However, the rate of

TABLE 8.--Average Income and Consumption Expenditures for 53 Panel Farm Households 1964-1970 in 1970 NT\$

Year	Income	Consumption Expenditures Classes								TOTAL	APC ^a
		Food			Total for Food	Clothing	Housing and Utilities	Human Agent	Other		
		Staple Food	Diet Other than Staple Food	Beverages							
1964	47,264	7,355	8,314	1,751	19,420	2,084	5,030	3,856	4,627	35,847	.76
1965	55,463	10,406	9,783	1,738	22,927	2,094	4,936	4,507	5,904	41,058	.74
1966	56,748	10,353	10,589	1,867	22,714	1,940	6,463	4,792	4,733	43,435	.77
1967	56,181	10,078	11,035	1,860	22,973	1,918	5,177	5,030	10,173	45,222	.81
1968	60,401	9,468	10,752	1,886	22,306	2,210	5,484	4,946	8,040	43,059	.72
1969	52,221	9,212	11,128	2,130	22,470	2,427	6,944	5,659	12,234	49,733	.95
1970	54,128	8,368	11,075	1,642	22,585	2,060	6,019	6,016	10,361	46,092	.85

^aAPC: Total Family Consumption/Total Family Income.

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

income growth expressed in 1970 prices of the panel farms was lower than that of all record-keeping farms. On the expenditure side, both the panel farms and all participating farms in the project experienced the same consumption patterns. There was an increase in expenditures of all classes while expenditures on staple food declined over the period 1964-1970.

In summary, over the thirteen year period (1960-1972) record-keeping farm households in Taiwan substantially increased their consumption expenditures, especially those for housing, education and health purposes. Although food expenditures increased 14 percent over the same period, its share in the total family budget declined down to less than half of total consumption. These trends are also true for the 53 panel farms over the seven-year period (1964-1970).

CHAPTER V

RESULTS OF THE STUDY

As indicated earlier, the purpose of this study is to assess the determinants of the consumption behavior of Taiwanese farmers. The main question this study tries to answer is how income instability affects the consumption and savings behavior of farm households in LDC's.

A linear model was used to describe the relationship between consumption and other independent variables: current income, income increase, income instability, size of the farm family, and the rate of return on farm equity or farm net worth. Income instability is represented by an index, which denotes the mean variation of the income growth rate over a period of time under study. This income instability index is computed and attached to each farm household.

A cross-section analysis was made of 53 panel farm households in Taiwan for the year of 1970. Regression coefficients for the consumption function in 1970 were estimated by the ordinary least-square method.

This chapter will present a description of the income instability of the 53 panel farms and the results of the regression analysis of panel data. Attention will focus first on total consumption expenditures and then on other important components of consumption: clothing expenditures, food consumption, household operations, and health and education expenditures. Following this, household income is divided into on-farm and off-farm components. Instability indexes for each of these components are computed and included in the basic regression model. Per capita total consumption is also presented and briefly discussed at the end of the chapter.

Income Instability of 53 Panel Farm
Households, 1964-1970

As was noted in Table 8 there was a good deal of year-to-year average income change among the panel households. Part of this change was due to rather steady growth in income over the period; the average household increased real income by about 2 and a half percent per year. As was suggested earlier, weather damage adversely affected individual farm income in some years. This was especially true for many of the panel households in 1969 when very serious typhoons hit the island. In addition to weather conditions, changes in technology and changes in the supply

and demand for farm products are some of the important factors affecting farm income stability. Of all the changes affecting farm production and income, weather is the most unpredictable and damaging; however, it is contended by Jhi T. Shih that in Taiwan losses resulting from adverse weather effects in recent years have not been offset by gains in farm output due to new technology.¹ As will be pointed out later rural households also experience a good deal of instability in their off-farm sources of income.

An analysis of individual household incomes shows a great deal of difference in income stability over time as well as among households. Appendix B presents a detailed picture of the income instability of each of the 53 panel farms over the seven year period. The range of the income instability indexes of these 53 panel farms is from 6.5 to 109.6. The distribution of panel farms in various ranges of income instability, their average farm size, average income, and annual income growth are shown in Table 9. Almost 85 percent of the panel farms have an income instability index below 40. Half of these farms are found with income instability ranging from 6.5 to 19.6 and the other

¹Jhi Tzeng Shih, "Efficiency of Agricultural Production in Taiwan: A Temporal Cross-Section Analysis, 1960-1970," unpublished Progress Report, Academia Sinica, Taipei, Taiwan, January 8, 1974.

half having income instability ranging from 20.6 to 38.3. Farms of large size have more income instability than do small farms. It is interesting to note that farms in the lowest range of income instability have the highest average income and their average size is almost identical to the average size of the 53 panel farms. There is a faster growth in annual income among farms with highly unstable income and among large farms.² Statistics in Table 10 indicate there is a correlation between income growth and income instability among the 53 panel farms.

TABLE 9.--Average Size of Farm, Net Household Income, Annual Income Growth by Income Instability Index Groups (1964-1970)

Items	Income Instability Index (1964-1970)			
	0-20	21-40	41-60	61+
No. of Farms	22	23	5	3
Farm Size (in ha.) 1970	1.40	1.31	1.56	1.93
Household Income (1970)	59,548	50,899	52,584	44,379
Annual Income Growth 1964-1970	2.53	8.47	19.18	32.78

SOURCE: Calculated from Taiwan Farm Record-keeping Accounts.

²In part, this might be explained by the incentives provided by large entrepreneurial gains in highly unstable income situations.

TABLE 10.--Average Net Household Income and Net Income From Farming Among 53 Panel Farms 1964-1970

Year	Net Total Household Income (Income)	Net Income from Farming	Net Income from Farming as Percent of Total Household Income
	Current NT\$		
1964	42,396	34,466	81.30
1965	49,473	38,052	76.91
1966	50,506	36,765	72.80
1967	52,529	38,118	72.57
1968	59,314	44,424	74.90
1969	49,923	33,344	66.79
1970	54,128	37,550	69.37

SOURCE: Calculated from Taiwan Farm Record-keeping Accounts.

As previously mentioned net household income is composed of two components: net farm income and net non-farm income. Table 10 shows the extent to which non-farm income has contributed to total household income. As can be noted, the percentage contribution of farming income steadily decreased from 1964 to 1970. On the average, three-fourths of the net household income was derived from farming operations and only one-fourth came from off-farm activities. Interestingly, the variability of off-farm was far greater than for farm income. Data in Appendices C and D show that the instability index for income from

farming ranged from 5.5 to 310.4, while the income instability index of non-farm income ranged from 15.6 to 2,297.2. In summary, on the average, over the years 1964-1970, there was a decreasing ratio of income from farming to the total earnings of the farm family, but for each individual farm, the off-farm sources of income were highly variable.

Table 11 presents the means and standard deviations of the dependent and independent variables of the consumption function for the 53 panel households in 1970. As can be noted, there was a high variability in the short-run change from 1969 income to 1970 income. Further, the income in 1969 was more variable among households than the 1970 income. Adverse weather in 1969 affected crop production in an uneven manner throughout the eight agricultural regions of Taiwan.

Total Consumption Expenditure

Regression coefficients associated with the five independent variables and other related statistics estimated for the total consumption function are shown in Table 12. The overall results of the analysis suggest that the fitted linear model explains rather well the variations in the dependent variable total consumption. A coefficient of multiple determination of .806 was obtained from the analysis. The F ratio statistic test shows that this

TABLE 11.--Means and Standard Deviations of Dependent and Independent Variables, 53 Panel Farms, 1970

Variable	Mean	Standard Deviation
Income 1970 ^a	54,128	41,848
Income 1969	49,923	39,208
Income Increase from 1969 to 1970	4,204	20,724
Income Instability Index 1964-1970	27.76	18.13
Size of Family	8.23	3.31
Total Consumption Expenditures ^a	46,092	27,370
Clothing	8,868	4,025
Household Operations	17,020	8,758
Food	3,755	2,454
Health and Education	6,016	4,192

^aIncome and Consumption Expenditures are in current NT\$.

TABLE 12.--Regression Coefficients and Other Related Statistics Using Total Consumption as the Dependent Variable and Income Instability and Four Other Independent Variables, 53 Panel Farms

Variable	Coefficients and t Value
Household Income 1970 t test for H: b=0	.540 10.97***
Return on Equity 1970 t test for H: b=0	- 355.3 2.13**
Short run Income Change (1970 Income less 1969 Income) t test for H: b=0	.036 .35
Size of Family 1970 t test for H: b=0	1,464 2.5***
Income Instability (1964-1970) t test for H: b=0	79.88 .81
Coefficient of Mult. Det. R ² F Ratio	.806 38.98***
Standard Error	12,690

***Significant at the .01 probability level.

**Significant at the .05 probability level.

coefficient is significantly different from zero at the .01 probability level. The coefficient of multiple determination (R²) is a measure of the success of the regression in explaining the variation in the dependent variable.

Income and Total Consumption Expenditures

The basic Keynesian consumption theory posits a relation between the level of current income and the consumption expenditures. Almost all consumption micro-models include current income as one of the most important determinants of consumption and numerous studies have generally supported the Keynesian theory. The t-test for $H_0: b=0$ in Table 12 indicates that the coefficient for current income is significantly different from zero at a probability level of .01. The regression coefficient associated with current income is .54, which means that the total consumption expenditures of the Taiwanese farm household increase by NT\$.540 for every NT\$ 1.00 increase in the current farm household income.

Return on Equity and Total Consumption Expenditures

The return-on-equity was previously defined as the ratio of net farm income in 1970 to the average farm net worth in 1970. It is a measure of the profitability of on-farm investment. The results in Table 12 indicate that return-on-equity is a significant variable in explaining total consumption expenditures. The regression coefficient associated with the return-on-equity variable is statistically significant at the .05 level and it turns out to

be a negative number (-355.3) as expected. This indicates that in 1970 the Taiwanese farmer would decrease his total consumption at the margin in response to an increase in the rate of farm profitability. For every 1 percent increase in the rate of farm profitability, there is a reduction in total consumption expenditures in the magnitude of NT\$ 355. This finding suggests that the Taiwanese rural household, in 1970 at least, recognized the trade-off between current consumption and the possibility of increased investment and increased expected profit in their farm enterprises. It is also possible that on-farm investments in 1970 were related to the typhoon damage in 1969. As suggested by Ong, Adams, and Singh,³ the favorable investment environment for Taiwanese farm households was due to appropriate government policies that included price policies, new technology, marketing facilities, land tenure, adjustments, and public investment programs.

Income Change (1970 Income less 1969
Income) and Total Consumption
Expenditures (1970)

The Keynesian income consumption formulation is

³Marcia L. Ong, Dale W Adams, and I. J. Singh, "Voluntary Saving Capacities in Taiwan 1960 to 1970," Economics and Sociology Occasional Paper No. 175, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio, February 8, 1974.

essentially static and implies that a consumer responds completely within one year to changes in current income. The model used in this study allows for a more dynamic response. The analysis showed, however, that total consumption household expenditures did not respond to short-run change in income between 1969 and 1970. The t test for $H_0: b=0$ shows that the regression coefficient associated with the income increase variable is not significantly different from zero. It was hypothesized that the farm would promptly increase its total consumption expenditures in response to an income increase in 1970, but the findings do not suggest this hypothesis. This may be due, on the average, to the relatively small amount of income increase in 1970 (Table 11). The average income increase for the 53 panel farms from 1969 income to 1970 income was only NT\$ 4,204 in current NT\$ or 9.7 percent with a standard deviation of 20,724. Some of the farm households experienced a decline in their incomes in 1970. This fact might have accounted for the zero effect of income increase on the total consumption expenditures in 1970. A low correlation between income increase and household income in 1970 (the correlation coefficient between these two variables is .371) does not seem to indicate that there is serious multicollinearity in the estimation method.

Size of Family and Total
Consumption Expenditures

The t test for $H_0: b=0$ indicates that the coefficient associated with the size of family is significantly different from zero at the .01 probability level. The coefficient is equal to 1,464, indicating that total consumption increased by NT\$ 1,464 for every increase of one member in the household.

Income Instability and Total
Consumption Expenditures

What comes as a surprise from the results of this analysis is that income instability does not appear to be related to the level of total consumption. The t test for $H_0: b=0$ shows that there is no relationship between the total consumption of the Taiwanese farm household and the index of income instability. The Taiwanese household has apparently internalized his pattern of income instability so that consumption behavior is largely isolated from short run swings in income. It might be concluded, as Friedman has suggested, that the farm households base their consumption behavior on some permanent income notion rather than on the unstable transitory income, which varies from year to year.⁴ Income instability appears not to be

⁴Milton Friedman, op. cit., p. 221.

a serious problem for the Taiwanese rural household because of multiple cropping, multiple enterprises, and realistic predictions of income changes.

Expenditures for Clothing

Income and Clothing Expenditures

The t test for $H_0: b=0$ in Table 13 shows that the clothing expenditures' regression coefficient associated with income is statistically different from zero at the .05 probability level. The results of the analysis, however, indicate that current income plays only a minor role in the determination of clothing expenditures. Only 2 percent of the marginal increase in the level of clothing expenditures is related to the increase in the level of current income.

Return on Equity and Clothing Expenditures

The regression coefficient associated with the return on equity (-44.00) is significantly different from zero at the .10 probability level. This indicates that the Taiwanese farm family would spend less on clothing if there was an opportunity to react to a high rate of return on equity. For every marginal increase of 1 percent in the rate of return on farm equity, there is a decrease in the amount of

NT\$44 spent on clothing.

TABLE 13.--Regression Coefficients and Other Related Statistics Using Clothing Expenditures as the Dependent Variable, 53 Panel Farms

Variable	Coefficients and t Value
Income (1970) t test for H: b=0	.02 2.03**
Return on Equity (1970) t test for H: b=0	-.44. 1.38*
Income Change (1970 Income less 1969 Income) t test for H: b=0	-.02 1.12
Size of Family (1970) t test for H: b=0	886.7 7.38***
Income Instability (1964-1970) t test for H: b=0	26.37 1.34*
Coefficient of Mult. Det. R ² F Ratio	.636 16.46***
Standard Error	2,552

***Significant at the .01 probability level.

**Significant at the .05 probability level.

*Significant at the .10 probability level.

Income Change and Clothing Expenditures

The effect of short-run changes in income on clothing expenditures is not significantly different from zero as shown in Table 13. The results of the analysis show that there is little short run change in clothing expenditure

habits among Taiwanese farm family.

Size of Family and Clothing Expenditures

The t test for $H_0: b=0$ shows that the regression coefficient associated with the size of family is different from zero. The value of this coefficient is equal to 867, indicating that if there is a marginal increase of one person residing on the farm, there corresponds an increase of NT\$867 spent on clothing.

Income Instability and Clothing Expenditures

The coefficient of the income instability variable indicates that farm families who experience more income instability tend to spend more on clothing. At the .10 significance level the t test on $H_0: b=0$ is significantly different from zero. It comes as a surprise that income instability has a positive effect on clothing expenditures. No plausible explanation can be offered by the researcher for this peculiar phenomenon.

Expenditures for Household Operations

Expenditures for household operations can be estimated either from asset values of occupied dwelling units and applying a constant ratio to capital as rental value or

simply by measuring current housing expenditures as it is done in this study. Expenditures for household operations in this study were primarily estimated from consumption flows rather than from consumer assets.

The coefficient of multiple determination for the household operations expenditures function is .525, which is significantly different from zero at the .01 probability level.

Income and Expenditures for Household Operations

The influence of income on household operating expenditures appears to be significant. The regression coefficient associated with the income variable, as shown in Table 14, is .146 and it is significantly different from zero at the .01 probability level. The inclusion of other independent variables in the equation does not alter the over-all relationship between income and expenditures for household operations.

Family Size and Expenditures for Household Operations

The evidence presented in Table 14 indicates that there is no relationship between family size and household operations. If there is an increase in the family size, the Taiwanese farm family may adjust by making more

intensive use of housing space.

TABLE 14.--Regression Coefficients and Other Related Statistics Using Expenditures for Household Operation as the Dependent Variable, 53 Panel Farms

Variable	Coefficients and t Value
Income (1970) t test for H: b=0	.148 5.99***
Return on Equity (1970) t test for H: b=0	-53.47 .68
Income Change (1970 Income less 1969 Income) t test for H: b=0	- .044 .89
Size of Family (1970) t test for H	302.45 1.04
Income Instability (1964-1970) t test for H: b=0	56.74 1.16
Coefficient of Mult. Det. R ² F Ratio	.525 10.38***
Standard Error	6,350.

***Significant at the .01 probability level.

Expenditures for Household
Operations and Other
Independent Variables

The t tests for H: b=0 show that the coefficients associated with income instability, income change, and return-on-equity variables are not significantly different from zero. The coefficient associated with return-on-equity

variable has a negative sign as expected but statistically speaking it is not different from zero.

Expenditures for Food

The basic food for the people in Taiwan consists mainly of rice, sweet potatoes, and wheat flour. There are, however, some differences in basic food consumption among people residing in different parts of the island because of dissimilarities in their consumption habits, income level and the sources of basic foodstuffs. The residuals of basic foods are mostly used for poultry and animal feed.⁵

Food consumption in this study includes such basic food items as rice and flour and other staple foods like meat and fruit. Cigarettes and beverage expenditures are also included in food consumption expenditures. Food produced and directly consumed by the farm family is estimated and also included in the measure for total food expenditures.

Food consumption expenditures are linearly regressed against five independent variables, namely income, income change, income instability, the rate of return on equity,

⁵Shih-Yih Liao, "Report on a Survey of the Consumption of Main Foodstuffs in Taiwan 1966," Taiwan Provincial Chung Hsing University, December, 1966.

and finally number of consuming units. Consuming units are calculated on the basis of the number of people residing on the farm and their age. Children and female members of the farm family are given less weight than adults and males. The following table gives the precise weights assigned to each age group for both males and females in the farm family.

	Age in Years						
	0-1	2-4	5-7	8-10	11-14	15-20	20+
Male	0.3	0.4	0.5	0.7	0.8	0.9	1.0
Female	0.3	0.4	0.5	0.7	0.8	0.9	.9

Source: Department of Agriculture and Forestry, Report of Farm Record-keeping Families in Taiwan, 1969, Nantou, Taiwan, p. 25.

The t test for $H_0: b=0$ presented in Table 15 indicates that the income variable is the only variable that is significantly different from zero at the .01 probability level. The coefficient associated with the income variable is .032, indicating that the marginal food consumption of the Taiwanese farm family is NT\$.03 for every increase in one new Taiwanese dollar in current income. The consuming units turn out to be insignificant although the sign of the coefficient associated with this variable is in the anticipated direction. Food consumption was also

fitted with the other four variables and the size of family instead of the consuming units. The coefficient associated with the size of family was not significantly different from zero, however. There was a slight improvement in the coefficient of determination, from .369 when size of family is among the five independent variables to .375 when consuming units replace the size of family.

TABLE 15.--Regression Coefficients and Other Related Statistics Using Food Consumption as the Dependent Variable, 53 Panel Farms

Variable	Coefficients and t Value
Income (1970) t test for H: b=0	.032 4.0***
Return on Equity t test for H: b=0	- 24.4 .98
Income Change (1970 Income less 1969 Income) t test for H: b=0	.007 .415
Consuming Units (1970) t test for H: b=0	129.4 1.17
Income Instability (1964-1970) t test for H: b=0	14.53 .92
Coefficient of Mult. Det. R ² F Ratio	.375 5.65***
Standard Error	2,040.

***Significant at the .01 probability level.

The coefficient associated with the rate of return on equity turns out to be negative as was expected, but statistically it was not different from zero. This indicates that the rate of profitability on farm investment does not directly relate to household food consumption behavior. The coefficients associated with income change and income instability were not significantly different from zero as shown by the t statistics presented in Table 15.

Health and Education Expenditures

Health and education expenditures included all educational expenses, sanitary expenses and money spent on medical treatments of the members of the household.

Table 16 indicates that the coefficient of the income variable is equal to .069, and is significantly different from zero. The t tests for $H_0: b=0$ show that the coefficients associated with the other four independent variables, namely income change, income instability, size of family and the rate of return on equity are not different from zero.

Per Capita Consumption

It is of interest to know how per capita consumption expenditures instead of consumption expenditures per family are determined by the four independent variables, namely

income, income increase, income instability and the rate of return on equity. In equation form, the consumption function may be presented as follows:

$$C_{it}/S_{it} = b_0 + b_1 Y_{it}/S_{it} + b_2 (Y_{it} - Y_{it-1})/S_{it} + b_3 I_i + b_4 r_{it} + e_{it}$$

All of these variables have been defined in Chapter III.

TABLE 16.--Regression Coefficients and Other Related Statistics Using Health and Education Expenditures as the Dependant Variable 53 Panel Farms

Variable	Coefficients and t Value
Income (1970) t test for H: b=0	.069 5.42***
Return on Equity (1970) t test for H: b=0	-25.13 .61
Income Change (1970 Income less 1969 Income) t test for H: b=0	.027 1.05
Size of Family (1970) t test for H: b=0	-122.3 .67
Income Instability (1964-1970) t test for H: b=0	- 17.23 .67
Coefficient of Mult. Det. R ² F Ratio	.438 7.32***
Standard Error	3,305.

***Significant at the .01 probability level.

The primary purpose of using per capita consumption is to remove the family size influence. Table 17 shows the regression coefficients and other related statistics when per capita consumption is the dependent variable.

The t test shown in Table 17 for $H: b=0$ indicates that the coefficient associated with per capita income is equal to .600, which is significantly different from zero at the .01 probability level and the coefficient associated with the return on equity is equal to 32.406, which is significantly different from zero at the .01 probability level.

The regression coefficients associated with other variables, namely income instability and income increase are not statistically different from zero. These results are not basically different from those obtained when total consumption per farm household is selected as the dependent variable.

The coefficient of multiple determination, R^2 , is, however, equal to .749 whereas when total consumption per farm household is linearly regressed against the five determinants that index the family size, the coefficient of multiple determination is .806. The low value of R^2 when per capita figures is used indicates that there is a lack of goodness of fit or the variation in the per capita expenditures is not well explained by the independent

variables.

TABLE 17.--Regression Coefficients and Other Related Statistics Using Per Capita Consumption as the Dependent Variable and Income Instability Among the Four Independent Variables, 53 Panel Farms

Variable	Coefficients and t Value
Income (1970)	.60 10.69***
Return on Equity (1970)	-32.41 1.50*
Income Change (1970 Income less 1969 Income)	- .078 .81
Income Instability	3.521 .27
Coefficient of Mult. Det. R^2 F Ratio	.749 35.81***
Standard Error	1,665.
Per Capita Consumption	5,962.
Standard Deviation of Per Capita Consumption	3,194.

***Significant at .01 probability level.

*Significant at .10 probability level.

Total Consumption, Farm Income, Non-Farm
Income and Their Instability

The analysis presented so far indicates that there is little effect of income instability on the consumption behavior of the Taiwanese farm households. The analysis

is carried one step further by breaking down income into its two components, namely farm income (Y_F) and non-farm income (Y_{NF}). Instability indexes are then computed for each of these income components and the figures entered into the model. These farm income instability and non-farm income instability indexes are presented in Appendix C and D. They show that farm income is less variable than non-farm income over the period 1964-1970.

Regression coefficients and related statistics for these new indexes are presented in Table 18. The results obtained are not basically different from the original model. Consumption is positively related to farm, non-farm income and family size. It is interesting to note that the marginal propensity to consume with respect to current farm income is .51, which is lower than that of non-farm income (.70).

The t tests show that income changes, and both farm income and non-farm income instability have no effect on the consumption behavior of the Taiwanese farm household.

The introduction of the two components of income and farm income and non-farm income instability into the model did not change substantially the coefficient of multiple determination which is about .81. The regression analysis also showed that farm income instability and non-farm income instability have no significant effect on the important

components of consumption, namely food, clothing, household operations, and health and education.

TABLE 18.--Regression and Other Related Statistics Using Total Consumption as the Dependent Variable and Farm Income Instability, Non-Farm Income Instability and Five Other Independent Variables, 53 Panel Farms

Variable	Coefficients and t Value
Farm Income (1970) t test for H: b=0	.510 9.48***
Non-Farm Income (1970) t test for H: b=0	.700 5.30***
Family Size (1970) t test for H: b=0	1,174. 1.87**
Return on Equity (1970) t test for H: b=0	- 291.6 1.73**
Non-Farm Income Instability (1964-1970) t test for H: b=0	5.41 1.14
Income Change (1970 Income less 1969 Income) t test for H: b=0	- .064 .62
Farm Income Instability t test for H: b=0	- 16.23 .53
Coefficient of Mult. Det. F Ratio	.814 28.07***
Standard Error	12,700.

***Significant at the .01 probability level.

**Significant at the .05 probability level.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The general objective of this study was to assess the determinants of consumption behavior among Taiwanese farm household and especially the effects of income instability on consumption. Panel data for 53 farms covering the period 1964-1970 were used in the analysis.

The specific objectives of this study were (1) to measure the impact that income changes have on consumption, and (2) to measure the effects of income instability and farm investment profitability on the expenditures for food, clothing, household operations, education and health and total consumption of the households under study.

Taiwan was selected as the setting for this study because of the availability of data and prior analyses of consumption which have been done at the micro level on Taiwan data. Moreover, Taiwan has often been cited as a case of successful agricultural development associated with high voluntary savings.

A review of the studies on the subject of consumption in developed and developing countries confirmed what is

generally known as the Keynesian formulation of the consumption function; consumption expenditures are primarily determined by income. Although the main determinant of consumption-saving behavior of peoples and countries is income, it has not been claimed in all empirical studies that this is the only factor nor that there is a unique static relation between the level of income and consumption expenditures. There are other determinants of consumption and it is important to study the effects of these additional variables. It is of interest to policy makers to know the effects of income instability on consumption and the trade-off between deferred consumption and farm investment profitability. Information on the micro decisions about consumption-saving behavior of the small farmer is useful in anticipating the possible impact of national economic plans on the agricultural sector.

Friedman expounded his theory of 'permanent income' with the belief that consumers do not react on a day-to-day basis and that they adapt their behavior to "permanent income" rather than react to the transitory components of their income. Numerous studies of consumption have been based on this hypothesis but most of them have used cross-sectional data, national statistics, or data obtained from consumer studies surveys and aggregated to the macro level. The availability of financial farm records from 53 farm

families participating on a long-term and continuing basis enabled the researcher to study the subject of income instability and consumption at the micro level. Over the period of seven years, 1964-1970, these 53 farm families, located in eight agricultural regions of Taiwan, provided detailed information on their farm and household economic activities on a weekly basis. Over this period, the average real income of these households increased by 15 percent from NT\$ 47,249 in 1964 to NT\$ 54,128 in 1970. Of all types of expenditures, food consumption remained rather stable while expenditures on health and education increased substantially from NT\$ 3,856 in 1964 to NT\$ 6,016 in 1970, or almost 56 percent.

Apart from a decline in farm income in 1969, which was due to adverse weather conditions, there was an upward trend in the average household income of the panel farms. In addition, individual farm records showed that there was a great deal of income variation from year to year among the individual panel households. An instability index was therefore computed for each household to measure the variability of its income over the period 1964-1970. When the growth of income is taken into consideration, the relative income instability index is used to indicate the relation between the income instability and income growth of panel farms.

The analysis of income instability indexes showed that farm households in the low range of income instability have smaller farm size and their income does not grow as fast as that of households having larger farm size. There also existed a strong positive correlation between income growth and income instability among the 53 panel farms.

A multiple regression analysis was used to examine the factors explaining consumption expenditures. A simple linear model was fitted to the data with consumption and its components as dependent variables. The independent variables were current income, income increases, an income instability index, the rate of return on farm equity or farm net worth, and the size of family. In the case of food consumption, consuming units were used in the place of a size-of-family variable.

In interpreting the results of the analysis, it should be remembered that the model used is in effect a single equation in a complex micro economic system. The coefficients therefore measure only the direct effect of each variable on the consumption behavior of the Taiwanese farmer.

Summary of Findings

Empirical evidence in this study indicates that the

reaction of farm households with regard to the instability of their income appears to have undergone no change. All the coefficients associated with income instability when the growth of income is taken into account, are not significantly different from zero. This is not only true with respect to total consumption but it is also true with all the important components of consumption, namely food consumption, expenditures for clothing, household operations, and expenditures for health and education. The evidence indicates that consumption is insensitive to income instability and that the consumption savings behavior of the Taiwanese farmer is directly dependent on the "permanent income" conceptualized by Friedman.

Observations on the farming practices of the Taiwanese farmer and the general economy of Taiwan may offer some plausible explanations for his consumption behavior to income instability. The presence of increasingly diversified and multiple cropping patterns and available off-farm employment opportunities during the last decade may make the Taiwanese more confident of evening out short term fluctuation in his streams of income. The well developed financial and credit markets also may be helpful in assisting the farmer to meet temporary income fluctuations. Land reform also has enabled many Taiwanese farmers to own their land, which accounts for a substantial part of his

farm net worth. The land ownership and increased land value would no doubt enhance the farmer's sense of economic security and make income instability less serious than it was thought by the researcher.

It appears that income gains in 1970, after devastating typhoons in 1969, did not induce the Taiwanese farm household to make any immediate adjustments in its everyday outlays. One reason may be that since there was more uncertainty about the amounts of increase involved and no farm household could be certain whether a particular income development is sustainable or not, there might be fewer immediate urges to make major purchases. Perhaps the Taiwanese farm household adopted a "wait and see" attitude, putting a part of the added income in reserves which are available to sustain a basic level of consumption should incomes decline later.

The results of this study also give a strong indication that farm investment profitability affects consumption decisions. The coefficients associated with the return-on-equity variable indicate that as the return on farm equity increases the Taiwanese farmer is willing to defer his consumption for further farm investment. This is especially true only for the total consumption and expenditures for clothing. Food consumption, expenditures

for household operations and for health and education decisions appear to move independent of changes in farm investment profitability.

The analysis shows that the size of family is positively related to the total consumption and expenditures for clothing, but it has no effect on food expenditures, household operations, and expenditures on health and education. Even when consuming units are substituted for the size of family variable, they also have no positive effect on food consumption. This implies that farm families with fewer persons residing in the household would be better fed, housed and would spend more for education and health per capita than larger farm families. As regards per capita consumption expenditures, the findings of the study indicate that income is the most important determinant in explaining its variation.

Policy Implications

The findings of this study are based on data from Taiwan. Since the consumption-saving behavior is a complex process, a process that is influenced by a number of economic, sociological and cultural factors, and since farm types and sizes are diverse in different LDC's, it is difficult to make generalizations. However, at least for the regions or countries having similar types of farming and small-size

rice farm holdings, it is relatively safe to suggest that consumption decisions are based on the notion of permanent income, and therefore appear to be independent of the instability of income derived from farm operations and off-farm work. If one intends to carry out a price stabilization or an income guaranteed policy, one should not be concerned with the possible effects of this policy on the consumption-saving behavior of rural households at the same level of development as found in Taiwan. There might be other factors that may influence the consumption-saving behavior of the farmer in a LDC when an income stabilization policy is implemented, but the findings from this study indicate that income instability has no relationship at all upon the total consumption nor on different subclasses of consumption expenditures.

As regards the effects of short run income changes, the results of this study suggest that a short run income increase does not contribute substantially to the rate of discretionary spending. Favorable income developments which have some permanence are more likely than those which are transitory to induce people to upgrade or add to their consumption patterns. The implication is that a short-run fiscal policy designed to increase the income of the farmer after a disaster, for example tax cut relief, may not induce him to change his consumption behavior.

It has been argued by Schultz¹ that farmers in poor communities do respond to normal economic incentives in using new and profitable factors of production. Empirical results from this study suggest that small farmers do respond to economic incentives, and they defer consumption in the face of profitable farm operations. It is shown from the results of the analysis that there is a significant negative relationship between the rate of return on equity and consumption. It might be concluded that credit granted to the small farmer will not be diverted to consumption purposes, if profitable investment alternatives are available. The policy implications for agricultural development are clear. They are (1) how to make new and profitable factors available to the farmers and (2) how to develop an efficient system of credit for the small farmer. The main concern should be with how to make the returns to farm investment more attractive, rather than whether the small farmer will respond to new and profitable technology and divert credit to consumption.

It may be argued that the consumption behavior of the farm household in another setting, for example, in a small rice farming community where the farmer does not own

¹Theodore W. Schultz, Transforming Traditional Agriculture, New Haven: Yale University Press, 1964, pp. 162-166.

many assets, where the credit system is not well developed and where no land reform has been instituted, may be entirely different from the behavior of the Taiwanese farm household that has been observed and studied. One can deal with this argument only by carrying out economic research in each setting.

Topics for Further Research

The availability of panel data from the Taiwanese farm records as well as the low rate of inflation during the last decade provide further opportunity for study of micro economic behavior. One important aspect that might be studied further is the relationship between income growth and income instability. It is not clear why there was a positive relationship between these two factors in the research herein reported. Further, one might focus research on the main determinants of farm income instability. That is, what factors cause farm household income instability? What part of this is due to changes in weather, diseases, marketing conditions, etc.? What part is due to changes in off-farm employment opportunities? Why do off-farm sources of income appear to be quite unstable?

Another interesting question that one may address is how income instability affects the asset portfolio

composition of rural households. This might include analysis of how income instability affects financial savings, liquid assets, and various forms of fixed assets held by the household. Further, it is not clear if there is any relationship between income instability and changes in farm net worth.

The relationship between income instability and household use of financial services might be a further area of fruitful research. Do households with highly unstable income make more use of financial services? Do they adjust to uneven income flows through credit and deposit transactions in financial markets? Do financial markets play a more important role in areas of unstable income than in areas where few shocks to income are experienced?

The results of this study indicate that income instability during the 1964-1970 period did not affect the consumption behavior of Taiwanese farm households. It is possible, however, that income instability may have a different impact on consumption as one moves across different household economic sub groups. Would poorer households react differently to unstable incomes?

Research is also needed on how different income time lags affect consumption decisions. Would a lagged income of 2, or more years show a stronger relationship

to current consumption than income lagged only one year?
Further, the investigation herein reported focused on consumption behavior among households whose income in the previous year was, on the average, sharply lower. Would an analysis of consumption behavior in a year following sharp increases in average income yield different results?

APPENDICES

APPENDIX A

General Index of Prices-received-by-farmers and Market Rate
of Exchange of U.S. Dollars Expressed in
New Taiwanese Dollars, 1960-1972

Year	General Index of Prices-received-by-farmers (1)		Market Exchange Rate NT\$ for 1 U.S. Dollar (2)
	1970	100	
1960	81.0		42.26
1961	83.5		43.98
1962	79.3		46.99
1963	86.4		42.48
1964	89.7		45.88
1965	89.2		41.63
1966	89.0		41.00
1967	93.5		41.61
1968	98.2		41.12
1969	95.6		41.25
1970	100.0		41.02
1971	102.9		40.10
1972	108.6		40.10

Source: (1) Calculated from Monthly Statistics on Price Received & Price Paid by Farmers in Taiwan, Bureau of Accounting and Statistics, Provincial Government of Taiwan, Nantou, Taiwan, December 1960 and December 1972.

(2) Council for International Cooperation and Development, Taiwan Statistical Data Book 1971, Taipei, Taiwan, 1971, p. 127.

International Monetary Fund, International Financial Statistics, Vol. XXVI, No. 12, December 1973.

APPENDIX B

Income Instability (I_1), Relative Income Instability (I_2), and Average Annual Growth of 53 Panel Farms, 1964-1970

Observations	Farm ID Number	Income Instability Index (I_1)	Relative Income Instability Index (I_2)*	Annual Growth
1	103070102	9.343	-2.323	- 4.0223
2	103070113	31.130	3.619	8.6014
3	207180003	35.624	1.446	24.6332
4	207180005	45.268	5.108	8.8627
5	207180006	9.861	-4.747	- 2.0771
6	207180014	21.764	1.690	12.8791
7	207180401	36.285	2.724	13.3209
8	207180402	60.393	2.894	20.8693
9	207180404	33.045	3.386	9.7593
10	313250104	24.193	-6.177	- 3.9167
11	313250109	14.393	2.306	6.2405
12	313250201	30.440	3.332	3.6535
13	313250403	17.147	18.039	0.9506
14	313260006	14.781	4.871	3.0347
15	313260202	37.793	1.964	19.2463
16	404330402	16.060	130.529	0.1230
17	404330405	54.040	1.424	37.9529
18	404330409	32.961	2.713	12.1479
19	404330410	14.952	10.552	1.4170
20	404330411	29.425	52.941	0.5558
21	404330412	13.731	2.170	6.3292
22	404340301	44.197	2.389	15.2962

APPENDIX B--Continued

Observations	Farm ID Number	Income Instability Index (I ₁)	Relative Income Instability Index (I ₂)*	Annual Growth
23	404340402	13.719	2.645	5.1871
24	404340404	12.541	-1.878	- 6.6776
25	404340406	12.930	3.299	3.9192
26	404340409	24.067	2.179	11.0472
27	404340410	20.603	1.870	11.0153
28	513400405	21.858	3.469	6.3009
29	513400408	18.024	6.718	2.6831
30	513400413	6.519	1.595	4.0879
31	513400415	18.856	1.075	17.5356
32	610430406	16.730	-3.466	- 4.8275
33	611470401	22.272	6.586	3.3819
34	611470405	17.605	1.936	8.8622
35	611470410	20.600	2.640	7.8032
36	611470412	70.945	2.291	30.9655
37	611480403	38.119	3.903	9.7656
38	611480405	11.853	-2.641	- 4.4885
39	611480407	19.611	1.982	9.8942
40	611480412	52.983	2.278	23.2590
41	611480414	25.913	2.120	12.2237
42	612500310	38.261	2.282	16.7702
43	612500312	31.724	34.561	0.9179
44	612500313	28.240	2.795	10.1045
45	612500410	21.423	-1.424	-15.0456
46	612500411	18.644	4.196	4.4430
47	708520409	16.645	15.623	1.0654
48	708530404	109.595	2.357	46.5056

APPENDIX B--Continued

Observations	Farm ID Number	Income Instability Index (I ₁)	Relative Income Instability Index (I ₂)*	Annual Growth
49	708530405	12.707	3.169	4.0100
50	712560402	27.690	8.996	3.0780
51	712560406	9.807	-2.330	- 4.2096
52	712560410	50.942	4.827	10.5526
53	814580402	33.064	1.988	16.6304

*I₂ = I₁ / Annual Growth

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX C

Net Farm Income Instability (FII), Relative Net Farm Income
Instability (RFII) of 53 Panel Farms, 1964-1970

Observations	Farm ID Number	FII	RFII*
1	103070102	11.632	- 2.499
2	103070113	19.443	- 3.917
3	207180003	58.013	9.117
4	207180005	24.064	- 2.257
5	207180006	16.827	- 3.873
6	207180014	5.452	- 1.479
7	207180401	24.091	-87.499
8	207180402	33.807	5.699
9	207180404	32.314	3.361
10	313250104	26.816	-18.092
11	313250109	12.691	3.416
12	313250201	23.056	7.236
13	313250403	48.820	2.019
14	313260006	35.356	11.121
15	313260202	30.335	1.436
16	404330402	55.504	5.748
17	404330405	49.216	1.275
18	404330409	24.491	5.159
19	404330410	22.469	19.492
20	404330411	33.815	199.328
21	404330412	12.295	3.279
22	404340301	52.208	3.434
23	404340402	16.122	2.334
24	404340404	12.237	- 1.428
25	404340406	16.150	- 2.547
26	404340409	19.400	2.685
27	404340410	18.496	1.774
28	513400405	22.193	2.687
29	513400408	15.205	2.250
30	513400413	17.119	5.364
31	513400415	37.523	20.796
32	610430406	40.385	6.060
33	611470401	24.703	2.717
34	611470405	13.526	1.815
35	611470410	22.812	1.772
36	611470412	49.219	2.701

APPENDIX C--Continued

Observations	Farm ID Number	FII	RFII*
37	611480403	290.727	1.892
38	611480405	5.745	- 0.603
39	611480407	21.062	3.269
40	611480412	40.214	2.433
41	611480414	28.425	3.100
42	612500310	310.385	1.556
43	612500312	42.933	8.395
44	612500313	13.732	- 2.931
45	612500410	23.345	- 1.446
46	612500411	13.462	3.374
47	708520409	18.150	-16.253
48	708530404	111.372	2.694
49	708530405	20.566	1.854
50	712560402	21.846	11.828
51	712560406	10.572	- 2.383
52	712560410	42.493	5.796
53	814580402	219.995	1.789

* RFII = FII/Annual Growth of Net Farm Income

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX D

Net Non-Farm Income Instability (NFII), Relative Net
 Non-Farm Income Instability (RNFII) of
 53 Panel Farms, 1964-1970

Observations	Farm ID Number	NFII	RNFII*
1	10307 102	871.26	1.5668
2	10307 113	157.30	1.6012
3	20718 003	87.06	1.1053
4	20718 005	489.59	1.2221
5	20718 006	78.54	2.3194
6	20718 014	39.96	1.1052
7	20718 401	343.56	1.1679
8	20718 402	188.66	1.6860
9	20718 404	118.60	2.2316
10	31325 104	64.61	2.2503
11	31325 109	127.98	1.4834
12	31325 201	805.73	1.6003
13	31325 403	16.37	- 3.8772
14	31326 006	38.80	1.8110
15	31326 202	64.32	2.4637
16	40433 402	27.77	2.1121
17	40433 405	416.04	2.7624
18	40433 409	132.85	1.7423
19	40433 410	45.70	2.2396
20	40433 411	39.82	2.9901
21	40433 412	27.89	1.0448
22	40434 301	32.49	1.6063
23	40434 402	238.87	21.3078
24	40434 404	135.34	1.9529
25	40434 406	18.36	0.6125
26	40434 409	192.95	2.2878
27	40434 410	1087.00	1.8181
28	51340 405	32.69	- 1.0610
29	51340 408	43.63	- 0.7741
30	51340 413	44.28	1.9195
31	51340 415	19.92	0.8205
32	61043 406	15.47	- 2.4561
33	61147 401	128.54	3.2466
34	61147 405	181.96	1.4866
35	61147 410	782.19	1.7922

APPENDIX D--Continued

Observations	Farm ID Number	NFII	RNFII*
36	61147 412	2297.16	1.6631
37	61148 403	52.72	2.7977
38	61148 405	57.92	1.6104
39	61148 407	551.84	1.3156
40	61148 412	149.93	1.1627
41	61148 414	27.50	1.3085
42	61250 310	21.52	5.1178
43	61250 312	66.13	-82.6124
44	61250 313	119.22	1.2356
45	61250 410	30.84	-12.7780
46	61250 411	29.95	3.3843
47	70852 409	70.71	1.4891
48	70853 404	137.26	1.4143
49	70853 405	28.92	9.6985
50	71256 402	82.31	2.9826
51	71256 406	52.14	3.5731
52	71256 410	1077.18	1.8177
53	81458 402	39.74	2.5338

*RNFII = NFII/Annual Growth of Non-Farm Income.

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX E

Income Instability (I_1), Relative Income Instability (I_2), and Average Annual Growth of 40 Panel Farms, 1964-1971

Observations	Farm ID Number	Income Instability Index (I_1)	Relative Income Instability Index (I_2)	Annual Growth
1	103070102	11.350	-10.333	- 1.098
2	103070113	27.203	3.537	7.691
3	207180003	39.370	2.748	14.325
4	207180005	41.583	7.403	5.617
5	207180006	12.260	5.183	2.365
6	207180401	33.305	2.924	11.392
7	207180402	52.670	2.402	21.931
8	313250104	36.893	3.532	10.444
9	313250109	12.871	1.875	6.864
10	313250201	35.016	3.055	11.462
11	313260006	14.260	12.100	1.179
12	313260202	33.161	1.807	18.351
13	404330402	28.940	2.693	10.746
14	404330405	64.202	3.029	21.198
15	404330409	30.532	3.227	9.461
16	404330410	13.546	5.027	2.695
17	404330411	31.226	3.893	8.020
18	404330412	20.140	1.341	15.019
19	404340301	52.406	1.871	28.003
20	404340402	14.401	1.920	7.499
21	404340404	28.694	3.557	8.066
22	404340406	11.619	3.528	3.293

APPENDIX E--Continued

Observations	Farm ID Number	Income Instability Index (I ₁)	Relative Income Instability Index (I ₂)*	Annual Growth
23	404340409	21.851	2.454	8.906
24	404340410	21.298	3.125	6.815
25	610430406	15.104	-4.328	3.490
26	611470401	26.438	2.686	9.842
27	611470405	20.190	4.320	4.674
28	611470412	63.353	2.389	26.515
29	611480403	34.757	5.681	6.118
30	611480405	15.653	8.574	1.826
31	611480407	25.106	613.999	0.041
32	611480412	45.544	1.978	23.031
33	612500310	38.083	1.660	22.939
34	612500312	38.125	3.582	10.644
35	612500313	26.677	2.175	12.267
36	612500411	38.505	1.856	20.748
37	703530404	96.801	2.653	36.485
38	712560406	12.561	-29.079	0.432
39	712560410	57.298	2.549	22.482
40	814580402	29.774	1.991	14.958

*I₂ = I₁/Annual Growth

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX F

Net Farm Income Instability (FII), Relative Net Farm Income Instability (RFII) of 40 Panel Farms, 1964-1971

Observations	Farm ID Number	FII	RFII*
1	103070102	14.039	149.919
2	103070113	23.221	8.650
3	207180003	68.515	3.511
4	207180005	25.893	-7.162
5	207180006	20.523	20.684
6	207180401	21.616	15.256
7	207180402	29.002	4.914
8	313250104	33.301	4.422
9	313250109	11.304	2.684
10	313250201	29.555	2.514
11	313260006	32.974	5.239
12	313260202	26.802	1.328
13	404330402	62.186	2.357
14	404330405	57.399	2.753
15	404330409	22.699	8.235
16	404330410	20.801	-32.199
17	404330411	35.464	4.588
18	404330412	19.913	1.457
19	404340301	65.976	1.953
20	404340402	16.124	1.807
21	404340404	12.305	-1.727
22	404340406	14.830	-2.858
23	404340409	19.324	5.059
24	404340410	20.137	3.585
25	610430406	37.475	11.257
26	611470401	23.528	2.110
27	611470405	15.995	4.444
28	611470412	43.776	2.834
29	611480403	256.911	2.029
30	611480405	9.244	-1.657
31	611480407	25.964	-11.081
32	611480412	36.949	3.031
33	612500310	273.855	1.591
34	612500312	45.581	3.562
35	612500313	31.194	3.209
36	612500411	17.576	1.844

APPENDIX F--Continued

Observations	Farm ID Number	FII	RFII*
37	708530404	93.231	3.123
38	712560406	14.532	38.079
39	712560410	43.306	2.235
40	314580402	193.967	1.863

*RFII = FII/Annual Growth of Net Farm Income.

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX G

Net Non-Farm Income Instability (NFII), Relative Net
Non-Farm Income Instability (RNFII) of
40 Panel Farms, 1964-1971

Observations	Farm ID Number	NFII	RNFII*
1	103070102	773.41	1.671
2	103070113	145.95	1.853
3	207180003	86.90	1.518
4	207180005	458.24	1.376
5	207180006	68.40	2.139
6	207180401	335.48	1.324
7	207180402	165.38	1.568
8	313250104	86.34	1.547
9	313250109	112.25	1.442
10	313250201	712.44	1.668
11	313260006	40.41	3.407
12	313260202	59.80	2.852
13	404330402	26.89	1.584
14	404330405	357.00	2.393
15	404330409	120.19	1.844
16	404330410	44.39	1.676
17	404330411	38.93	2.058
18	404330412	26.80	0.891
19	404340301	30.98	1.349
20	404340402	205.21	21.355
21	404340404	172.29	1.453
22	404340406	19.37	0.763
23	404340409	165.91	2.011
24	404340410	956.12	1.866
25	610430406	18.43	-9.211
26	611470401	166.16	1.876
27	611470405	175.77	1.770
28	611470412	2025.18	1.710
29	611480403	45.68	2.540
30	611480405	56.02	1.291
31	611480407	493.19	1.414
32	611480412	157.97	0.977
33	612500310	33.77	1.785
34	612500312	56.75	-82.708
35	612500313	112.58	1.438

APPENDIX G--Continued

Observations	Farm ID Number	NFII	RNFII*
36	612500411	60.47	1.674
37	708530404	131.03	1.609
38	712560406	46.58	5.823
39	712560410	941.39	1.773
40	814580402	34.08	2.176

*RNFII = NFII/Annual Growth of Net Non-Farm Income.

SOURCE: Calculated from Taiwan Farm Record-Keeping Accounts.

APPENDIX H

Regression Coefficients and Other Related Statistics Using
Total Consumption as the Dependent Variable,
40 Panel Farms

Variable	Coefficients and t Value
Income (1971) t test for H: b=0	.324 4.86***
Return on Equity (1971) t test for H: b=0	-97.480 .42
Income Change (1971 Income less 1970 Income) t test for H: b=0	.420 3.01***
Size of Family (1971) t test for H: b=0	-351.2 .41
Income Instability (1964-1971) t test for H: b=0	173.3 1.00
Coefficient of Mult. at. R ² F Ratio	.729 18.26***
Standard Error	18,644.

***Significant at the .01 probability level.

APPENDIX I

Regression Coefficients and Other Related Statistics Using
Clothing Expenditures as the Dependent Variable,
40 Panel Farms

Variable	Coefficients and t Value
Income (1971) t test for H: b=0	.014 .94
Return on Equity (1971) t test for H: b=0	28.81 .55
Income Increase (1971 Income less 1970 Income) t test for H: b=0	.025 .79
Size of Family (1971) t test for H: b=0	655.4 3.41***
Income Instability (1964-1971) t test for H: b=0	-8.945 .23
Coefficient of Mult. Det. R ² F Ratio	.353 3.71***
Standard Error	4,186.

***Significant at .01 probability level.

APPENDIX J

Regression Coefficients and Other Related Statistics Using Expenditures for Household Operations as the Dependent Variables 40 Panel Farms

Variable	Coefficients and t Value
Income (1971) t test for H: b=0	.131 7.02***
Return on Equity (1971) t test for H: b=0	-111.56 1.50*
Income Change (1971 Income less 1970 Income)	does not enter the equation
Size of Family (1971) t test for H: b=0	-32.06 .11
Income Instability (1964-1971) t test for H: b=0	-51.28 .89
Coefficient of Mult. Det. R ² F Ratio	.68 18.67***
Standard Error	6,227.

***Significant at the .01 probability level.

*Significant at the .10 probability level.

APPENDIX K

Regression Coefficients and Other Related Statistics Using
Food Consumption as the Dependent
Variable 40 Panel Farms

Variable	Coefficients and t Value
Income (1971) t test for H: b=0	.011 1.41*
Return on Equity (1971) t test for H: b=0	25.23 .93
Income Change (1971 Income less 1970 Income) t test for H: b=0	.052 3.19***
Size of Family (1971) t test for H: b=0	54.13 .54
Income Instability (1964-1971) t test for H: b=0	23.76 1.18
Coefficient of Mult. Det. R ² F Ratio	.534 7.79***
Standard Error	2,181.

***Significant at the .01 probability level.

*Significant at the .10 probability level.

APPENDIX L

Regression Coefficients and Other Related Statistics Using
Expenditures for Health and Education as the
Dependent Variable 40 Panel Farms

Variable	Coefficients and t Value
Income (1971) t test for H: b=0	.073 4.35***
Return on Equity (1971) t test for H: b=0	-22.90 .39
Income Change (1971 Income less 1970 Income) t test for H: b=0	-.021 .58
Size of Family (1971) t test for H: b=0	-84.10 .39
Income Instability (1964-1970) t test for H: b=0	-36.18 .84
Coefficient of Mult. Det. R^2 F Ratio	.479 6.26***
Standard Error	4,695.

***Significant at the .01 probability level.

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