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CONSUMPTION FUNCTIONS AND CONSUMPTION BEHAVIORS

An Evaluation of the Absolute Income, the Relative Income, the Permanent Income, and the Life Cycle Hypotheses with a Cross-Sectional Application

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PREFACE

The theory of the consumption function was changed radically in the mid-1950s with the emergence of "the new theories" of the consumption function-that is, the Permanent Income Hypothesis, and related theories. Since then there has grown up a substantial body of literature testing and evaluating these theories. But there is still great disagreement about their validity because nobody has taken the trouble to go through these tests systematically, separating valid from invalid tests, and seeing precisely what the valid tests really show.

The new theories of the consumption function as well as traditional theories, are paradigms for which their supporters have provided much empirical evidence. Thus, when a supporter of one of these paradigms is confronted with a new test which claims to contradict his paradigm, he is often ready to reject the new test without much ado because he has the evidence of so many other tests to support his view.

One of the standard issues in empirical economics in recent years has been the testing of the Permanent Income and the Life-Cycle Hypotheses. A vast number of empirical tests of these theories have been published. Unfortunately, these empirical tests did not suffice to clarify the issue. In fact, their very large number combined with the disagreements in their results probably means that the whole subject is as much "up in the air" as it was in the late 1950s. Even an economist who makes a strenuous effort to keep up with empirical macroeconomics is unlikely to have read most of these tests, and of those he has read there are probably many which he has not had time to evaluate adequately. As a result of this there is much confusion in the theory of the consumption function. The plethora of conflicting empirical evidence is such that an economist can decide on the basis of personal likes and dislikes whether he wants to accept or reject these "new theories" of the consumption function, and he can then find numerous empirical tests which will support and justify his chosen point of view. This is, of course, the opposite of the way things should be; empirical tests should limit the opinions which people justifiably hold.

Therefore, in brief, I have tried to show that all the valid evidence on the new theories of the consumption function-the evidence from previously published papers as well as from newly presented papers-is consistent with a theory-permanent income or life-cycle hypothesis-stemming from a multiperiod consumption model which is familiar in the microeconomic theory since Irving Fisher.

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CHAPTER I

INTRODUCTION

Unlike investment spending, consumption spending tends to be orderly, rising and falling primarily in response to disposable income. It is less likely to initiate fluctuations in output. As a rule, movements in investment or in government or foreign spending alter income levels and induce (the multiplier) related movements in consumption. The consumption sector is not entirely passive. However, some types of expenditures, such as those for consumer durables or luxuries, shift in response to nonincome forces, such as inflationary expectations, consumer credit, and changes in interest rates. For instance, a precipitous drop in outomobile sales, reacting to such pressures, was a key factor causing output to decline in 1980s in the U.S.A. and West Europe.

Since consumption purchases bulk large in the total GNP, even small fluctuations can be significant. Cyclical movements are especially important in some large industries supplying consumer goods and services, such as automobiles, airlines, travel, and recreation. Knowledge of the factors governing consumption plays a large role in the analysis of the long-run and short-run effects of changing fiscal policies. Alterations in tax rates can influence consumption spending by affecting disposable income. When taxes are raised, reduced income will lead to less spending, but the amount and timing of changes in spending and saving can be particularly important.

The elementary theory of the consumption function is so well known. It is easy to forget what the nature of the original Keynesian rationale was. It was simply that a consumer's expenditure in real terms is a function of his real personal disposable income. Both the marginal propensity to consume and the income elasticity of demand are positive but less than unity. Most current interest in the consumption function concerns much more complex relations of aggregate consumer's behavior. These refinements involve the shape of the function, the exclusion of short-run fluctuations in income, the inclusion of wealth variables, distinctions between sources of income and categories of expenditure and the development of lag structures.

The dependence of consumption on income was, as we have seen, a fundemantal proposition of the "General Theory".

The precise form of this dependence has, however, been the subject of protracted (and continuing) debate. Keynes's fundemental psychological law implied that the marginal propensity to consume was higher than the average propensity to consume, but less than one. Despite the many qualifications which Keynes mentioned, most Keynesian writers initially adopted some simple version of this relationship. These simple models soon run into trouble. First, the collection of national account data and of family budget data suggested that the consumption-income relationship differed according as it was taken to apply to long-run changes, to short-run changes, or to cross section differences in family incomes.

Early national income studies suggested that there had been considerable stability in the average propensity to consume over the long run, if cyclical changes were ignored.

Cyclical changes could probably be explained in terms of lags in the adjustment to changes in income, as Keynes had suggested. Far more difficult was the reconciliation of this apparent long-run constany of the saving ratio with the observation of savings ratios which rose sharply with income in cross-section analysis, and a number of hypothesis were advanced which attempted such reconciliation.

Secondly, it is noted that the simple consumption theories were no more than rough descriptions of observed behavior, and lacked a solid theoretical foundation. In particular, it became evident that once the role of saving in increasing wealth was recognized, the theory of consumption would have to allow for interrelations among consumption, income, and wealth, rather than simply between consumption and incomes.

Of post-war attempts to re-specify the consumption function so as to explain on the one hand both cross-section and time-series behavior, and on the other hand both short-run and long-run changes in the relation between consumption and income, the "Permanent Income Hypothesis" intruduced by Friedman and the "Life-Cycle Hypothesis" introduced by Modigliani and Brumberg have probably had most influence.

Another notable attempt was made by Duesenberry, who accounted for the apparent discrepancy between time-series and cross-section data by suggesting that at any point in time, an individual's propensity to consume depends on his position in the income scale (that is, on his income relative to others) rather than on the absolute level of his income.

Friedman's Permanent Income Hypothesis makes variations in the observed consumption-income ratio depend on differences between actual income and some concept of "normal" income-in this case called "permanent income". Permanent Income reflects the income derived from "non-human wealth" (capital assets) and from "human wealth" (earning capacity), while the remainder of actual or "measured", income comprises all other income elements, attributable essentially to random fluctuations of various kinds. Consumption, analogously, comprises a permanent component which is determined by permanent income, and a random component which is termed "transitory" consumption. Permanent consumption is taken to be a constant fraction of permanent income, the value of the constant fraction for each consumer depending on a variety of factors including wealth, rates of interes, tastes and preferences.

The Life-Cycle Hypothesis results from on attempt to derive an aggregate consumption function from the conventional microeconomic analysis of consumer choice. It is supposed that individuals derive utility from their lifetime streams of consumption and from the bequathing of assets to their heirs. This utility is to be maximized subject to the constraint of the stream of expected earnings, and the function of saving (or dissaving) is then to cope with situations in which current actual income is not equal to the optimum level of current consumption. More formally, if the proportion of his total resources which a consumer plans to consume at some future date is determined only by his tastes and not by the size of his resources (and if the receipt and leaving of legacies are neglected), then at any time, the consumption of any individual will be proportional to the present value of his total resources-that is, to his net worth carried over from the previous period plus current income plus the discounted value of future income receipts. If certain simplifying assumptions are made-that the consumption functions for individuals of the same age are identical, and that the age-structure of the population and relative distributions of income, net worth, and expected future income are all constant this relationship may be aggregated over all consumers to give an aggregate consumption function in which consumption depends on net worth, current income, and expected income.

A main characteristic of this study is to provide a fundemantal microeconomic model for the Life-Cycle and Permanent Income Hypotheses in Chapter II. Macroeconomics is not merely more closely oriented than microeconomics towards policy problems but depends on them for its very existence. As pointed out by Summer and Zis [1984], it is a commonplace that in a world which functioned as smoothly as a Walrasian general equilibrium system, the demand for money would be less significant than the demand for peanuts; indeed, it is dificult to visualize any demand for money as such. There would be no difficulty in determining current investment, since future demand for consumption needs would be declared in advance. The consumption function, a fundamental component of all macroeconomic models, would make no sense because current income, instead of acting as an exogenous constraint on consumer's expenditure would be determined endegenously along with the demand for goods as the outcome of utility-maximizing choices by individual market participants. A statistical relationship between consumption and income would still exist, but it would be devoid of any economic significance. It is only when the conditions assumed in the fullest development of microeconomics do not hold that macroeconomic problems emerge and the central relations of macroeconomics become proper subjects for study.

The main conclusion of the Chapter III can be summarized as follows: Despite its central importance in macroeconomic theory, the theory of aggregate consumption behavior still lacks a really satisfactory underpinning. At the same time, a number of empirical generalizations seem to have been established. First, consumption depends only rather weakly on current income. Rather, it depends either on wealth or on some notion of normal income, both of which will be only marginally affected by short-run changes in actual income. Secondly, most satisfactory versions of the time-series consumption function relate the current level of consumption to current income and to lagged consumption. When this formulation is adopted, it becomes virtually impossible to distinguish empirically between several apparently competing hypotheses. Thirdly, cross-section data must be explained, at least in part, by the variability of household incomes. Finally, there is a strong presumption that in a long-run stationary equilibrium, savings would be zero; adjustment lags of one short or another explain cyclical movements in the savings ratio, while the secular growth of real income (and perhaps of population) must be elements in the explanation of the positive aggregate savings ratios which are observed.

In the final chapter an empirical comparision of the competing theories was made with various consumption functions using cross-section data collected from the urban Adana. It was seen that only two consumption function specifications among the thirty can be acceptable as sucessful. The first one of these two functions is the distributed lag form of the Permanent Income Hypothesis.

The second one is the distributed lag form of the Life-Cycle Hypothesis. Comparison of the marginal propensity to consume out of these models show that the distributed lag form of the Life-Cycle Hypothesis predicts the long-run marginal propensity to consume more correctly. However, the long-run marginal propensity to consume out of the distributed lag form of the Permanent Income Hypothesis does approach to the expected level.

CHAPTER II

THE MICROECONOMIC FOUNDATIONS OF MACROECONOMIC CONSUMPTION FUNCTIONS

In this chapter the approaches which provides the base for aggregate consumption functions were examined in details. The aim of this chapter is to show that the gap between microeconomics and macroeconomics has reached to stage of nearly being closed in the discussion of aggregate consumption functions. Analysis here starts from household decision-making process and extends to provide a foundation for the theories discussed in the coming chapters.

2.1. FRAMEWORK OF HOUSEHOLD DECISION-MAKING

The decisions on which the analyses concentrate are those concerned with work effort, consumption savings, wealth, transfer of wealth and portfolio composition.

The relationship between these different decisions is set out schematically in Table 2.1. At the beginning of the year, the household has a stock of wealth. This wealth may be held in a variety of different assets-cash, government bonds, equities, etc.-and the household must decide how to allocate its portfolio, a decision on which depends the household's investment income derived. This portfolio choice is made under uncertainty being based not only on expected income but also on the risk incurred. The second main decision that effects income is that concerning labor supply: how many hours, whether the wife works, whether to retire, etc. The income derived from these sources together with any amounts received as bequest lotary or gifts during the period, constitute the resources available to the household.

The first decision about the use of resources is how much to consume and how much to save. This decision is our main concern and examined in the coming chapters. Decision about consumption and savings is likely to be influenced by a number of factors, including the need to spread consumption over different periods in the household's lifetime, the requirement to build up a reserve against emergencies,and the desire to leave bequests. The second decision concerns the allocation of the amount that the household plans to consume. How much should the household spend on different commodities? (This discussed in detail in the coming chapters). Third, there is the decision whether to transfer wealth through gifts (and ultimately, bequests) (Atkinson and Stiglitz, 1987, pp.24-25).

TABLE 2.1
HOUSEHOLD DECISION PROCESS*

Decision about work effort ——	Earnings		Savings	—— Decision about savings
	+		+	
Decision about investment of wealth ——	Investment income	= Resources =	Consumption	Decision about allocation of savings
	+		+	
	Bequest and gifts received		Wealth transfers	—— Decision about gifts and bequests

* Adopted from Atkinson and Stiglitz, 1987, p.24.

In considering the effects of different factors on these decisions, there are several points to be born in mind. First, although the decisions are discussed separately, they are highly interdependent. The decision about the pattern of consumption may be influenced by that about work effort; for example, a tennis racquet is of limited value if the person is working all daylight hours. Savings depend on when a person expects to retire. The choice of portfolio may well be related to the saving decision. In what follows, the possibility of interrelationship must be borne in mind.

In describing the various decisions above, we treated them as taking place within single period, but this needs to be embedded in a lifetime model of household behavior (Miller, 1978, pp.70-72). This is most obvious in the case of savings and consumption, but dynamic elements are also significant in the case of labor supply (e.g., occupational choice) or in the case of consumption patterns (e.g., purchase of consumer durables). The decisions made by parents, and later by individuals themselves, may subsequently effect occupational choice, savings behavior, and even patterns of consumption. Models of household intertemporal decision making have received considerable attention in recent years. This applies particularly to theories of life-cycle consumption, of schooling, and of job search. It is in the nature of such models, however, that the analysis is quite complex-even before the introduction of such real-world phenomena as uncertainty and market imperfections (Kogiku, 1971,pp.34-36; Atkinson and Stiglitz, 1987,p.25).

2.1.1. Labor Supply and Household Decision-Making Process

So far, a general introduction to household decision-making process was provided. In the coming chapters, the main concern will be decision about consumption, but not going further, decision about labor supply is discussed in some details since it is referenced frequently.

2.1.1.1. Basic Model of Labor Supply

The basic model postulates that an individual's labor supply is a function of after-tax wage and after-tax income from other sources. For fixed other income, the labor supply curve is often assumed to be such that, for low wages, an increase in the wage increases labor supply, but for high wages the labor supply curve bends backward. The standard model (Robbins, 1930; Cooper,1952) treats the individual as maximizing a utility function defined over net income (Y) and leisure (S), defined to be L_o-L where L_o is the total hours available to the worker and L are the hours spent working, the worker's utility function is

$$U = U(Y,L_o-L); \quad \frac{\delta U}{\delta Y}, \frac{\delta U}{\delta (L_o-L)} > 0 \qquad (2.1)$$

where U refers to utility. The function (2.1) is assumed to be quasi-concave, continuously differentable, and strictly increasing in Y, strictly decreasing in L (Varian, 1978,pp.81-83, 162-163). In the absence of taxation, the individual budget constraint is

$$Y = wL + I \qquad (2.2)$$

where w is wage and I is other income. The individual's choice may be represented as shown in Figure 2.1. Each U (indifference) curve shows all the combinations of Y and S that yield the same level of satisfaction or utility. The points on U_1 represent a higher level of utility than those on U_0. The entire Y,S space is filled with such curves, none crossing any other. L_oI represents other income level. The worker-consumer wants to reach the highest indifference curve possible. At real wage w_o, if the worker chooses to have no leisure at all, he or she will have w_o. All points on or below the budget line are attainable, or feasible; those above it are not. From the budget constraint Y=wL+I, we have dY=-w•dS, so that the slope of the budget line, dY/dS, is -w.

With a given real wage rate, the worker will reach maximum utility at the the point where the straight line is just tangent to an indifference curve, such as Y_0, S_0 in Figure 2.1. This will be the highest indifference curve and thus the highest level of utility, attainable. As the real wage rate changes, the slope of the budget line changes. For example, if the wage rate were

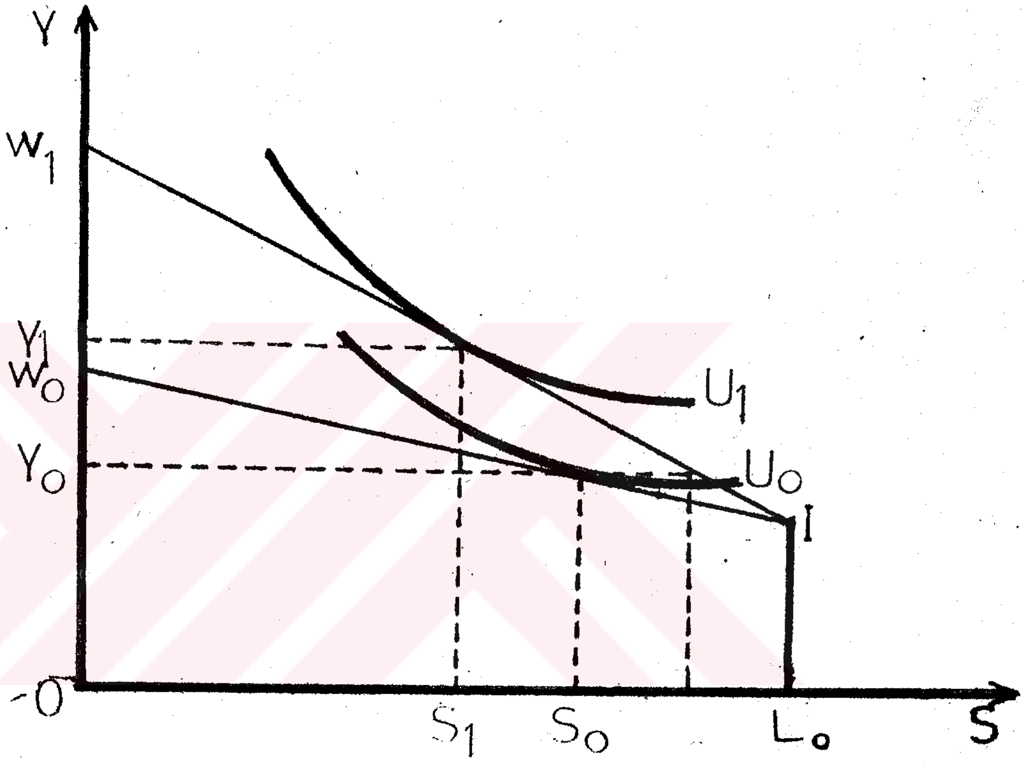

Figure 2.1

increased to w_1, the budget line would swing up to meat the Y-axis at w_1, and the equilibrium point would move Y_1, S_1.

The analysis made so far was very simple. To complete the analysis, we will consider the effect of government on the income part of household decision-making process. A proportional income tax at rate t changes the budget constraint to:

$$Y = (¥L+I)(1-t) \equiv ¥Y + M \qquad (2.3)$$

where ¥ denotes the after-tax wage rate and M after-tax other income. The effects of income tax may be considered in two stages. First there is the tax on other income, I. This shifts the budget constraint down, and with the conventional assumption that leisure is a normal good

($\delta L/\delta M<0$), increases the supply of labor. Second, there is the effect of a tax on wage income, which is usually decomposed into two parts, a substitution effect and an income effect, according to Slutsky equation. In the absence of taxation, we have

$$\frac{\delta L}{\delta w} = \left.\frac{\delta L}{\delta w}\right|_{\bar{U}} + L\,\frac{\delta L}{\delta M} \qquad (2.4)$$

the first term, referred to as the compensated or Slutsky term, is the change in labor that would have occurred had lump-sum income changed in such a way as to leave utility unaltered (Malinvaud, 1972, p.37). This is the substitution effect and is always positive. The second term ($L\delta L/\delta M$) is the income effect, which is the change in labor supply resulting from the fact that, as a result of the increase in wages, individuals are better off.

Combining the two aspects of the income tax, (2.4) may be written as:

$$\frac{dL}{dt} = \frac{\delta L}{\delta ¥}\,\frac{\delta ¥}{\delta t} + \frac{\delta L}{\delta M}\,\frac{\delta M}{\delta t} = -wS - (wL+I)\,\frac{\delta L}{\delta M} \qquad (2.5)$$

In order to illustrate the analysis, let us consider the case where the utility function may be written as

$$U(Y,L) = u_1(Y) + u_2(L_0 - L) \qquad (2.6)$$

Substituting from the budget constraint (2.3), the individual maximizes

$$X(L) \equiv u_1(¥L+M) + u_2\,(L_0 - L) \qquad (2.7)$$

the first order condition is (for an interior solution)

$$X'(L) = ¥u_1'(Y) - u_2 = 0 \qquad (2.8)$$

where u' denotes the first derivative (and u" the second derivative). Differentiating (2.8) again with respect to ¥,

$$(¥^2 u_1'' + u_2'')\,\frac{\delta L}{\delta ¥} = -u_1' - ¥L u_1'' \qquad (2.9)$$

Rearranging,

$$(¥u_1''L+u_2''L/¥)\ \frac{¥}{L}\ \frac{\delta L}{\delta ¥} = -u_1'\left|1-\left(\frac{¥L}{Y}\right)\left(\frac{-u_1''Y}{u_1'}\right)\right| \qquad (2.10)$$

The second-order conditions ensure that the bracket on the left-hand side is negative (as is X"). On the right hand side,

$$-\frac{u_1''Y}{u_1'} \equiv \epsilon^u{}_1 \qquad (2.11)$$

which is the elasticity of the marginal utility of income.

The elasticity of labor supply with respect to the after tax wage is positive or negative depending on whether ϵ_1 times the share of labor in total income is less than or greater than unity (Atkinson and Stiglitz, 1987, p.35). Thus if $\epsilon_1=1$ (i.e., u_1 is logarithmic) then the labor supply curve slopes upward where there is positive other income ($¥L<Y$). This brings out the fact that the Cobb-Douglas utility function:

$$U = a \log Y + (1-a) \log (L_0-L)$$

has rather special implications for labor supply.

The preceding analyses employed the standard model of individual consumer behavior. This may be criticized on a number of grounds, including that it ignores: (1) constraints on individual choice, (2) the enjoyment that many people seem to find in their work (Townsend, 1968), (3) production activities that occur within the household sector and consumption activities within the production sector (Becker, 1965; Lancaster, 1966; and Muth, 1966), and (4) the way labor supply decision are made within a family (Ashenfelter and Heckman, 1974; Sen, 1966).

2.1.1.2. Labor Supply and Consumption Models

Recent literature on consumption models employs labor supply equations directly or indirectly considering the above fact, the studies that use such models are summarized below.

The major difference between modern neoclassical and traditional Keynesian macroeconomic theories is that the former regard observed levels of employment, consumption, and output as realizations from dynamic optimizing decisions by both households and firms, while the latter regard them as reflecting constraints on households and firms. This distinction is clearest in the case of labor supply decisions. In classical macroeconomic models, observed levels of labor supply represent the optimizing choices of households given their perceptions of the macroeconomic environment. In Keynesian macro models, employment is frequently regarded as "demand determined", and fluctuations in employment do not necessarily correspond to any change in desired labor supply (Mankiw, Rotemberg, and Summers 1985, p.227).

Papers by Lucas and Rapping [1969], Altonji [1982], and Hall [1980], attempt to estimate the structural labor supply functions that result from the dynamic optimization of a representative individual. These studies face three difficulties. First, the closed-form solution of this optimization problem is unknown when the environment is stochastic. Second, identification is problematic. Since the labor supply schedule is likely to shifts through time, it is inappropriate to regard the real wage as an exogenous variable. The problem is that satisfactory instruments are almost impossible to find. Labor supply shocks are likely to affect most macroeconomic policy variables.

The third difficulty involves the measurement of expectations. The theory holds that labor supply should be a function of the distribution of the entire path of future real wages and interest rates, not just of the first moments of those variables in the succeeding period. Satisfactory proxies for these expectations are almost impossible to develop (Mankiw, Rotemberg, and Summers, 1985, p.229).

Mankiw, Rotemberg, and Summers [1985] examine a basic premise of many classical macroeconomic models that observed movements in per capita consumption and leisure correspond to the behavior of rational individual who derives pleasure from these two goods and whose utility function is stationary and additively separable over time. That is,

$$V_t = E_t \Sigma p^{\tau - t} U(C_\tau, L_\tau) \qquad (2.12)$$

Here, V_t is expected utility at t, E_t is the expectations operator conditional on information available at t, p is a constant discount factor, C_τ is consumption of goods at τ, L_τ is leisure at τ, and U is a function that is increasing and concave in its two arguments.

Mankiw [1981], Hansen and Singleton [1981], and Hall [1982] attempt to estimate directly the form of U in (2.12) without specifying a model capable of predicting the chosen levels of C_t and L_t. Mankiw, Rotemberg, and Summers [1985] exploit the restrictions on the data imposed by the first order conditions necessary for maximization of (2.12) subject to a budget constraint. In particular, when the representative individual is following his optimal path of consumption and leisure, they impose these three first-order conditions.

$$\frac{Wt\ \delta U/\delta C_t}{Pt\ \delta U/\delta L_t} - 1 = 0 \qquad (2.13)$$

$$E_t\ p\ \frac{\delta U/\delta L_{t+1}}{\delta u/\delta C_t}\ \frac{P_t(1+r_t)}{P_{t+1}} - 1 = 0 \qquad (2.14)$$

$$E_t\ p\ \frac{\delta U/\delta L_{t+1}}{\delta U/\delta L_t}\ \frac{W_t(1+r_t)}{W_{t+1}} - 1 = 0 \qquad (2.15)$$

Here, P_t is the nominal price of a unit of C_t, W_t is the wage the individual receives when he foregoes one unit of L_t, and r_t is the nominal return from holding a security between t and t+1.

The static first order condition (2.13) says that the individual cannot make himself better off by foregoing one unit of consumption (thereby decreasing his utility by $\delta U/\delta C_t$) and spending the proceeds (P_t) on P_t/W_t units of leisure, each of which he values at $\delta U/\delta L_t$. The Euler equation (2.14) for consumption states that along an optimal path the representative individual cannot alter his expected utility by giving up one unit of consumption in period t, investing its cost in any available security and consuming the proceeds in period t+1. The utility cost of giving up a unit of consumption in period t is given by $\delta U/\delta C_t$. The expected utility gain is given by

$$E_t\ p\ \frac{\delta U}{\delta C_{t+1}}\ \frac{\dot{P}_t}{P_{t+1}}\ (1+r_t) \qquad (2.16)$$

Equating the cost and gain from this perturbation yields the first-order condition (2.14). Finally, the Euler equation for leisure (2.15) asserts that along an optimal path the representative individual cannot improve his welfare by working one hour more at t (thereby losing $LU/\delta L_t$ of utility) and using his earnings W_t to purchase a security whose proceeds will be used to buy back W_t $(1+r_t)/W_{t+1}$ of leisure at t+1 in all states of nature. Such an investment would increase expected utility by E_t p $[\delta U/\delta L_{t+1}]$ W_t $(1+r_t)/W_{t+1}$. Therefore, (2.15) ensures that this expression is equal to $\delta U/\delta L_t$ (Mankiw, Rotemberg, and Summers, 1985, pp.130-31).

In order to estimate the instantaneous utility function U, it is necessary to specify a functional form. The most general function used is

$$U(C_t, L_t) = \frac{1}{1-\theta} \left| \frac{C_t^{1-\alpha} - 1}{1-\alpha} + d \frac{L_t^{1-\beta} - 1}{1-\beta} \right|^{1-\theta} \tag{2.17}$$

This utility function, which us used by MaCurdy [1981], has, as special cases, an additively separable utility function in consumption and leisure ($\theta=0$); a CES form for the ordinal utility function characterizing single-period decision making ($\alpha=\beta$); and a logarithmic utility function ($\alpha=1, \beta=1, \theta=1$). This functional form also provides for the possibility of deferential degrees of intertemporal substitution in consumption and leisure. This is easiest to see when $\theta=0$, so that $1/\alpha$ represents the elasticity of intertemporal substitution consumption and $1/\beta$ represents the corresponding elasticity for leisure.

An important approach to the consumption model with wage equation was presented in Sibley [1975]. In Sibley's model, wages are governed by the process

$$w_t = pw_{t-1} + \epsilon_t \tag{2.18}$$

where w_t is the wage in time t, p is constant, and ϵ_t is an identically independently distributed random variable;

$$\epsilon_{min} \leq \epsilon_t \leq \epsilon_{max} \tag{2.19}$$

where $\epsilon_{max} \leq \infty$

Sibley, later, introduces an optimal consumption model with wage income uncertainty. In the model consumer acts so as to maximize the expected sum of discounted utilities of consumption over a planning horizon of T periods. His utility function is increasing, concave, and thrice continuously differentable. In each time period he receives a wage which follows the process (2.18). In any time period t, given the outcome of the wage and given net worth, the consumer can invest in an asset with a safe return r and can also borrow at that rate. Principal plus interest on a loan must be repaid in the period immediately following the one in which the debt was incurred. Since "death" occurs after period T, the consumer cannot borrow in that period (Sibley, 1975, p.69).

The notations in the model are:

w_t = wage in time t, i=0,1,...,t,...,T

W_t = net worth in time t, i=0,1,...,t,...,T

B_t = borrowing in time t, i=0,1,...,t,...,T

C_t = consumption in time t, i=0,1,...,t,...,T

$Y_t \equiv w_t + W_t$

Here, Y_t refers to wealth in time t. The following relationships hold:

$$B_t = C_t - Y_t \tag{2.20}$$

$$W_{t+1} = (Y_t - C_t)\, r \tag{2.21}$$

From (2.20), positive borrowing ($B_t>0$) represents an excess of consumption over wealth. Negative borrowing constitutes investment in the safe asset.

The consumer chooses a list of consumption policies $(C_0, C_1, \ldots, C_T)$ subject to two constraints:

$$C_t = Y_t \tag{2.22}$$

$$\text{Prob } \{C_0 \geq 0,\ C_1 \geq 0, \ldots,\ C_T \geq 0\} = 1 \tag{2.23}$$

Constraint (2.22) is the familiar no-bequest constraint; (2.23) is a solvency constraint, requiring non-negativity of consumption in each period, jointly, with probability one.

To state the model formally, Sibley [1975] assumes the consumer acts so as t to

$$\underset{(C_0,\ldots,C_T)}{\text{Maximize } E} \left| \sum_{i=0}^{T} U(C_i)\delta^i \right|, \qquad \delta > 0 \tag{2.24}$$

Subject to Eq. (2.18), E is the expectations operator taken over $w_0, w_1, \ldots, w_T$. δ is one over one plus the pure rate of time discount (Sibley, 1975, p. 70).

Constraint (2.23) implies and is implied by the inequality constraint

$$0 \leq C_t \leq Y_t + \sum_{i=1}^{T-t} \left| \frac{w_{min,t+i}}{r^i} \right| \tag{2.25}$$

In this expression $w_{min,t+i}$ is the minimum wage in period t+1. In the case of random wages it makes sense to have $W_{min,t+i} \geq 0$.

In order to use the techniques of discrete dynamic programming to solve the control problem (2.24), Sibley [1975] defines the optimal value function:

$$V^{t}(Y_t) = \max_{\{c_t, C_{t+1}, \ldots, C_T\}} E \left| \sum_{i=t}^{T} U(C_i)\delta^{i-t} \right| \qquad (2.26)$$

subject to the above constraints. It is straightforward to show that $V^{t}(Y_t)$ is increasing, concave and thrice continuously differentable in Y_t as long as U(C) is in C. From (2.25), (2.26), and Principle of Optimality, the following functional equation holds along the optimal path:

$$V^{t}(Y_t) = \max_{\{c_t\}} \{U(C_t) + \delta EV^{t+1}((Y_t - C_t)r + w_{t+1})\} \qquad (2.27)$$

$$\text{S.t. } 0 \leq C_t + \sum_{i=1}^{T-t} \frac{W_{min,t+i}}{r^{i}} \qquad (2.28)$$

Under these conditions, the optimal level of consumption in time t given Y_t, is such that

$$U'(C_t^{*}) = r\delta EV_y^{t+1}(\cdot) \qquad (2.29)$$

In words, the current marginal utility of consumption should equal to discounted expected marginal valuation of wealth over the T-t periods remaining in the planing horizon. Given the concavity of the problem (2.29) implies $1 > \delta C_t / \delta Y_t > 0$.

Some models analogous to those two explained above employed in Kahn and Mookherjee [1988], Jones [1988], Barro and King [1984], Hamburger [1955], Campbell [1987], and Browning, Deaton and Irish [1985].

2.1.2. Household Decision-Making about Consumption

Now, the theory of consumer choice will be applied to the allocation of consumption over time. This analysis is the basis of all modern work on the consumption function and of a great deal of the literature on economic growth. Keynesian consumption hypotheses were based largely upon introspection and the most causal observation. On more solid base Keynes propounded what he called his "fundamental psychological law". Keynes may also have seen intuitively that his function is consistent with the behavior of a rational consumer of given tastes, nevertheless, he failed to provide any detailed <u>a priori</u> argument showing how the behavior he described would necessarily follow from the usual psychological assumptions which economists make. However, numerous later economists have sought to derive the consumption-income relationship from or integrate it with the general analysis of consumer preference which constitutes an important cornerstone of microeconomics. For instance Friedman [1957], Modigliani and Brumberg [1954], and Modigliani and Brumberg [1980].

One might reason crudely, for instance, from the notion of diminishing marginal utility of particular goods as their quantities increase, to diminishing marginal utility of goods in general. Indeed, the idea of a diminishing marginal utility of income was specifically formulated by Marshall and other writers. By itself, however, this will not support the proposition that only a portion of an increment of income would be consumed. It needs to be supplemented by some concepts of a diminishing (but positive) marginal utility of saving. Income must either be consumed or saved and the optimum division between the two must involve equal marginal utilities of consumption and saving. An increase in income will be divided so as to maintain this equity, at a lover level of marginal utility for each. This will involve both more consumption and more saving. Although various explanation can be developed for a diminishing utility of saving, the basic idea that consumption and saving are competitive sources of utility is already in the classical interest rate analysis, with its view that the margin between consumption and saving will be shifted by a change in the interest rate. In fact, a single formulation of the conditions for utility maximization will permit derivation both of the interest elasticity and the income elasticity of saving and consumption (Ackley, 1967, pp.219-20).

The problem area can involve extremely complex analyses. Therefore, we will start with some basic concepts before forwarding the analyses.

<u>2.1.2.1. Basic Concepts</u>

Multiperiod consumption analysis requires the introduction of several concepts to describe the methods and costs of borrowing and lending, and to determine the present values of wealth consumption and income.

<u>2.1.2.1.1. The Bond Market</u>

Borrowing and lending are introduced with the following simplifying assumptions: (1) consumers and entrepreneurs are free to enter into borrowing and lending contracts only on the first day of each period; (2) there is only one type of credit instrument: bonds with a one-period duration; (3) the bond market is perfectly competitive; (4) borrowers sell bonds to lenders in exchange for specific amount of account; and (5) loans plus borrowing fees are repaid without default on the following marketing date (Bulmuş, 1984, p.35)

Let B_t be the bond position of some individual at the end of trading on the t(th) marketing date. The sign of B_t signifies whether he is a borrower or lender. If $B_t < 0$, he is a borrower with bonds outstanding and must repay B_t plus the appropriate borrowing fee on the (t+1)th marketing date. If $B_t > 0$, he is a lender who holds the bonds of others and will receive B_t plus the appropriate borrowing fee on the (t+1)th marketing date. Since borrowing fees are also expressed in terms of money of account, they may be quoted as proportions of the amounts borrowed. On the (t+1)th marketing date a borrower must repay $(1+r_t)$ times the amount he borrowed on the t(th). The proportion r_t is the market rate of interest connecting the t(th) and (t+1)th marketing dates (Henderson and Quandt, 1958, p.226).

2.1.2.1.2. Market Rates of Return

Individuals desiring to borrow for a duration of more than one period can sell new bonds on successive marketing dates to pay off the principal and interest on their maturing issues. Similarly, lenders may reinvest their principal and interest income. Consider the case of an individual who invest B_t monetary unit on the (t)th marketing date and continues to reinvest both principal and interest until the (T)th marketing date. The value of his investment at the beginning of the (t+1)th marketing date is $B_t(1+r_t)$. If he invest the entire amount, the value of his investment at the beginning of the (t+2)th marketing date is $B_t(1+r_t)(1+r_{t+1})$. The value of his investment at the beginning of the (T) th marketing date is

$$B_t \ (1+r_t)\ (1+r_{t+1})\ \ldots\ (1+r_{T-1}) \qquad (2.30)$$

The total return on this investment is

$$J = B_t(1+r_t)\ (1+r_{t+1})\ \ldots\ (1+r_{T-1}) - B_t \qquad (2.31)$$

Since the bond market is perfectly competitive, the average and marginal rates of return (ϵ_{tT}) for this investment are equal and constant:

$$\epsilon_{tT} = \frac{J}{B_t} = \frac{dJ}{dB_t} = (1+r_t)\ (1+r_{t+1})\ldots(1+r_{T-1}) - 1 \quad (2.32)$$

It is convenient do define

$$\epsilon_{tt} = 0 \quad (2.33)$$

which states that an investor will earn a zero rate of return if he buys and sells bonds on the same marketing date (Bulmuş,1984, p.37; Hirshlefier, 1970, pp.57–8).

If the investor expects a constant rate of interest, $r_t = \ldots = r_{T-1} = r$, Eqs. (2.32) and (2.33) become,

$$\epsilon_{tT} = (1+r)^{T-t} - 1 \quad (2.34)$$

<u>2.1.2.1.3. Discount Rates and Present Values</u>

The existence of a bond market implies that a rational individual will not consider one monetary unit payable on the current (t=1) marketing date equivalent to 1 monetary value payable on some future marketing date. If he invest 1 monetary value in bonds on the current marketing date, he will receive $(1+r_1)$ monetary unit on the second marketing date. One monetary unit payable on the second marketing date is the market equivalent of $(1+r_1)^{-1}=1/(1+r_1)$ monetary value payable on the first date. The ratio $(1+r_1)^{-1}$ is the "discount date" for amounts payable on the second marketing date. The "present value", sometimes called discounted value, Y2 monetary unit payable on the second marketing date is $Y2(1+r_1)^{-1}$ monetary unit (Henderson and Quandt, 1958, p.228),

Discount rates can be defined for amounts payable on any marketing date. In general, the discount for sums payable on the (t)th marketing date is

$$[(1+r_1)\ (1+r_2)\ \ldots\ (1+r_{t-1})]^{-1} = (1+\epsilon_{1t})^{-1} \quad (2.35)$$

It follows from (2.32) and (2.33) that an investment of $(1+\epsilon_{1t})^{-1}$ monetary unit on the first marketing date will have a value of 1 monetary unit on the (t)th.

An entire income or outlay stream and consumptions over time can be expressed in terms of their present values, a single number. Consider the income stream $(Y_1, Y_2, \ldots, Y_T)$ where Y_t is the income. The present value (Y) of this stream is

$$Y = Y_1 + \frac{Y_2}{(1+\epsilon 12)} + \ldots + \frac{Y_T}{(1+\epsilon_{1t})} \qquad (2.36)$$

the present value of consumption plans $(C_1, C_2, \ldots, C_T)$ over time is

$$C = C_1 + \frac{C_2}{(1+\epsilon_{12})} + \ldots + \frac{C_T}{(1+\epsilon_{1T})} \qquad (2.37)$$

In the two-period analysis, the wealth W_1 associated with an arbitrary consumption combinations (C_1, C_1) can be defined by $W_1 = C_1 + C_2/(1+r_2)$, where r_2 is the interest rate established by the market for exchanges between funds of time 1 and time 2. More generally there will be distinct market interest rates r_1, $r_2, \ldots, r_T$ for exchanges between each time t and the preceding period t-1. The equation for wealth may then be written as

$$W_1 = C_1 + \frac{C_2}{(1+\epsilon_{12})} + \frac{C_3}{(1+\epsilon_{13})} + \ldots + \frac{C_T}{(1+\epsilon_{1T})} \qquad (2.38)$$

(2.38) can be rewritten as

$$W_1 = C_1 + \frac{C_2}{(1+r_2)} + \frac{C_3}{(1+r_3)(1+r_2)} + \ldots + \frac{C_T}{(1+r_T)\ldots(1+r_3)\,(1+r_2)} \qquad (2.39)$$

In the continuous form (2.39) can be written as

$$W_1 = \int_1^T C(t)e^{-rt}dt \qquad (2.40)$$

In this formula the consumption element C_t for each time period has been carried back in time, to the present or (1)th period, by successive discounting at the rates established by the market for conversion of monetary unit of each period into monetary unit of the next preceding period (Hirshleifer, 1970, p.38).

Less frequently, we will be concerned with the "compounded" or "terminal" value W_T-wealth measured in units of C_T-as opposed to the discounted or present value W_1.

$$W_T = C_1 [(1+r_2)(1+r_3)\ldots(1+r_T)] + C_2 [(1+r_3)\ldots(1+r_T)] + \ldots + C_{T-1}(1+r_T) + C_T \qquad (2.41)$$

Compounding is the inverse process to discounting.

2.1.2.2. Multiperiod Consumption

Modern consumption functions are derived from the classical-microeconomic theory. In this part, a pure microeconomic-multiperiod consumption model is introduced and later it will be shown that how consumption functions can be derived from this microeconomic model.

2.1.2.2.1. A Pure Microeconomic Model of Multiperiod Consumption

A consumer generally receives income and purchases commodities on each marketing date. His present purchases are influenced by his expectations regarding future prices and income levels, and he must tentatively plan purchases for future marketing dates. If his expectations prove correct and his tastes do not differ from the expected pattern, his tentative plans will be carried out on future marketing dates. If his expectations are not realized, he will revise his tentative plans . The present discussion is restricted to a consumer who formulates an integrated plan on the current marketing date for his consumption expenditures on n goods over a horizon containing T periods. His horizon is simply the period of time for which he plans on the current marketing date. It may be of any length, but for simplicity assume that it corresponds to the remainder of his expected lifetime. It is not essential that he actually know how long he will live; it is not necessary that he presently plan as if he did. If his life expectancy should change in the future, he would alter his horizon accordingly and revise his plans (Malinvaud, 1971, pp.230-31; Henderson and Quandt, 1958, p.229).

2.1.2.2.1.1. The Multiperiod Utility Function

In the most general case the consumer's ordinal utility index depends upon his planned consumption of each of the n goods in each of the T time periods.

$$U = U(q_{11},\ldots,q_{n1},q_{12},\ldots,q_{n2},\ldots,q_{1T},\ldots,q_{nT}) \qquad (2.42)$$

where q_{it} is the quantity of Q_i that the purchases on the (t)th marketing date and consumers during the (t)th period.

The above utility is assumed to be quasi-concave, continuously differentable, and strictly increasing in Q (Kogiku, 1971, pp.11-4). Further, completeness, reflexity, transivity, continuity, strong monotonity, local nonsatiation and strict convexity of consumer preferences are assumed (Varian, 1978, pp.80-2).

The construction of a single utility index does not imply that the consumer expects his tastes to remain unchanged over time. It only implies that he plans as if he know the manner in which they will change. For example, he may know that a baby carriage will yield a great deal of satisfaction during the years in which he is raising his family and no satisfaction at all during the years of his retirement. (2.42) does not necessarily valid for the consumer's entire planning horizon. It merely express his present expectations. A change in his objective circumstances or subjective desires may cause him to revise his utility index on some future marketing date.

2.1.2.2.1.2. The Budget Constraint

The consumer expects to receive the earned income stream $(Y_1, Y_2, \ldots, Y_T)$ on the marketing dates within his planning horizon. Generally his expected-income stream is not even over time. One possibility is a relatively low earned income during the early years of the consumers working life, which increases as he gains training and seniority and reaches a peak during the middle years of his working life. His earned income may then begin to fall and become zero after retirement. Whatever his earned-income stream may be, it will seldom coincide with his desired consumption stream. Through borrowing and lending he is able to reconcile the two streams (Henderson and Quandt,1955, p.230)

The consumer's total income receipts on the (t)th marketing date are the some of his earned income and his interest income from bonds held during the preceding period: $[Y_t + (r_{t-1} B_{t-1})]$. His interest income will be positive if his bond holdings are positive and negative if his bond holdings are negative. His expected savings on the (t)th marketing date, denoted by St, are defined as the difference between his expected income and total consumption expenditures on that date:

$$S_t = Y_t + r_{t-1} B_{t-1} - \sum_{j=1}^{n} p_{jt} q_{jt} \quad (t=1,\ldots,T) \qquad (2.43)$$

where p_{j1} is the price of Q_j on the initial marketing date and p_{jt} (t=2,...,T) is the price that he expects to prevail for Q_j on the (t)th marketing date. Similarly, r_1 is the rate of interest determined on the initial marketing date and r_t (t=2,....,T-1) is the rate of interest that the consumer expects to prevail on the (t)th marketing date. The consumer's savings will be negative if his expenditures exceed his total income.

If the consumer is at the beginning of his earning life, his initial bond holding (B_1) represents his inherited wealth. If he is revising his plans at a date subsequent to the beginning of his earning life, his bond holdings also reflect the results of his post saving decisions. To simplify the present analysis assume that he is at the beginning of his earning life and that B_0=0. On each marketing the consumer will increase or decrease the value of his bond holdings by the amount of his savings on that date:

$$B_t = B_{t-1} + S_t \qquad (t=1,...,T) \qquad (2.44)$$

A "typical" consumer might dissave and go into debt during the early years of his earning life while he is earning a comparatively low income, buying a home, and raising a family; then save to retire his debts and establish a positive bond position during the remainder of his working life; and finally dissave and liquidate his bonds during retirement (Bulmuş, 1984, pp.40–1; Miller, 1978, pp.133–34).

Taking (2.43) and (2.44) together, the consumer's planned bond holdings after trading on the (τ)th marketing date can be expressed as a function of his earned incomes, his consumption levels, prices and interest rates:

$$B_1 = (Y_1 - \sum_{j=1}^{n} p_{j1}q_{j1}) \qquad (2.45)$$

$$B_2 = (Y_1 - \sum_{j=1}^{n} p_{j1}q_{j1})\ (1+r_1) + (Y_2 - \sum_{j=1}^{n} p_{j2}q_{j2}) \qquad (2.46)$$

and in general, utilizing (2.32),

$$B_\tau = \sum_{t=1}^{\tau} (Y_t - \sum_{j=1}^{n} p_{jt}q_{jt})\ (1+\epsilon_{t\tau}) \quad (\tau=1,...,T) \qquad (2.47)$$

The consumer's bond holdings after trade on the (τ)th marketing date equal the algebraic sum of all his savings, net of interest expense or income, through that date with interest compounded on each.

In the single-period case the optimizing consumer would buy a sufficiently large quantity of each commodity to reach complete satiation if he did not possess a budget constraint. A similar situation would arise in the multiperiod case if there were no limitation upon the amount of debt that he could amass over his lifetime. The budget constraint for a multiperiod analysis can be expressed as a restriction upon the amount of the consumer's terminal bond holdings (B_T). He may plan to leave an estate (or debts) for his heirs, but for simplicity assume that he plans to leave his heirs neither assets nor debts. Evaluating B_T from (2.47), his budget constraint is:

$$B_T = \sum_{t=1}^{T} (Y_t - \sum_{j=1}^{n} p_{jt}q_{jt}) (1+\epsilon_{tT}) = 0 \qquad (2.48)$$

Dividing through by the constraint $(1+\epsilon_{1T})$ and moving the consumption expenditure terms to the right, the consumer's budget constraint can also be written as.

$$\sum_{t=1}^{T} Y_t (1+\epsilon_{1t})^{-1} = \sum_{t=1}^{T} \sum_{j=1}^{n} p_{jt}q_{jt} (1+\epsilon_{1t})^{-1} \qquad (2.49)$$

since

$$\frac{1+\epsilon_{tT}}{1+\epsilon_{1T}} = \frac{(1+r_t) \dots (1+r_{T-1})}{(1+r_1) \dots (1+r_{T-1})} = \frac{1}{(1+r_1)\ (1+r_{t-1})}$$
$$= (1+\epsilon_{1t})^{-1} \qquad (2.50)$$

In the form (2.49) the budget constraint states that the consumer equates the present values of his earned income and consumption streams (Malinvaud, 1972, p.236; Henderson and Quandt, 1958, p.232).

2.1.2.2.1.3. Utility Maximization

The consumer desires to maximize the level of his lifetime utility function (2.42) subject to his budget constraint (2.49). Form the function

$$U^* = U(q_{11},\dots,q_{nT}) + \Omega \sum_{t=1}^{T} (Y_t - \sum_{j=1}^{n} p_{jt}q_{jt}) (1+\epsilon_{1t})^{-1} \qquad (2.51)$$

and set its partial derivatives equal to zero:

$$\frac{\partial U^*}{\partial q_{jt}} = \frac{\partial U}{\partial q_{jt}} - \Omega \, (1+\epsilon_{1t})^{-1} \, p_{jt} = 0 \quad \begin{matrix}(j=1,\ldots,n)\\(t=1,\ldots,T)\end{matrix} \qquad (2.52)$$

$$\frac{\partial U^*}{\partial \Omega} = \sum_{t=1}^{T} (Y_t - \sum_{j=1}^{n} p_{jt} q_{jt}) \, (1+\epsilon_{1t}) = 0 \qquad (2.53)$$

and

$$-\frac{\partial q_{jt}}{\partial q_{k\tau}} = \frac{\partial U/\partial q_{k\tau}}{\partial U/\partial q_{jt}} = \frac{p_{kt} \, (1+\epsilon_{1\tau})^{-1}}{p_{jt} \, (1+\epsilon_{1t})^{-1}} \quad \begin{matrix}(j,k=1,..,n)\\(t,\tau=1,..,T)\end{matrix} \qquad (2.54)$$

The consumer must equate the rates of substitution between each pair of commodities in every pair of periods to the ratio of their discounted prices. The first-order conditions are similar to those for the single-period analysis. Commodities are now distinguished by time period as well as kind, and discounted prices have replaced simple prices. Once these modifications have been made, the second order conditions are the same as the general one-period analysis. Income and substitution effects can be defined with respect to the changes in the discounted prices of the various commodities on the various marketing dates if the interest rates remain unchanged (Malinvaud, 1972, pp.232-33); Henderson and Quandt, 1958, pp.232-33).

2.1.2.2.2. A Modified General Model of Multiperiod Consumption

Though much of the analysis of multiperiod consumption is formally identical with the analysis for a single period, the explicit introduction of time and interest rates presents a number of new problems. Attention is centered upon the unique problems of multiperiod consumption by assuming that actual and expected commodity prices are fixed in value and remain unchanged. The consumer's problem can then be stated as that of selecting an optimal time pattern for his consumption expenditures.

Consumption will be postulated to be the sole end of economic activity. The world "consumption" will not here be verbally defined;it is a primitive term in the theory. To postulate itself is not such a self-evident truth as might appear at first sight:

> There is the "work to live" school in which wants are treated as ends, and the "live to work" school in which activities are treated

> as ends... One who (implicitly, perhaps) takes the former position, like Alvin Hansen, is likely to regard existing wants as primary and the consumer as the dominant economic entity. From this it is but a short step to the idea of stable consumption function and from the stable consumption function to the idea of stagnation. On the other hand,. one who takes the latter viewpoint, like Schumpeter, will conceive of activities as primary. The producer-innovator is the dominant economic entity; innovation is the prevailing theme, even though it may come in waves, and one arrives at a theory of economic development (Friedman, 1962, p.12).

This divergence of point of view has special significance in the theory of intertemporal choice, where one school of thought has it that saving or accumulation is nothing but deferred consumption ("save to live") while the other maintains that the accumulation is an object of choice independent of consumption ("live to save"). The main theoretical development here accepts the consumption-oriented viewpoint, the traditional line of economic theory, though certainly all the complexities of human motivation are not fully represented thereby.

2.1.2.2.2.1. The Consumption-Utility Function

For pairs of commodities purchased on a particular marketing date, the first-order condition given by (2.54) become

$$-\frac{\delta q_{jt}}{\delta q_{kt}} = \frac{p_{kt}}{p_{jt}} \qquad (j,k = 1,\ldots,n) \quad (t = 1,\ldots,T) \qquad (2.55)$$

The consumer equates the rate of commodity substitution between every point of commodities purchased on a single marketing date to their simple price ratio. The interperiod substitution rates are independent of the interest rates. Thus, with regard to purchases on each marketing date t, the consumer satisfies the first-order conditions for single-period utility maximization, with the expection of the single period budget constraint. The consumer's optimization problem can be separated into two parts:

1. The selection of optimal values for his total consumption expenditures on the various marketing dates, and

2. The selection of optimal commodity combinations corresponding to the planned expenditures on each marketing date.

Once the first problem has been solved, the consumer can solve the second by formulating T independent single-period problems with the optimal total consumption expenditures serving as single-period budget constraints (Henderson and Quandt, 1958, p.234; Malinvaud, 1972, p.234).

Define C_t as the consumer's total expenditure for commodities on the (t)th marketing date.

$$C_t = \sum_{j=1}^{n} p_{jt} q_{jt} \qquad (t=1,\dots,T) \qquad (2.56)$$

The utility function (2.42), together with (2.56) and the (n-1)T independent equations of (2.55), forms a system of (nT+1) equations in (nT+T+1) variables; U, q_{jt} (j=1,...,n) (t=1,...,T), and C_t (t=1,...,T). Generally, nT of these equations can be utilized to eliminate the q_{jt}(s), and the consumer's utility function can be expressed as a function of his consumption expenditures:

$$U = U(C_1,\dots,C_t,\dots,C_T) \qquad (2.57)$$

The utility function has the following properties: U is twice-differentiable; U is increasing. That is $U_1, U_2, \dots, U_T$ are positive and therefore there is no satiation; U is strictly quasi-concave,

$$\begin{vmatrix} U_{11} & U_{12} & \cdots & U_{1T} & U_1 \\ U_{21} & U_{22} & \cdots & U_{2T} & U_2 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ U_{T1} & U_{T2} & \cdots & U_{TT} & U_T \\ U_1 & U_2 & \cdots & U_T & 0 \end{vmatrix} > 0 \qquad (2.58)$$

that is, indifference curves are strictly convex to the origin, or the marginal rate of substitution is strictly diminishing (Kogiku, 1971, p.238).

Since (2.57) is constructed on the assumption that (2.55) is satisfied, it gives the maximum value of utility corresponding to each consumption-expenditure pattern. The consumer's time-substitution rate:

$$-\frac{\delta C_\tau}{\delta C_t} = \frac{U_t}{U_\tau} \qquad (t,\tau = 1,\ldots,T \qquad (2.59)$$

is the rate at which consumption expenditure on the (τ)th marketing date must be increased to compensate for a reduction of consumption expenditure on the (t)th in order to leave the consumer's satisfaction level unchanged. No generality is lost by limiting attention to the cases for which $\tau > t$. The above rate is defined as the consumer's rate of time preference for consumption in period t rather than period τ and is denoted by $\Phi_{t,\tau}$:

$$\Phi_{t,\tau} = \frac{\delta C_\tau}{\delta C_t} - 1 \qquad (t,\tau = 1,\ldots,T) \ (\tau > t) \qquad (2.60)$$

The consumer's rates of time preference may be negative for some consumptions time patterns, i.e., he may willing to sacrifice a lira's worth of consumption in period t in order to secure less than a lira's worth in a later period. The consumer's subjective rates of time preference are derived from his consumption-utility function and depend on the levels of his consumption expenditures. They are independent of the market rates of interest and his borrowing and lending opportunities.

In some cases we will use the terms "subjective discount factor" and "personal rate of discount" instead of "rate of time preference" since these three terms are used as same meanings in the literature (See Varian [1978]; Malinvaud [1972]; Miller [1978]; Tobin [1976], Modigliani [1986], and Hirshleifer [1970]).

2.1.2.2.2.2. The Consumption Plan: An Intertemporal Optimizing Model of Consumption

The basic postulate of the theory is that it is consumption that yields satisfaction. The objects of choice that underlie the savings decision must be consumption both now and in the future. Obviously, a full characterization of this choice problem would have us considering the time path of consumption over an individual's planning horizon, a horizon which might well be as long as his lifetime.

The consumer's utility maximization problem can now be reformulated using his consumption expenditures as variables. He wants to maximize the level of his consumption-utility function, $U=U(C_1,C_2,\ldots,C_t,\ldots, C_T)$, subject to his lifetime budget constraint. From the function

$$U^{*} = U(C_1, C_2, \ldots, C_t, \ldots, C_T) + \Omega \sum_{t=1}^{T} (Y_t - C_t)\ (1+\in_{1t}) \qquad (2.61)$$

some authors, such as Carlino [1982], Evans [1983], Bernanke [1985], Landsberger [1970], Weber [1971], and White [1978], prefer the following form:

$$U(C_1, C_2, \ldots, C_t, \ldots, C_T) = \sum_{t=1}^{T} U(C_t)\ (1+\Phi)^{-t} \qquad (2.62)$$

or, in continuous form,

$$\int_{1}^{T} U(C(t))\ e^{-\Phi t}\ dt \qquad (2.63)$$

where Φ is subjective discounting factor.

There is no difference between (2.61), (2.62) and (2.63) in the meaning (Modigliani, 1975, p.6).

Setting the partial derivatives of (2.61) equal to zero:

$$\frac{\delta U^{*}}{\delta C_t} = U_t - \Omega\ (1+\in_{1t})^{-1} = 0 \qquad (t = 1, \ldots, T) \qquad (2.64)$$

$$\frac{\delta U^{*}}{\delta \Omega} = \sum_{t=1}^{T} (Y_t - C_t)\ (1+\in_{1t})^{-1} = 0 \qquad (2.65)$$

and

$$-\frac{\delta C_\tau}{\delta C_t} = \frac{(1+\in_{1t})^{-1}}{(1+\in_{1\tau})^{-1}} = (1+\in_{t\tau}) \qquad (t, \tau = 1, \ldots, T \qquad (2.66)$$

and substituting from (2.32) and (2.60),

$$\Phi_{t\tau} = \in_{t\tau} \qquad (t, \tau = 1, \ldots, T)\ (\tau > t) \qquad (2.67)$$

The consumer in this case adjust his subjective preference to his market opportunities by equating his rate of time preference (subjective discounting factor) between every pair of periods to the corresponding market rate of return (interest rate). If $\Phi_{t\tau}$ were less than $\in_{t\tau}$, the consumer could buy bonds and receive a premium greater than necessary to maintain indifference. If $\Phi_{t\tau}$ were greater than $\in_{t\tau}$, he could increase his satisfaction by selling bonds and increasing his consumption in period t at the expense of consumption in period τ. Though $\Phi_{t\tau}$ may be negative for some consumption-expenditure patterns the observed (optimum) values of $\Phi_{t\tau}$ will always be positive if the interest rates are positive (Bulmuş, 1984, pp.64-5).

It is usually assumed in actual observed situations that the subjective discounting factors are in most cases less than 1 and that most subjective interest rates are positive. This may result from the joint realization of two assumptions and one particular circumstance. According to the first assumption, individuals show a systematic psychological preference for the present over the future; this can be called "impatience". By this we mean that, if the consumption plan involves the same quantities at all dates for each good, then the increase in C_{it} to compensate for a decrease of one unit in C_{i1} must be greater than 1. This may be seen in Fig.2.2. Consider in particular the case of a single good and two dates. The consumer's indifference curves can be represented on a graph with C11 as abscissa and C_{12} as ordinate. With respect to the particular vector C, the subjective discount factor $\Phi_{t\tau}$ (for the second period) is determined by the tangent to the indifference curve passing through C, as shown in Fig.2.2. It follows from (2.59) that it is in fact the gradient of the normal to this tangent. The definition of the subjective interest rate implies that the vector $(1+\epsilon_{t\tau},1)$ is collinear with the vector $(1, \Phi_{t\tau})$ and is therefore parallel to the normal at C. On Fig. 2.2., at any point on the line $C_{11}=C_{12}$, the tangent to the indifference curve would have a gradient whose absolute value is greater than 1. The second assumption is that the utility functions are quasi-concave. The effect of this on the graph would be to make the indifference curves concave upwards. Finally, the consumption plans usually considered involve greater future than present consumption. In the particular case of Fig.2.2. C would lie above the line $C_{11}=C_{12}$. The gradient of the tangent to U_1 at C would then be greater than the gradient of the tangent at the point of intersection with the bisector. The subjective interest rate would be higher at C than at this point of intersection, and therefore a fortiori would be greater than 1 (Malinvaud, 1972, pp.235-36).

Returning to the maximization of consumption utility function, second-order conditions require that the principal minors of the relevant bordered Hessian determinant alternate in sign:

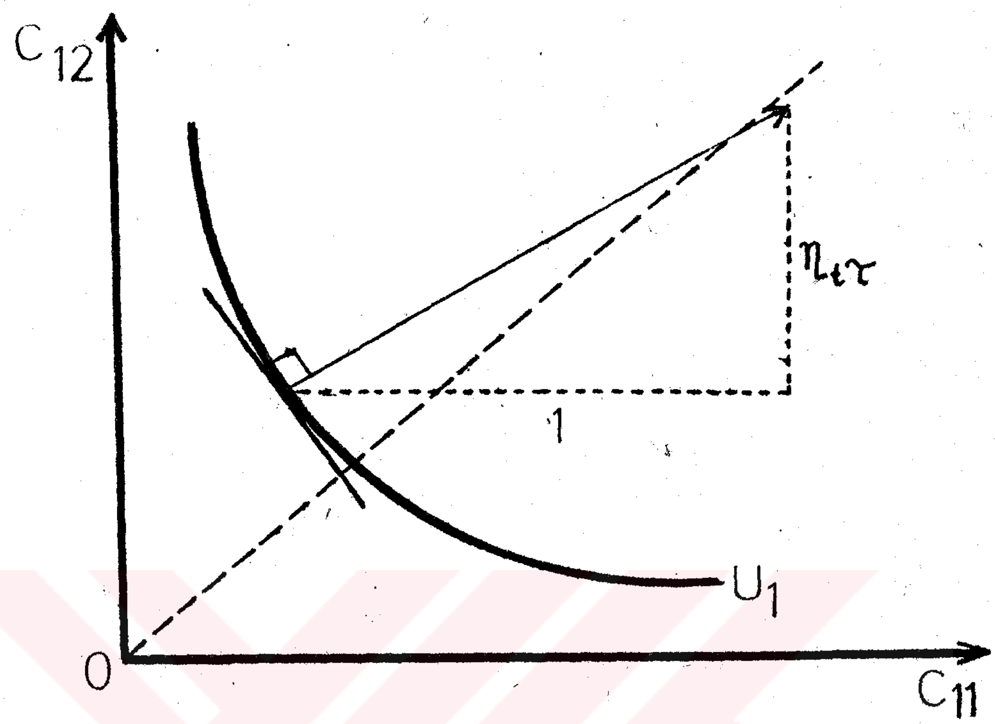

Figure 2.2

$$\begin{vmatrix} U_{11} & U_{12} & -1 \\ U_{21} & U_{22} & -(1+\epsilon_{12})^{-1} \\ -1 & -(1+\epsilon_{12})^{-1} & 0 \end{vmatrix} > 0; \tag{2.68}$$

$$\begin{vmatrix} U_{11} & U_{12} & U_{13} & -1 \\ U_{21} & U_{22} & U_{23} & -(1+\epsilon_{12})^{-1} \\ U_{31} & U_{32} & U_{33} & -(1+\epsilon_{13})^{-1} \\ -1 & -(1+\epsilon_{12})^{-1} & -(1+\epsilon_{13})^{-1} & 0 \end{vmatrix} < 0$$

From (2.68) it may be verified that the second-order conditions imply that the rates of time preference be decreasing.

The two-period horizon case can be described graphically by giving a new interpretation to the conventional indifference curve diagram (Sachs, 1981, p.216).

Let us consider as an example a two-period case in which the individual has an income stream Y_1, Y_2 and wants to maximize:

$$U = U(C_1, C_2) \tag{2.69}$$

subject to the borrowing lending constraint

$$C_1 + \frac{C_2}{(1+r)} = Y_1 + \frac{Y_2}{(1+r)} \tag{2.70}$$

If all income is consumed in period 1, total consumption is equal to

$$Y_1 + \frac{Y_2}{(1+r)} \tag{2.71}$$

If, on the other hand, all income is saved in period 1, total income available in period 2 is

$$Y_2 + Y_1 (1+r) \tag{2.72}$$

or period 2 income plus income from period 1.

Therefore, assuming perfect capital markets and perfect certainty we have (Timbrell, 1976, p.171).

$$C_1 \leq Y_1 \frac{Y_2}{(1+r)} \tag{2.73}$$

and

$$C_2 \leq Y_2 + Y_1 (1+r) \tag{2.74}$$

We assume that consumer can either lend or borrow money at the interest rate r. Thus, if his income in period 1 greater than the value of goods and services he wants to consume in that period, he can lend, that is, save. His unspent income is:

$$S_1 = Y_1 - C_1 \tag{2.75}$$

By lending this amount, he will receive in period 2 an amount equal to $S_1 (1+r)$, so that his consumption in period 2 can exceed his income by that amount, which is his period 2 dissaving, S_2 becomes:

$$S_2 = -(1+r)\ S_1 = Y_2 - C_2 \tag{2.76}$$

The minus sign enters equation (2.76) because the dissaving in period 2 is of the opposite sign to the saving in period 1, and $C_2 > Y_2$. Dividing the expression for S_2 by that of S_1 yields the trade-off between present and future consumption

$$\frac{S_2}{S_1} = -\frac{S_1\ (1+r)}{S_1} = \frac{Y_2 - C_2}{Y_1 - C_1} \tag{2.77}$$

From the right hand equality in (2.77), by canceling S_1s and multiplying through by $(Y_1 - C_1)$, we obtain

$$Y_2 - C_2 = -(1+r)\ (Y_1 - C_1) \tag{2.78}$$

This says that by reducing consumption in period 1 below

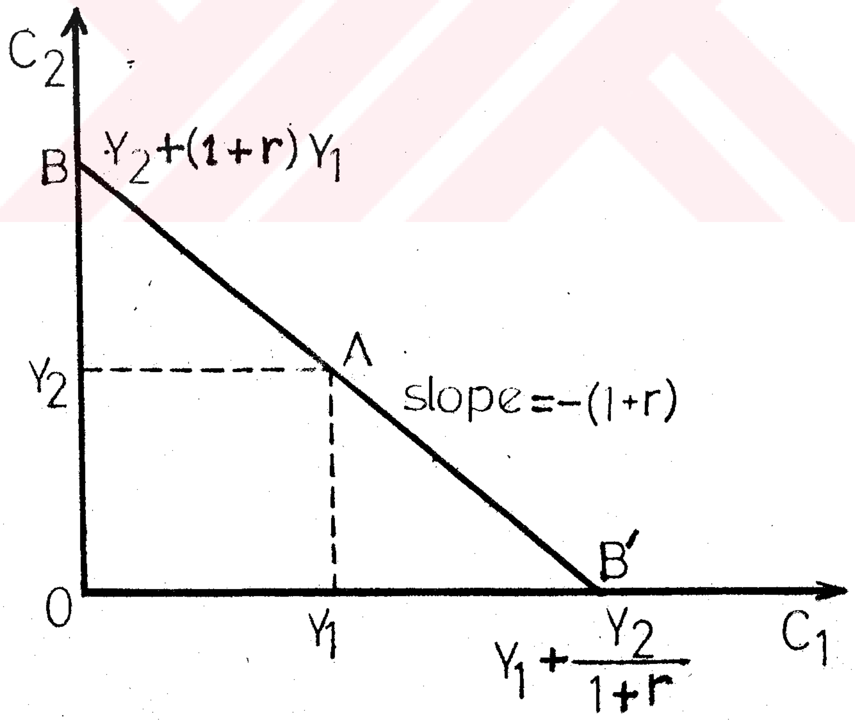

Figure 2.3

income by the amount $S_1 = Y_1 - C_1$, the consumer can enjoy in period 2 consumption in excess of income, $C_2 - Y_2$, by the amount $(1+r)S_1$. In other words, the consumer can trade from a Y_1, Y_2 income point in Fig. 2.3 to a C_1, C_2

consumption point along a budget constraint that has a slope of $-(1+r)$ (Branson, 1989, p.245).

The proof of that the slope of the budged line is equal to $-(1+r)$ can be shown as fallows: For point $A(Y_1, Y_2)$, the slope will be equal to

$$\text{Slope} = -\frac{Y_2 B}{Y_2 A}$$

If we substitute the values of B and A, then we obtain a formula for slope which is equal to

$$\text{Slope} = -\frac{Y_2 + (1+r)Y_1 - Y_2}{Y_1}$$

$$= -\frac{(1+r)\ Y_1}{Y_1}$$

$$= -\ (1+r)$$

Assuming that present consumption is preferred to future consumption, <u>ceteris paribus</u>, we can define an individual's personal valuation of consumption today compared with consumption tomorrow. This is called "subjective rate of discount", and it is defined as follows:

$$\Phi = \frac{dC_2}{dC_1} - 1 \qquad (2.79)$$

It is individual's subjective rate of discount that determines the shape of indifference curve between consumption in period 1 and consumption in period 2. A typical indifference curve has been drawn in Fig. 2.4. Here the two goods in question are consumption in period 1, C_1, and consumption in period 2, C_2. At any point along the indifference curve, U_1, the slope, as measured by the slope of the tangent to that point, represents the marginal (subjective) rate of substitution between present, C_1, and future, C_2, consumption, MRS_{12}. Considering the below equation:

$$MRS_{12} = \frac{dC_2}{dC_1} \qquad (2.80)$$

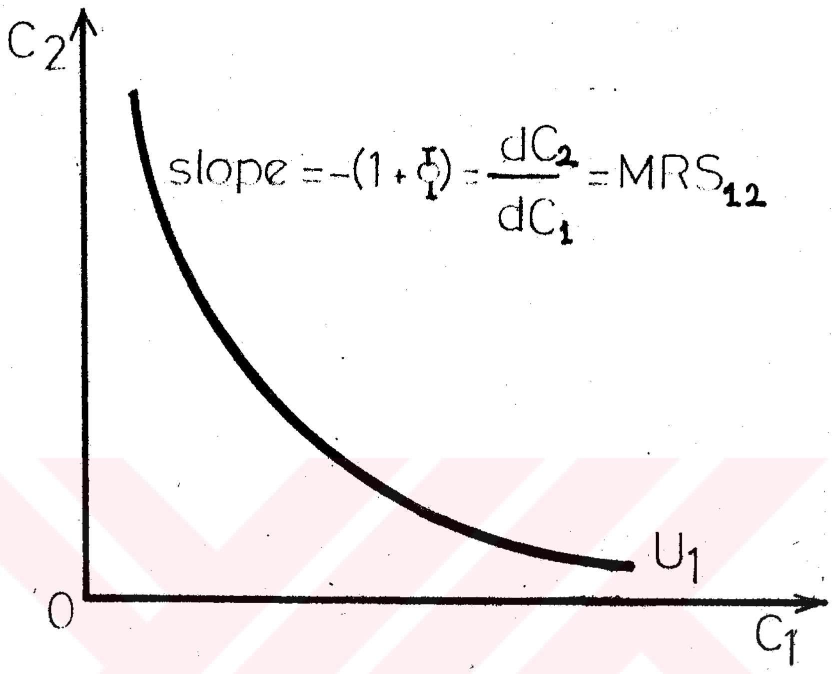

Figure 2.4

and using equation (2.79), we have $\Phi=(dC_2/dC_1)-1$. Then, $dC_2/dC_1=1+\Phi$.

But because the indifference curve has a negative slope

$$\frac{dC_2}{dC_1} = -(1+\Phi) \tag{2.81}$$

Therefore, the slope of the indifference curve U_1 in Fig.2.4 is $-(1+\Phi)$. The indifference curve has been drawn convex to the origin, reflecting diminishing marginal valuation of present consumption in terms of future consumption (Miller, 1978, p.137).

Using the budget line in Fig.2.3 and indifference curves such as in Fig.2.4, we can show the consumer's optimum graphically.

From the individual's utility function $U=U(C_1,C_2)$, we can obtain a set of indifference curves that show the points at which he is indifferent between additional consumption in period 2 or period 1 at each level of utility. These curves are U_1, U_2, and U_3 in Fig.2.5.

Movement from U_1 to U_1, to U_3 raises the individual's level of utility. All points on or below the budget line in Fig.2.5 are attainable. That is the individual may of any level in

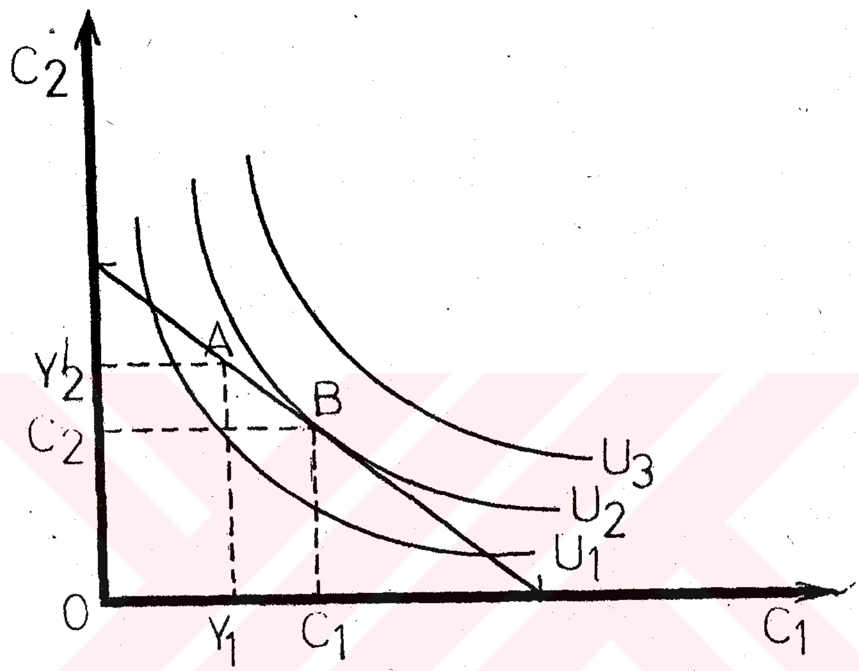

Figure 2.5

either period up to the budget constraint. In order to maximize utility, he will consume at a point on the budget line where it is just tangent to an indifference curve such as point B in Fig.2.5. At point B, the individual's consumption pattern is C_1, C_2. Since his income flow is skewed toward period 2 (Y_2 is much greater than Y_1), he borrows $C_1 - Y_1$ in period 1 at interest rate r. In period 2, he pays back $Y_2 - C_2 = (1+r)(C_1 - Y_1)$. The consumer's pattern of consumption, including present consumption C_1, is determined by the position of his budget line and the shape of his indifference curves (Branson, 1989, pp.245-46). The consumer's optimum exist at point B. At this point, the slope of the budget line is equal to the slope of the indifference curve, or

$$-(1+r) = -(1+\Phi) \qquad (2.82)$$

Thus, a consumption optimum requires that $r=\Phi$; the market rate of interest (return) must equal to the subjective discount factor. This can be proved as follows: Let the consumer be constrained in the two periods by

$$C_1 = Y_1 - S_1 \tag{2.83}$$

$$C_2 = Y_2 + (1+r)S_1 \tag{2.84}$$

where S_1 represents consumer's savings in period 1, and $(1+r)S_1$ represents the value of his savings after one period.

To optimize, combine the constraints and from the Lagrangean given as equation (2.85):

$$S = U(C_1,C_2) - \Omega[C_2 - Y_2 - Y_1(1+r) + C_1(1+r)] \tag{2.85}$$

At the optimum, for C_1, and C_2 as choice variables, we have

$$\frac{\delta S}{\delta C_1} = U_1 - \Omega(1+r) = 0 \tag{2.86}$$

$$\frac{\delta S}{\delta C_2} = U_2 - \Omega = 0 \tag{2.87}$$

and

$$\frac{\delta S}{\delta \Omega} = Y_2 + Y_1(1+r) - C_1(1+r) - C_2 = 0 \tag{2.88}$$

Eliminating Ω between (2.86) and (2.87), we find that

$$-\frac{U1}{U2} = -(1+r) \tag{2.89}$$

If we combine (2.89) and (2.59), it results in $-(1+r)=-(1+\Phi)$ (Fisher, 1985, p.55).

<u>2.1.2.2.2.3. Substitution and Income Effects</u>

An intertemporal-decision-making of an individual about consumption cannot be independent of interest rate since the change in the interest rate affects all variables related to consumption (Weber,1970,p.591). The effects of a change in the rate of interest upon the consumer's optimal consumption level can be separated into income and substitution effects. Assume that the consumer's horizon encompasses two periods. In order to determine the effects of change in the interest rate and income levels differentiate the first-order conditions (2.64-66) totaly for T=2:

$$U_{11} dC_1 + U_{12} dC_2 - \Omega = 0$$

$$U_{21} dC_1 + U_{22} dC_2 - (1+r_1)^{-1}\, d\Omega = \Omega\,(1+r_1)^{-2}\, dr_1 \tag{2.90}$$

$$-dC_1 + (1+r_1)^{-1}\, dC_2 - 0 = -dY_1 - (1+r_1)^{-1}\, dY_2 + (Y_2 - C_2)\,(1+r_1)^{-2}\, dr_1$$

the array of coffecients on the left-hand side of (2.90) is the same as the array for the last (and for T=2, the only), bordered Hessian determinant of (2.68). Using Cramer's rule to solve (2.90) for dC_1

$$dC_1 = -\Omega\,(1+r_1)^{-1}\,\frac{D_{21}}{D}\, dr_1 + [-dY_1 - (1+r_1)]^{-1}\, dY_2 + (Y_2 - C_2)\,(1+r_1)^{-2}\, dr_1]\,\frac{D_{31}}{D} \tag{2.91}$$

where D is the bordered Hessian determinant and $D_{t\tau}$ is the cofactor of the element in its (t)th row and (τ)th column. Dividing (2.91) by dr_1 and assuming that $dY_1 = dY_2 = 0$,

$$\frac{\delta C_1}{\delta r_1} = \Omega(1+r_1)^{-2}\,\frac{D_{21}}{D} + (Y_2 - C_2)\,(1+r_1)^{-2}\,\frac{D31}{D} \tag{2.92}$$

let Y denote the present value of consumer's income stream:

$$Y = Y_1 + Y_2\,(1+r_1)^{-1} \tag{2.93}$$

The rate of increase of C_1 with respect to increase in the present value of consumer's income stream can be derived from (2.91).

$$\frac{\delta C_1}{\delta Y} = \frac{\delta C_1}{\delta Y_1} = (1+r_1)\,\frac{\delta C_1}{\delta Y_2} = -\,\frac{D_{31}}{D} \tag{2.94}$$

A change of r_1 will alter the present values of consumer's income and consumption streams (Weber, 1970,p.421).

Consider those changes of r_1 which are accompanied by changes in C_1, and C_2 such that the level of consumer's utility remains unchanged:

$$dU = U_1 dC_1 + U_2 dC_2 = 0 \tag{2.95}$$

Since (2.65) requires that $U_1/U_2 = (1+r_1)^{-1}$, it follows that

$$-dC_1 - (1+r_1)^{-1}\, dC_2 = 0 \qquad (2.96)$$

and from (2.90) it follows that

$$-dY_1 - (1+r_1)^{-1} dY_2 + (Y_2 - C_2)(1+r_1)^{-2} dr_1 = 0 \qquad (2.97)$$

Substituting into (2.91)

$$\left.\frac{\delta C_1}{\delta r_1}\right|_{\bar{U}} = -\Omega(1+r_1)^{-2} \frac{D21}{D} \qquad (2.98)$$

Substituting $-(Y_1 - C_1)(1+r_1)^{-1} = (Y_2 - C_2)(1+r_1)^{-2}$, which follows from the budget constraint, and using (2.92) and (2.94), (2.90) may be written as

$$\frac{\delta C_1}{\delta r_1} = \left.\frac{\delta C_1}{\delta r_1}\right|_{\bar{U}} + (Y_1 - C_1)\ (1+r_1)-1 \left.\frac{\delta C_1}{\delta Y}\right|_{\bar{r}_1} \qquad (2.99)$$

the total effect of a change in the rate of interest is the sum of a substitution and income effect. The income effect equals the rate of change of consumption expenditure with respect to an increase in the present value of the consumer's income stream weighted by his bond holdings multiplied by a discount factor. The sign of the substitution effect is easily determined. From the first-order conditions $\Omega>0$. Evaluating D_{21},

$$D_{21} = -\begin{vmatrix} U_{12} & -1 \\ -(1+r_1)^{-1} & 0 \end{vmatrix} = (1+r_1)^{-1} > 0 \qquad (2.100)$$

Therefore the substitution effect with respect to C_1 in (2.92) is negative. The substitution effect with respect to C_2 is

$$\left.\frac{\delta C_2}{\delta r_1}\right|_{\bar{U}} = -\Omega(1+r_1)^{-2} \frac{D_{22}}{D} \qquad (2.101)$$

Since $D_{22}=-1<0$, the substitution effect with respect to C_2 is positive. Although an increase of income may cause a reduction in the purchases of a particular commodity, it is difficult to imagine a situation in which an increase of income will cause a reduction in the aggregate consumption expenditure. One can assume that $(\delta C_1/\delta Y)r_1$ is positive for all except the most extraordinary cases. If this is true, the direction of the income effect is determined by the sign of the consumer's bond position $(Y_1 - C_1)$ (Henderson and Quandt, 1958, pp. 239-40).

To further the analysis, let $(1+r)^{-1}=p$, is just the "price" of consumption in the second period and Y is the present value of consumer's lifetime wealth. If we reformulate (2.70) as

$$C_1 + \frac{C_2}{1+r} = Y \qquad (2.102)$$

then we can write Slutsky equations:

$$\frac{\delta C_1}{\delta p} = \left.\frac{\delta C_1}{\delta p}\right|_{\bar{U}} - C_2 \frac{\delta C_1}{\delta Y} \qquad (2.103)$$

Substitution effect — Income effect

$$\frac{\delta C_2}{\delta p} = \left.\frac{\delta C_2}{\delta p}\right|_{\bar{U}} - C_2 \frac{\delta C_2}{\delta Y} \qquad (2.104)$$

An increase in p (decrease in the rate of interest) leads to an increase first-period consumption through the substitution effect, (In a two-good model the cross substitution effects are positive, but a decrease through the income effect, since the individual is a net lender and therefore worse off (and $\delta C/\delta Y>0$ by assumption). The net effect is therefore ambiguous. On the other hand, for C_2, assuming normality, the income and substitution effects both work in the direction of reducing consumption (Atkinson and Stiglitz, 1987, p.74); Samuelson, 1966, p.225).

In Figs. 2.6 and 2.7, the substitution effect of a rise in p is represented by Q—P', and it can be seen to depend on the curvature of the indifference curve.
It is convenient to characterize this in terms of the elasticity of substitution:

$$\sigma = \left.\frac{d \log (C_2/C_1)}{d \log (1+r)}\right|_{\bar{U}} \qquad (2.105)$$

This is the percentage change in the ratio C_2/C_1 as $(1+r)$, the slope of the budget constraint, changes along the indifference curve. Thus Fig. 2.6 shows a relatively low

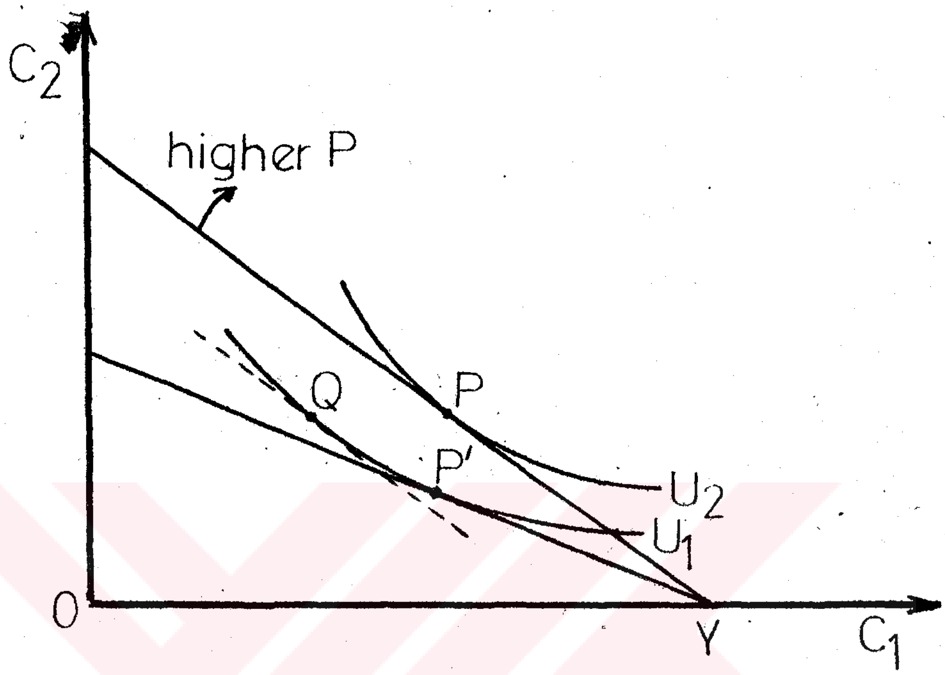

Figure 2.6

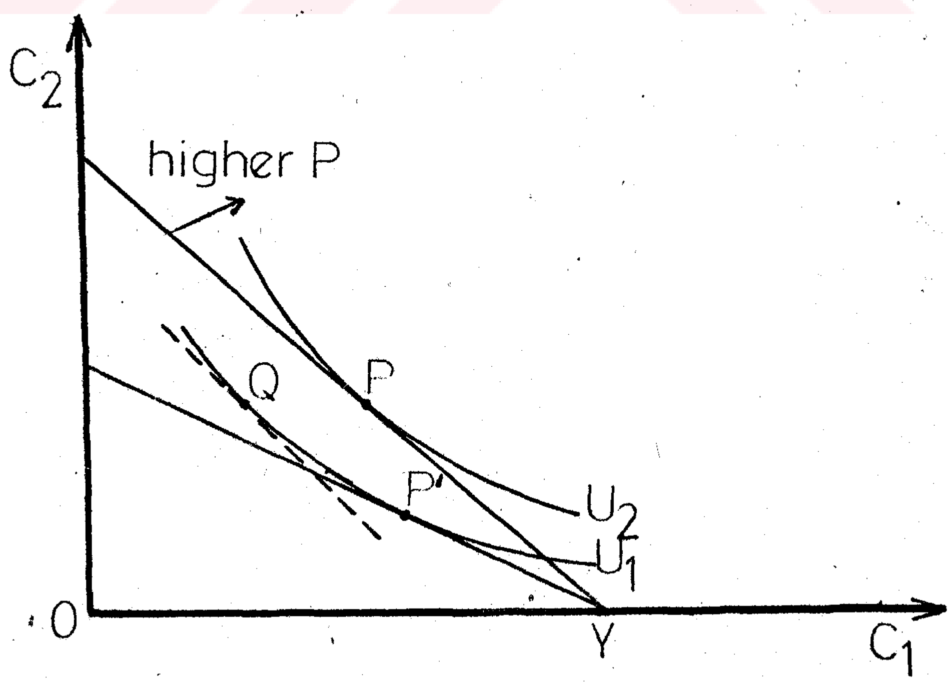

Figure 2.7

elasticity, with the ratio C_2/C_1 changing little despite a big change in the slope. The extreme in that direction is the case zero elasticity, were the indifference curves are L–shaped. Fig. 2.7 shows a relatively high elasticity, and the limit is the case where the indifference curves are straight lines (Rossi, 1988, pp.105–7; Atkinson and Stiglitz, 1987, p.74).

In this model we can derive a simple expression relating the effect on first–period consumption to the income (in other term, wealth) elasticity of consumption and the elasticity of substitution. Expanding (2.105), and using the defination of $p = (1+r)^{-1}$,

$$\sigma = \frac{\partial \log C_1}{\partial \log p}\bigg|_{\bar{U}} - \frac{\partial \log C_2}{\partial \log p}\bigg|_{\bar{U}} \qquad (2.106)$$

but

$$\frac{\partial C_1}{\partial \log p}\bigg|_{\bar{U}} + p\,\frac{\partial C_2}{\partial \log p}\bigg|_{\bar{U}} = 0 \qquad (2.107)$$

Hence, substituting in (2.106)

$$\frac{\partial \log C_1}{\partial \log p}\bigg|_{\bar{U}} = \frac{p C_2}{C_1 + pC_2}\,\sigma \equiv s\sigma \qquad (2.108)$$

where s is the saving rate. Substituting into (2.103)

$$\frac{\partial \log C_1}{\partial \log p} = s(\sigma - \eta) \qquad (2.109)$$

where η is the income elasticity of first–period consumption $(Y/C_1 \cdot \partial C_1/\partial Y)$.

Whether saving increase or decrease with the net rate of return depends therefore on the relative magnitude of the elasticity of substitution and the income elasticity of consumption. Thus, if the indifference curves are homothetic, so $\phi=1$, the effect depends simply on whether the elasticity of substitution between consumption early in life and later in life is greater or less than unity. In the Cobb–Douglas case, with

$$U = \alpha \log C_1 + (1-\alpha) \log C_2 \qquad (2.110)$$

first-period consumption is independent of the rate of interest, since $\sigma=\phi=1$. Note that this implies that expenditure on second-period consumption (pC_2) is constant, as we would expect for the Cobb-Douglas function (Atkinson and Stiglitz, 1987, pp.75-6; Carlino, 1982, pp.232-34). If we consider CES case, the above implication does not hold. In CES case, utility fuiction may be written as

$$U^{1-1/\sigma} = C_1^{1-1/\sigma} + C_2^{1-1/\sigma} \qquad (2.111)$$

and

$$C_1 = \frac{Y}{[1+(1+r)^{\sigma-1}]} \qquad (2.112)$$

$$C_2 = (1+r)^{\sigma} C_1 \qquad (2.113)$$

Finally, consider the effect of a change in the interest rate. In particular, a rise in the interest rate will increase OB'and decrease OB in Fig. 2.8, the former being an income adjustment and the latter a wealth adjustment on the budget line. Thus BB' rotates to a steeper slope in the event of a

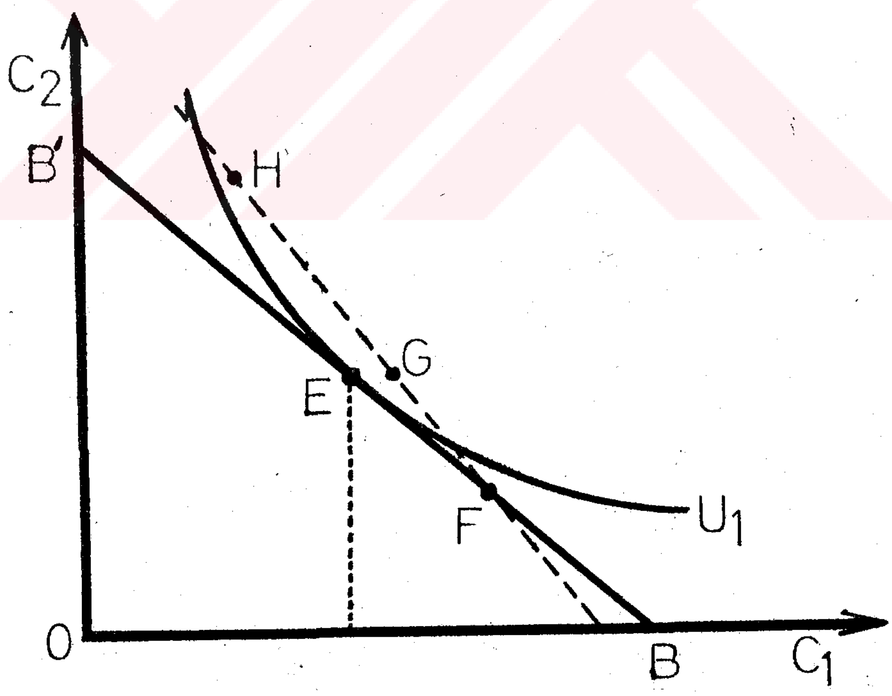

Figure 2.8

a rise in the interest rate. The new line, however, goes through point F in Fig.2.8, as represented by the dashed line, in which case we cannot assert that the new optimum (which may be at point G or at point H) produces a higher or lower first-period consumption (C_1). Only when we know the magnitudes of the various effect can we say in which direction the effect will go. Thus, normally, an increase in income or wealth (when Y changes) can be expected to produce a positive effect on consumption, but a change in the interest rate is generally ambiguous because it changes wealth and future income. These propositions state the the role of interest rate is thereby seen to be basically an empirical one (Fisher, 1985, pp. 56-57). We will expand this discussion further, in the next chapter.

2.1.2.2.3. Multiperiod Consumption Model When Capital Markets are Imperfect

So far, it was implicitly assumed that capital markets are perfectly competitive. In this section, we relax this assumption and generalize the analysis to the case in which capital markets are imperfect. Multiperiod consumption model with capital market imperfection generally discussed in Atkinson and Stiglitz [1987], Tobin [1971], Flemming [1975], Hirshleifer [1970], and Jaffee and Russell [1976].

The model considered to date does not allow borrowing since the individual has no source of income in the second period. Suppose now that the individual has wage income Wt in period t. This means that the individual could set C_1 greater than W1 by borrowing. The Slutzky equation become.

$$\frac{\delta Ct}{\delta p} = \left.\frac{\delta Ct}{\delta p}\right|_{\bar{U}} - (C_2 - W2)\frac{\delta Ct}{\delta R} \qquad (2.114)$$

where R shows individual's total resource available at time t-the income effect depends simply on the difference between consumption and wage income in the second period. The kinked budget constraint in Fig. 2.9 illustrates the capital market imperfection: Borrowing exceed lending rates. This situation is a typical capital market imperfection. The effect of this imperfection is likely to be that people cluster at the kink.

Suppose, for example, that the individuals differ in their rates of time preference. The lending and borrowing rates are r_1 and r_B, respectively, and that we consider the isoelastic utility function (Where δ^* is the rate of time preference).

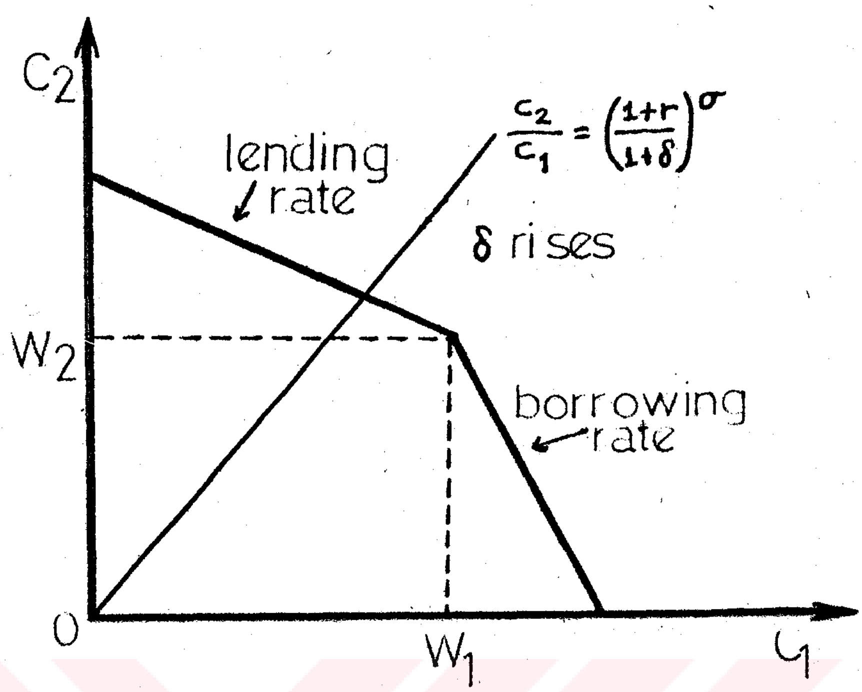

Figure 2.9

$$U^{1-1/\sigma} = C_1^{1-1/\sigma} + \frac{1}{(1+\delta^*)} C_2^{1-1/\sigma} \qquad (2.115)$$

so that

$$\frac{C_2}{C_1} = \left|\frac{1+r}{1+\delta^*}\right|^{\sigma} \qquad (2.116)$$

As may be seen from Fig. 2.9, as we consider larger values of σ, the chosen point moves down towards the kink, and there is a critical value, δ^*_1, where

$$\left|\frac{1+r_L}{1+\delta^*_1}\right|^{\sigma} = \frac{W_2}{W_1} \qquad (2.117)$$

There is a further critical value defined by the borrowing rate

$$\left|\frac{1+r_B}{1+\delta^*_2}\right|^{\sigma} = \frac{W_2}{W_1} \qquad (2.118)$$

where $\delta^*_2 > \delta^*_1$. There is then a range of $\delta 1 \leq \delta \leq \delta 2$ such that people have zero saving. It is of course quite possible that the borrowing rate becomes effectively infinite at some point—where there are some constraints on borrowing (Atkinson and Stiglitz, 1987, pp.82—3).

2.1.2.2.4. Multiperiod Consumption Model Under Uncertainty

Before proceeding further with the implications of the multiperiod consumption model, it is necessary to denote brief attention to one conceivably important element that it has been neglected so far, namely, the phenomenon of uncertainty.

In his classical work, The Theory of Interest, Irving Fisher argued that income risk (uncertainty about future non-capital income) reduces the rate of time preference and hence decreases current consumption: "This tendency is expressed in term 'to lay up for a rainy day'. The greater the risk of rainy days in the future, the greater is the impulse to provide for them at the expense of the present". The problem of uncertainty was mainly discussed in Bassman, Molina and Slottje [1983], Dreze and Modigliani [1972], Hanoch [1977], Kreps and Porteus [1978], Leland [1978], Menezes and Duten [1978], Merton [1969], Merton [1971], Miller [1974], Miller [1976], Mirman [1971], Modigliani [1974], Modigliani and Brumberg [1954], Modigliani and Brumberg [1979], Samuelson [1969], Sandmo [1970], Selden [1978], and Zeldes [1989] in details.

It may be simply noted, at this point, that the presence of uncertainty might be expected to give rise two additional motivates for saving, thereby consumption:

1. The precautionary motive, i.e, the desire to accumulate assets through saving to meet possible emergencies whose occurrence, nature, and timing cannot be perfectly foreseen. Such emergencies might take the form of a temporary fall in income blow the planned level or of temporary consumption requirements over and above the anticipated level. In both cases the achievement of the optimum consumption level might depend on the availability of previously acquired assets.

2. As a result of the presence of uncertainty, it is necessary, or at least cheaper, to have an equity in certain kinds of assets before an individual can receive services from them. These assets are consumer's durable goods. If there were no uncertainty, a person could borrow the whole sum necessary to purchase the assets (the debt canceling the increase in real asset

holdings), and pay of the loans as the assets are consumed. In the real world, however, the uncertainty as to the individual's ability to pay forces the individual to hold at least a partial equity in these assets (Modigliani and Brumberg, 1954, pp.388–89).

Intuitively, one would expect that the introduction of uncertainty in the future would alter the optimal consumption decision which would prevail if the future were known with certainty. In fact some important cases have been discussed in the literature. Hador and Russell [1974], Phelps [1962], and Stignum [1974] show, using a linear production function, that for some utility functions the optimal initial consumption in the random case decreases for all values of initial wealth as compared with the initial consumption in the deterministic case. Hence it seems, from these examples, that two divergent forces are at work: The first is the desire to consume more initially as a hedge against the uncertain future. The second force is the desire to consume less initially so as to increase the future consumption prospects. The relative strength of each of those forces, as implied by the utility function, is the key to the relationship between random consumption and deterministic consumption (Mirman, 1971, p.179).

The above discussion can be represented in a formal model. This model is a modification of Menezes and Auten [1978]. In the model, an individual's preference for certain and uncertain consumption bundles, the latter being lotteries with consumption bundles as outcomes, is examined. Let $C_1, C_2 > 0$ individual's utility function is $U(C_1, C_2)$. Now a special type of temporal risk in which current consumption is sure but future consumption is a random variable can be defined. Let $\tilde{z}_h$ be a random variable such that

$$P(z_h = +h) = P(z_h = -h) = \frac{1}{2} \qquad (2.119)$$

where $h>0$ denotes the size of the gamble. Let (C_{a1}, C_{a2}) be some sure consumption bundle. The risk $(C_{a1}, C_{a2}+z_h)$ is a $(C_{a1}, C_{a2}+h)$ or the consumption bundle $(C_{a1}, C_{a2}-h)$, each with probability one-half. This risk is denoted by La, z_h. The holder of La, z_h is guaranteed present consumption in the amount C_{a1} but future consumption will be either $C_{a2}+h$ or $C_{a2}-h$ with equal probability. The expected utility of La, z_h is

$$E\,U(C_{a1},C_{a2}+z_h) = \frac{1}{2}[U(C_{a1},C_{a2}+h)+U(C_{a1},C_{a2}-h)] \quad (2.120)$$

While the utility of its expected value is $U(C_{a1},C_{a2})$ since the expected value of La,z_h is (C_{a1},C_{a2}) (Menezes and Auten, 1978, pp.253-54).

Let the set of sure consumption bundles defined by $U(C_1,C_2)=U$ denoted by

$$I = \{(C_1,C_2): U(C_1,C_2) = \overline{U}\} \quad (2.121)$$

The assumptions about preferences guarantee that the graph of indifference curve I, is strictly convex as shown in Fig. 2.10. Let $Ca=(C_{a1},C_{a2})$ and $Cb=(C_{b1},C_{b2})$ be any pair of points on I such that $C_{a1}<C_{b1}$. By definition Ca and Cb are sure consumption bundles equal to expected value of the risk:

$$L_a,z_h = (C_{a1},C_{a2}+z_h) \quad (2.122)$$
$$L_b,z_h = (C_{b1},C_{b2}+z_h) \quad (2.123)$$

We are interested in the nature of an individual's preference between (2.122) and (2.123) given his indifference to the sure options Ca and Cb. The hypothesis about an individual's preferences between such risks can be formally stated as:

$$E\,U(C_{a1},C_{a2}+z_h) > E\,U(C_{b1},C_{b2}+z_h) \quad (2.124)$$

for all (C_{a1},C_{a2}) and (C_{b1}, C_{b2}) such that

$$U(C_{a1},C_{a2}) = U(C_{b1},C_{b2}) = \overline{U} \quad (2.125)$$

and such that

$$C_{a1} < C_{b1} \quad (2.126)$$

We now show that preference property (2.124)-(2.126) is equivalent to the hypothesis that income risk decreases the marginal rate of time preference. To demonstrate this at an intuitive level, let

$$J_a = \{(C_1,C_2):EU(C_1,C_2+z_h) = EU(C_{a1},C_{a2}+z_h)\} \quad (2.127)$$

represent the set of risk (C_1,C_2+z_h) which are indifferent to L_a,z_h. Geometrically, J_a is an indifference curve under the uncertainty since its graph is the locus of expected values of risks (C_1,C_2+z_h), which have the same expected utility as L_a,z_h. J_b, defined analogously, gives a set of risks indifferent to L_b,z_h. By definition, (C_{a1},C_{a2}) is on both I and J_a while (C_{b1}, C_{b2}) is on both I and J_b. Since by

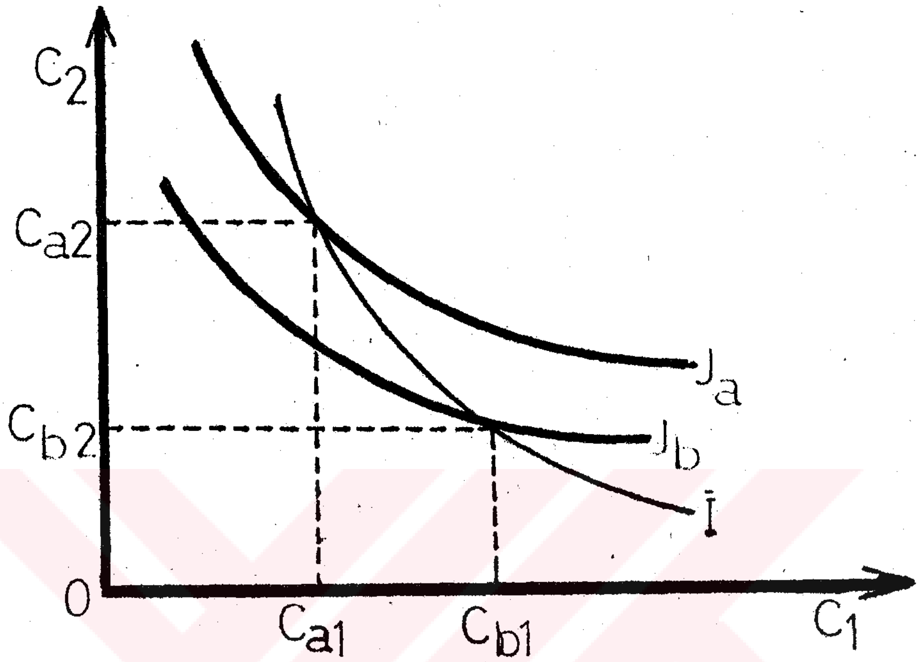

Figure 2.10

hypothesis (2.124), the expected utility of any risk indifferent to L_a, z_h is greater than that of any risk indifferent to L_b, z_h. Therefore, as illustrated in Fig.2.10, J_a is everywhere above J_b and both curves intersect I from below. This means that at each point on I the corresponding J curve is flatter than I at that point. Stated differently, the effect of uncertainty is to "twist" the indifference curves in a counterdokwise direction. In other words, the rate of time preference is lower under uncereainty than under certainty. Denote the rate of time preferences under certainty and under uncertainty, respectively by

$$R(C_1, C_2) = \frac{U_1(C_1, C_2)}{U_2(C_1, C_2)} \qquad (2.128)$$

$$Rz_h(C_1, C_2) = \frac{EU_1(C_1, C_2 + z_h)}{EU_2(C_1, C_2 + z_h)} \qquad (2.129)$$

R and Rz_h are the absolute values of the slopes of the I and J curves at the point (C_1, C_2). It has been shown the uncertainty reduces the rate of time preference (Menezes and Auten, 1978, pp. 254–55).

In an important article Yaari [1976] shows that in the long run decision about concumption under certainity and under uncertainty will end in the same result.

Consider a consumer unit with an n–period planning horizon. Suppose that the unit expects with certainty to earn an amount Y_1 in the first period, Y_2 in the second, and so an up to the (n)th period, in which earnings will be Y_n. Finally assume that the consumer unit can borrow and lend freely at a zero rate of interest and that its rate of subjective discount is also zero. Then, under a lifetime wealth constraint, it is optimal to set the consumption level in each period equal to:

$$C_t = \frac{(Y_1 + Y_2 + \ldots + Y_n)}{n} \tag{2.130}$$

Now consider a sequence of consumer allocation problems of this sort, with the number of planning periods, n, becoming very large. If, as $n \longrightarrow \infty$, the quantity $(Y_1, Y_2 + \ldots + Y_n)/n$, i.e., average earnings, tends to some real number, say , then optimal consumption will also tend to as $n \longrightarrow \infty$. Now, let us leave the world of certainty and consider the case where future earnings are random. Specially, let us assume that $y_1, y_2, y_3, \ldots$ is a sequence of independent, identically distributed random variables, whose common distribution has mean . Then, by the law of large numbers, the sample mean

$$\mu = \frac{(y_1 + y_2 + \ldots + y_n)}{n} \tag{2.131}$$

tends to almost surely. This means, roughly speaking, that the consumer knows with virtual certainty that, no matter how future earnings might evolve, they will, in the long run, average out to a rate of per period. Therefore, it seems reasonable to expect that, as $n \longrightarrow \infty$ the optimal consumption level will tend to μ (Yaari, 1976, p.202).

A great deal of recent research and tests have been consentrated on multiperiod consumption model under uncertainty. One of the most important sources of uncertainty facing individuals is that of income, especially, of labor income. Yet, closed–form decision rules for optimal consumption in the presence of uncertain income have not in general been derived. It seems strange that so much theoretical and empirical work has been done studying consumption and yet we do not even know what the optimal level of consumption or sensivity of consumption to income should in most very simple settings.

2.1.2.2.5. Other Considerations in Multiperiod Consumption Model

Despite the multiperiod consumption model was extended in some aspects in the above analyses, it is still not complete. In the analyses to the date, we have disregarded the individual's money holding, bequest motive, and the effects of tax on the individual's consumption decision.

First, the analysis will be extended as to include individual's money holding. It will be convenient to characterize money, the medium of exchange , by a number of some what unrealistic, idealized properties:

1. Money is a more counter, and does not consist of objects themselves desirable or useful for nonmonetary (productive or consumptive) purposes.

2. Individuals and other private economic agents do not produce or create money.

3. Money can be stored costlessly over time.

4. Money does not bear interest—i.e., it does not yield any increment over time to its holder.

As an admittedly imperfect approximation, the first approach (actually, the standard one in the literature of monetary theory) will be adopted here: It is postulated that money is a peculiar commodity, such that people derive utility merely from holding it. The property of money that yields this benefit is called "liquidity", the measure of which is the "real value" of the money held—its command over nonmonetary commodities (Hirshleifer, 1970, p.135). If there is single monetary commodity M and a homogeneous nonmonetary commodity or "good" X, then at time t real cash—holding or liquidity is measured by M_t / p_t^*. Here p_t^* is the price of C_t in terms of M_t—i.e., the price level at time t. In the below two—period analysis we label p_2^* as p^* and never use p_1^* since p_1^* can be assumed 1.

Within the two—period paradigm of choice, the "monetary rate of interest" r^*, is defined as

$$p^* = \frac{1}{1+r^*} \qquad (2.132)$$

(2.132) can be interpreted as the price of next year's money in terms of this year's money. The corresponding real rate of interest (what was called in previous sections the rate of interest) is defines as

$$p = \frac{1}{(1+r)} \qquad (2.133)$$

The exchange ratio between future monetary value and current monetary value, $dM_2/dM_1 = 1+r^*$, can then be expressed in terms of the real rate of interest and the price levels at t=1 and t=2:

$$1 + r^* = p^*(1+r) \qquad (2.134)$$

This equation says in effect, that the market ratio of effective today between future and current monetary units must equal to the market ratio between future and current claims when each class of claims is multiplied by its respective price level.

The household or individual utility function for two-period model may written as follows:

$$U = U(C_1, C_2, M_1, M_2) \qquad (2.135)$$

where M_1 and M_2 show money holdings (money balances) at time 1 and 2. The introduction of M_t into the utility function is an approach which has been followed by a number of economists for treating the services of money. Among them, Dixit and Goldman [1970], Douglas [1968], Mussa [1967], Patinkin [1965], Samuelson [1947], and Sidrauski [1967] can be mentioned. Many economists have been highly critical of this approach, in particular, Tobin [1961]. This approach is adopted primarily because of the lack of a workable alternative.

(2.135) may be written in the continuous form as follows:

$$U = \int_0^\infty (C_t, M_t) \exp(-\delta t)\, dt \qquad (2.136)$$

where δ is the rate of time preference.

The budget constraint for (2.135) may be written as follows:

$$C_1 + \frac{pC_2}{1+r^*} + \frac{r^*M_1+M_2}{1+r^*} = Y_1 + \frac{pY_2}{1+r^*} + M^* + \frac{M_2}{1+r^*} \qquad (2.137)$$

where M^* is the individual's or household's excess supply of money. In (2.137) the right–hand side can be regarded as the "sources" of wealth, and the left hand side as the "uses" of wealth. The conditions for an individual optimum, obtained by the usual maximizing procedure, are given in equations (2.138)–(2.140),

$$\left.\frac{\delta C_2}{\delta C_1}\right|_{\bar{U}} = -\frac{1+r^*}{p^*} \qquad (2.138)$$

$$\left.\frac{\delta M_1}{\delta C_1}\right|_{\bar{U}} = -\frac{1+r^*}{r^*} \qquad (2.139)$$

$$\left.\frac{\delta M_2}{\delta C_2}\right|_{\bar{U}} = -1 \qquad (2.140)$$

As shown in equation (2.134), the expression on the right–hand side of the equation (2.138) is also equal to –(1+r), where r is the real rate of interest. This is of course, the same result as that obtained earlier for "moneyless" models. It would be wrong to infer, however, that the introduction of money–holding leaves unchanged the time–preference decision as among dated real consumption, since $\delta C_2/\delta C_1|U$ will in general have been effected by the amount of real cash balances held as well as of C_1 and C_2 consumed. An asymmetry between the optimality conditions governing present and future money–holding stand out clearly in the equations (2.139) and (2.140). Since real money–holding at time 2, M_2/p^*, represents sacrifice of an equal amount of real consumption C_2, the individual optimum must be where the marginal rate of substitution between the two real claims is unity. But, while real money holding at time 1, involves aproximately a corresponding sacrifice of C_1, there is additional effects to consider. The time–1 money–holdings is carried over to t=2, making possible increased consumption (or money–holding) at the latter date; when this effect is taken into account at the initial t=1 decision, the individual realizes that be need not sacrifice consumption C_1 unit–for–unit to hold liquidity M_1. The equivalent C_1 sacrifice per unit of real liquidity is in fact $r^*/(1+r^*)$–which can be interpreted as the C_2 consumption implicit in the "interest foregone", r^*/p^*, discounted by the real rate of interest (MRS between C_1 and C_2) on the right–hand side of the equation (2.138) (Hirshleifer, 1970, pp.144–45; Mussa, 1976, pp.38–42).

A graphical interpretation of the determination of C_t and M_t by the conditions (2.138)–(2.140) is given in Figs. 2.11 and 2.12. In Fig. 2.11 consumption C is plotted on the horizontal axis and the real money balance M are plotted on the vertical axis. Combinations of C and M which yield various constant level of utility are shown by the indifference curves labeled U_1, U_2, and U3. The Engel curve, labeled $E\Phi^*_t$, shows the combinations of C and M for which equation (2.141) is satisfied for the given value of Φ^*_t.

$$\frac{\delta U/\delta M}{\delta U/\delta C} = \Phi^* \qquad (2.141)$$

This equation says that the values of C and M must be chosen so that the marginal rate of substitution between the services of cash balances and the flow of consumption $(\delta U/\delta M)/(\delta U/\delta C)$, is equal to the marginal cost of holding money Φ^*, Provided both C and M "normal goods" in the utility function, the Engel curve will be upward slopping as shown in the diagram. In Fig. 2.12, the curve labeled $\delta U/\delta C|\Phi^*_t$ shows the marginal utility of consumption as a function of the level of total expenditures on current goods an services 2, subject tu the condition that (2.141) is satisfied, i.e., subject to the condition that these expenditures are optimally divided between commodity consumption and consumption of the services of cash balances.

An increase in the given value of Φ^*_t rotates the engel curve of Fig.2.11 in a counterclockwise direction and shifts the $\delta U/\delta C|\Phi^*_t$ curve of Fig. 2.12 upward (Mussa, 1976, p.66). The determination of C_t and M_t by the use of Fig. 2.11. and Fig. 2.12 proceeds as follows. First, determine the Engel curve in Fig. 2.11 and the marginal utility of expenditure curve in Fig.2.12 which corresponds to the exogenously given value of Φ^*_t. Second, in Fig. 2.12 determine the value of Z which equates the marginal utility of expenditure $\delta U/\delta C|\Phi^*_t$, with given value of marginal utility of consumption, Ω_t. Third, using this value of Z_t as the intercept along the horizontal axis of Fig. 2.11, construct a budged line with slope of $1/\Phi^*_t$. This budget line shows the combinations of C and M for which total expenditures are equal to the optimal level determined in Fig. 2.12. Fourth, determine the point at which the constructed budget line intersects the Engel curve. This point determines the optimal decision of total expenditures between commodity consumption and purchases of services of cash balances: this point determines the optimal values of C and M.

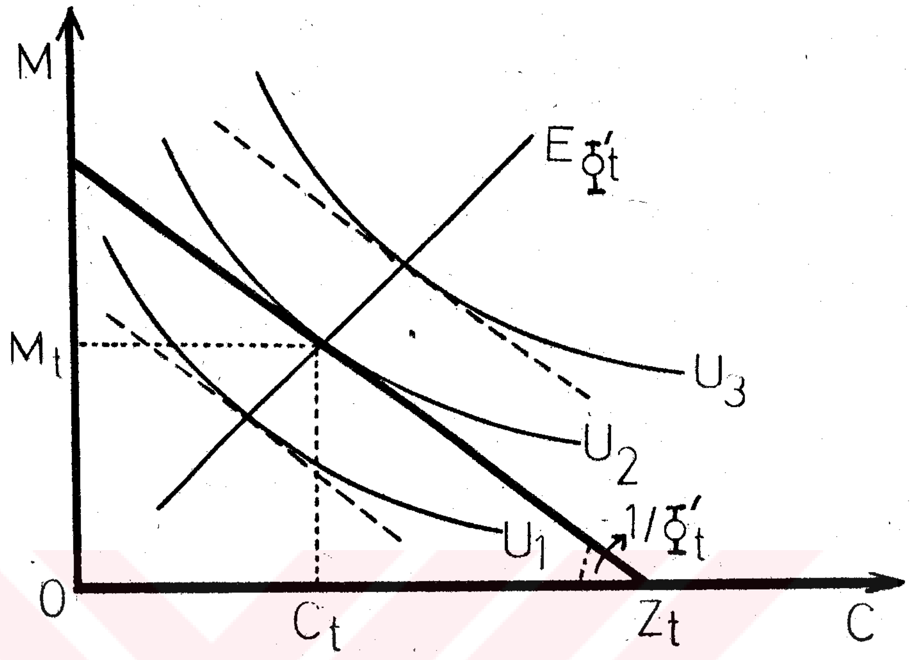

Figure 2.11

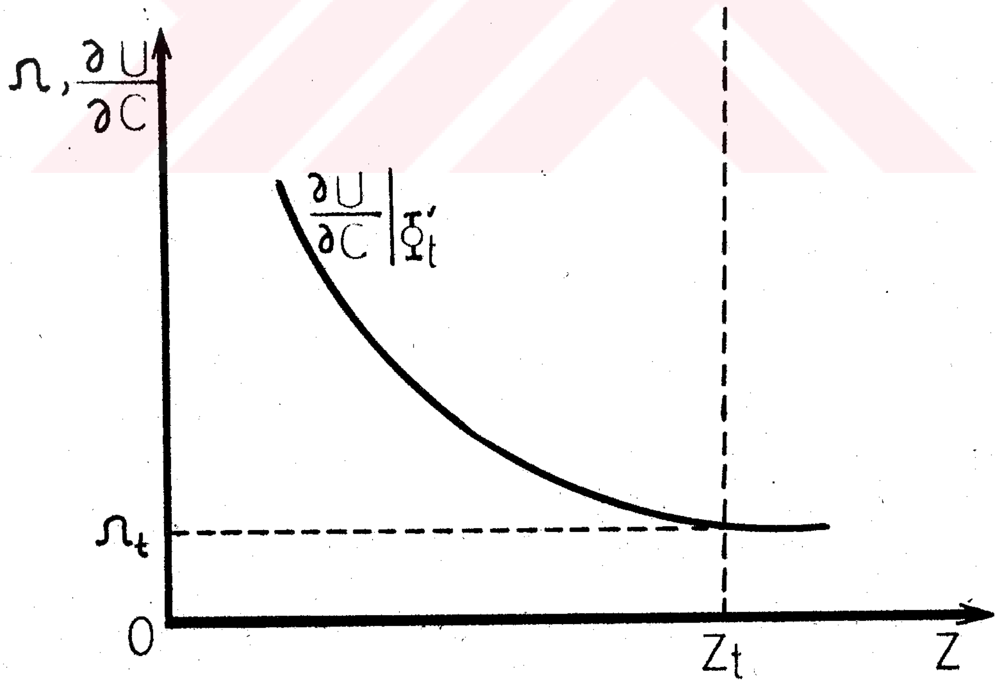

Figure 2.12

Despite the model has been modified as to include money-holding, the effect of monetary policy has not been considered. There is growing literature on this subject such as: Barro and Grossman [1971], Cukerman [1972], Dusanky and Kalman [1974], Fischer [1970], Hubbard and Judd [1986], Merton [1970], Pissarides [1978], Scheinkman and Weiss [1986], Tobin [1971, 1972], Zeldes [1989], and Zellner, Huang and Chau [1965]. These other aspects of the money-holding will be evaluated in the next chapter.

First the multiperiod-consumption model was extended as to include money. Now, secondly, it will be extended as to include effect of taxation.

Indeed, there is wide range of literature on the effects of tax. Atkinson and Stiglitz [1987], Barro [1978], and Tobin [1971,1972] discuss the effects of taxation in an extensive range. Aschaur [1985], Balanchard [1985], Haque [1988], Frenkel and Razin [1988], and Rossi [1988], consider the tax affects combining with fiscal policy. Seidman [1983], and Drazen [1978] extended the model with effects of different taxes discussed in Blinder [1981], Boskin [1978], Evans [1983], Summers [1981], and Taubman [1978].

An important element of the economic environment which effects consumption decision is taxation policy. All of the income streams, both property or labor, are after-tax disposable incomes. Assume that, there are an income tax at the rate t_y and an expenditure tax at the rate t_c being equal in all periods. Then budget constraint can be written as:

$$C_1 + \frac{C_2}{1+r} = (Y_1 + \frac{Y_2}{1+r})(1-t_y) - (C_1 + \frac{C_2}{1+r})(1-t_c) \qquad (2.142)$$

Equilibrium point; E_2, after the taxes is shown in Fig. 2.13.

A proportional tax on expenditure, or equivalently an income (or wage) tax, shifts the budget constraint inwards to a position parallel to the pre-tax constraint.

The difference between the expenditure tax and income tax lies in the taxation of interest income, and it is on this that we concentrate. A proportional tax, t_i, on interest income tilts the budget constraint around the

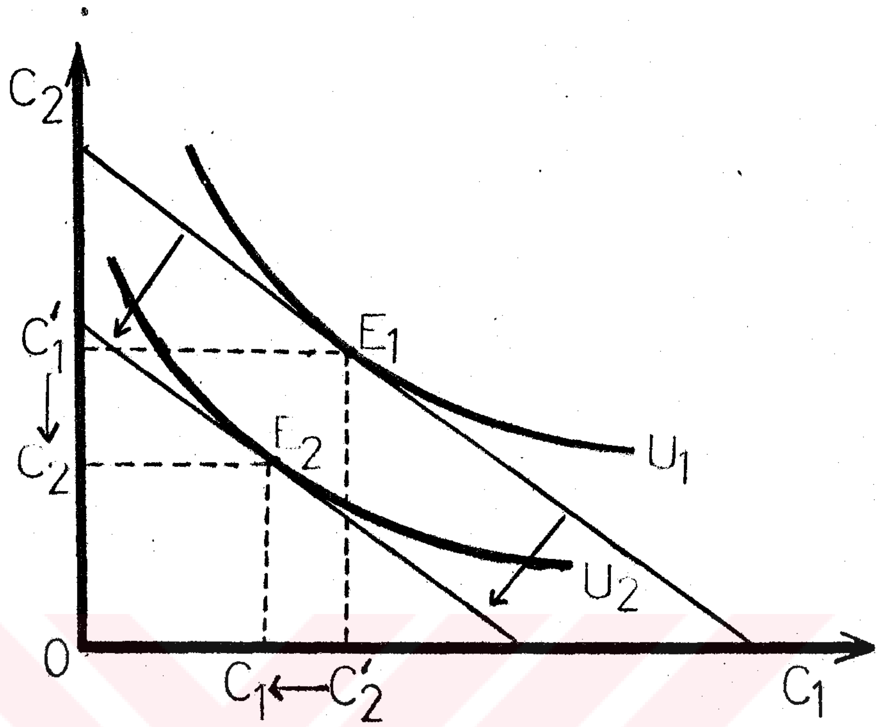

Figure 2.13

point where no wealth is carried forward, and the effect can be seen from the earlier analysis. The after-tax interest is now $r(1-t_i)$ and hence:

$$p = \frac{1}{1+r\ (1-t_i)} \qquad (2.143)$$

The "price" of second period consumption therefore increases with the tax rate, for fixed r. Combining the tax on interest income with one on wage income at rate t_y use can see that savings are given by

$$(1-t_y)Y - C_1 \qquad (2.144)$$

where Y is two-period-lifetime wealth. The change in savings with response to changes in ti and t_y is

$$-Y\ dt_y\ (1 - \frac{\delta C_1}{\delta M}) - \frac{\delta C_1}{\delta p}\ \frac{\delta p}{\delta t_i}\ dt_i \qquad (2.145)$$

where $M=Y(1-t_y)$. Let us assume that the relative tax rates are both positive and such that $(1-t_i)/(1-t_y)$ remains unchanged as the tax rates very. This is clearly satisfied for the income tax $(t_i=t_y)$ and for a particular form of investment income surcharge. Dividing (2.145) by $dt_1/(1-t_1)$, which equals $dt_y/(1-t_y)$, the change in C_1 (savings) in response to an increase in taxation is positive (negative) if:

$$(1-t_y)Y\left(1 - \phi\frac{C_1}{M}\right) + s(\sigma-\phi)\, C_1(1-p) > 0 \qquad (2.146)$$

where (2.109) has been substituted and the fact that $\delta p/\delta t_1 = rp^2$ was used. Dividing by $Y(1-t_y)$, and rearranging:

$$s\sigma(1-p) + \frac{1}{1-s} > \phi[1+s(1-p)] \qquad (2.147)$$

This shows how response of change in consumption between the period 1 and period 2 to the income tax depends on the wealth elasticity of first-period consumption (ϕ), the elasticity of substitution (σ), the savings rate (s), and the price of second-period consumption. Where the utility function is Cobb-Douglas, $\sigma=\phi=1$, and saving is reduced (for $s>0$)–i.e., C_2 is decreased. In the extreme no-substitution case, where $\sigma=0$, C_2 could rise, but only if the wealth elasticity of first-period consumption is sufficiently large (greater than the value $1/(1-s^2)$ if ($p=0$). If $\sigma>0$, the required wealth elasticity would be correspondingly greater (Aschaur, 1985, pp.117-19; Atkinson and Stiglitz, 1987, pp.77-8).

The effect of interest income taxation depends on whether interest paid can be set against tax. If there is deductibility, taxation of interest income works just like a fall in r, and those to the right of Q in Fig. 2.14 there is a positive wealth effect, tending to increase C_1 (the dashed line). If there is no deductibility, then the budget line becomes kinked– the heavy line in Fig. 2.14. Those choosing to the right of Q such as Q", are unaffected by the tax. Tax the effect of this is likely to be that people cluster at the kink.

As coming to the inheritance taxes, suppose that inheritances (or gifts) are taxed at proportionate rate tg. In particular, the bequest from a member of generation i, yields a net receipt to his descendant a member of generation i+1, $(1-t_g)$ times the bequest. Of course, the tax receipts must also go somewhere. Suppose that these receipts are transferred to members of generation i+1 (while old) in accordance with a rule that is independent of the size of each individual's inheritance. Since an individual's contribution to general tax revenue will typically be valued by him at less than an equal amount of own income, it is clear that an increase in tg will tend to lower the amount of intergenerational transfers, hence the consumption. In particular, the higher the value of tg, the less likely that a consumption due to bequest or gift motive will be operative (Barro, 1974, p.1108).

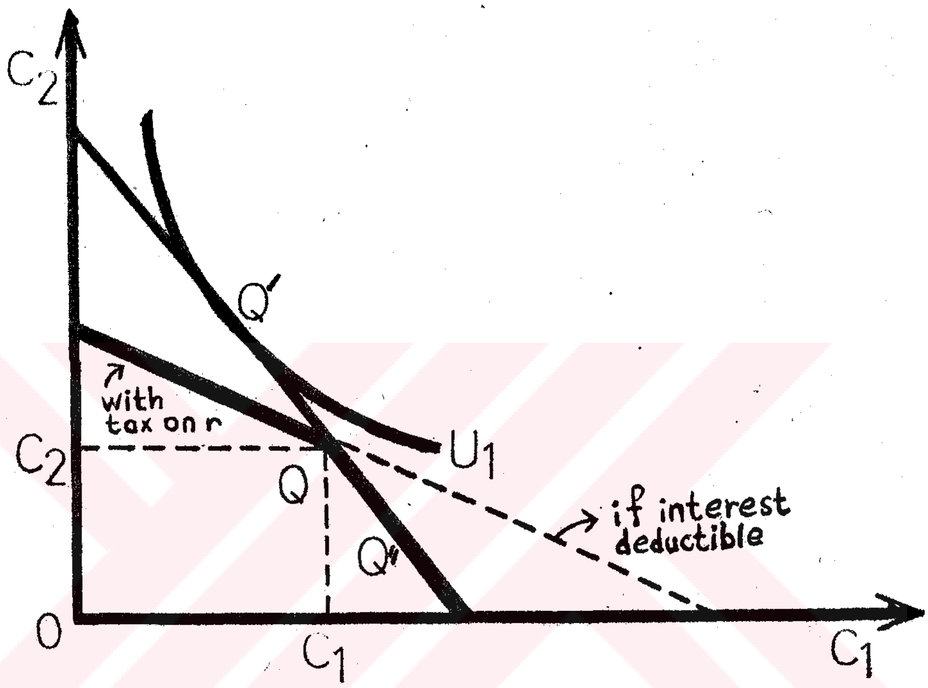

Figure 2.14

Another point in taxation is that, while most economist recognize the efficiency advantages in taxing consumption rather than income, the general argument against a consumption tax has been that it is regressive because it excludes interest income from the tax base. This analysis is correct as far as it goes, for interest income does accrue disproportionately to the wealthy. However it overlooks two basic points. First the rate structure may be set differently under a consumption tax; second, the exemption of interest income from the tax base may decrease the consumption. The net outcome, of course, depends upon the particulars of the two taxes being compared. The differential effect on consumption between an income tax and an equal yield expenditure tax is likely to be small (Boskin, 1978, p.6).

Finally, we must consider the distinction between permanent and temporary tax changes. Income gains and losses from temporary taxes will eventually be spent just like any other increment or decrement to lifetime resources: If less is spent at first, then more will be spent later. Thus if we want to inquire about the effectiveness of temporary taxes, one must specify a time horizon. Over a long enough run, they must be just as effective as permanent ones. But there is a so-called zero effect view, that consumers ignore the surtax and consume as if it never happened (Blinder, 1981, p.29). Temporary tax increases diminish wealth calculations very little and will have weak or zero income effects. But some households may be subject to liquidity constraints. If we stay within the certainty context, these constrained households will react strongly to even temporary income changes. Thus the aggregate marginal propensity to consume (MPC) for a temporary tax is a weighted average of the low MPCs of unconstrained households and the high MPCs of constrained ones. The importance of this phenomenon is an empirical question (Blinder, 1981, p.29; Tobin, 1971, p.179).

As a final extension the basic model will be modified to include inheritance and straightforward representation of the bequest motive. Multiperiod consumption model with bequest and inheritance is a widening era in the study of consumption and consumer theory in economics. Inheritance and bequests are generally examined in Barro [1974], Blinder [1975],and Felstein [1974]. In specific, inheritance is examined in details in Blinder [1973] and Davies [1982]. Bequest are extensively examined in Abel [1985], Blinder [1976], Burbidge [1983], Drazen [1978], Menchik and David [1983], and Seidman [1983]. Bequest and inheritance combined with social security are discussed in Felstein [1974, 1976], Wilcox [1986], and Williamson and Jones [1981]. An important part of the subject, intergenerational transfers, is examined in Arthur and McNicoll [1978], Blinder [1976], Goldberger [1989], and Samuelson [1958]. All of the above aspects of the bequest and inheritance with empirical impression is discussed in Modigliani [1988].

The earlier basic model can readily be modified to include inheritance and a straight forward representation of the bequest motive, where the person inherits I in period 1 and leaves B as a bequest in period 2. Initially, let us suppose that the individual derives utility directly from B, so that he maximizes:

$$U=U(C_1, C_2, B) \qquad (2.147)$$

subject to the budget constraint

$$C_1 + pC_2 + p_b B = Y + I \qquad (2.148)$$

where p_b is the price of bequests including any tax on the transfers of wealth (and hence may differ from p). Blinder [1975] employed a model in continuous form. That is,

$$\int_0^T C_t e^{-rt} + B_T e^{-rt} = Y + I \qquad (2.149)$$

where t is age, r is the rate of interest, T is the length of life. Blinder assumes that consumption at each instant proportional to I + Y, and the lifetime utility function must be the form:

$$U = \int_0^T \frac{C_t^{1-\phi}}{1-\phi} e^{-\rho t}\, dt + \frac{bB_T^{1-\beta}}{1-\beta}, \quad \beta,\phi>0; b\geq 0 \qquad (2.150)$$

The maximization of (2.150) subject to (2.149) is a heuristic method of solution and optimal plan implicitly by the following equations:

$$C_t = C_0 e^{gt} \quad \text{where } g \equiv (r-p)/\phi \qquad (2.151)$$

$$C_0 = æ(r,p,\phi,T)\,[(Y+I)-B_T e^{-rT}] \qquad (2.152)$$

$$B_T = (be^{rT})^{1/\beta}\, C_0^{\phi/\beta} \qquad (2.153)$$

where æ(•) is a known function. If there is no utility from bequests, then the optimal B_T will be zero for every person, as is clear from (2.153). By (2.151) and (2.152), then C_0 (and hence all C_t) will be proportional to (Y+I). Specifically, $C_t = æe^{gt}(Y+I)$. If $\phi=\beta$, B_T is proportional to Co. If β, the elasticity of the marginal utility of bequest, exceeds ϕ, the elasticity of the marginal utility of consumption, then consumption is luxury good, that is, has a wealth elasticity greater than unity. Conversely, if $\phi>\beta$, then bequest are the luxury good (Blinder, 1973, pp.449–50).

How much does the bequest motive contribute to total wealth? Katlikoff and Summers [1981] have correctly pointed out that this issue is the really interesting one. It has been further proposed measuring the impact of bequests on total wealth by the elasticity of total wealth with respect to the flow of bequest: that is, by the percentage change in total wealth resulting from 1 percent change in bequests' flow. This elasticity, which may be labeled as the true measure of importance of bequests can be written as:

$$\epsilon^{*} = \frac{d(Y+I)}{dB} \frac{B}{(Y+I)} = \frac{d(Y+I)}{dI} \frac{I}{(Y+I)} \qquad (2.154)$$

Here, the second equality follows from the consideration that the stock of inherited wealth I is proportional to the annual flow of B. The first equality, on the other hand, shows that (given the flow of bequests) the true measure of importance is independent of how one chooses to define the share, as must be the case since the elasticity is, in principle, an observable fact. The second equality brings to light a simple relation between the true measure of importance and measure of the share of bequests. Specifically, let I^{j} stand for a any stated measure of aggregate wealth such as T^{*}. Then the corresponding measure of the share $I^{j}/(Y+I)$ will be an upward biased measure of importance if $d(Y+I)/dI^{j}$ is less than unity; it will be downward biased in the opposite case. No measure of the inherited wealth is likely to measure the desired elasticity correctly for several reasons. In the first place, when the economy is growing, the share of wealth received by bequests must tend to underestimate the contribution of bequest to wealth by not allowing for the effect of accumulation earmarked for future bequests. Second, there is reason to believe that $d(Y+I)/dI$ is not unity, however it is defined, simply because beneficiaries of bequests will probably change their consumption by an amount positive, but less than the full return on bequests (Modigliani, 1988, pp.32—33),

To further the analysis we will introduce Barro [1974] model of consumer. Barro wrote the utility function for someone who cases about his heirs as:

$$U_{i} = U_{i}(C_{i}^{1}, C_{i}^{2}, U_{i+1}) \qquad (2.155)$$

where U_{i}, C_{i}^{1}, C_{i}^{2} are utility and consumption when young and old for generation i, and U_{i+1} is the attainable utility level of the individual's descendant (Barro, 1974, p.1100). But there must be some discounting of U_{i+1} for U_{i} to be bounded, that is for there to exist a sensible optimization problem. Considering this fact Buiter [1979] writes (2.155) as being additively separable in the individual's own consumption and his descendant's utility level:

$$U_{i} = V(C_{i}^{1}, C_{i}^{2}) + U_{i+1}/(1+p) \quad p > 0 \qquad (2.156)$$

where p is the discount rate applied to the utility level of the individual's immediate successors (Buiter, 1979, p.418). If we assume that population grows at the rate of n, so that a person has not heir but 1+n heirs. It is appropriate to write the utility function of someone born at i as

$$U_i = V(C_i^1, C_i^2) + \frac{1+n}{1+p} U_{i+1} = \sum_{k=0}^{\infty} \left|\frac{1+n}{1+p}\right|^k V(C_{i+k}^1, C_{i+k}^2) \quad (2.157)$$

The utility function in (2.157) is well defined only if the sum converges and therefore p>n is a necessary condition for sensible results (Carmichael, 1982, p.205).

Children discount the utility of their parents at P. Consistency of the family's consumption plan requires, however, that if the utility of heirs is discounted at P the utility of parents is "reverse-discounted at", that is,

$$U_i = V(C_i^1,\ C_i^2) + \left(\frac{1+n}{1+p}\right)^{-1} U_{i-1}$$

$$= V(C_i^1, C_i^2) + \left(\frac{1+n}{1+p}\right)^{-1} (C_{i-1}^1, C_{i-1}^2) + \left(\frac{1+n}{1+p}\right)^{-2} U_{i-2} \quad (2.158)$$

Since someone born at time i can effect only the utility level of his or her parents, U_{i-1} is exogenous at time i. A formulation of the utility function that permits analysis of gifts as well as bequests is equation (2.159), in which must exceed n:

$$U_i = \sum_{k=-1}^{\infty} \left(\frac{1+n}{1+p}\right)^k V(C_{i+k}^1, C_{i+k}^2) \quad (2.159)$$

Here, there will be either gifts from children to parents, or bequests from parents to children, but not both (Buiter, 1979,p.421; Carmichael,1982, p.205).

However, an individual's budget constraint can be set up with both gifts and bequest. Assuming individuals work full time when young, and not at all when old, the budget constraint for someone born at time i is given by

$$C_i^1 + G_i + \frac{C_i^2}{1+r_{i+1}} + \frac{B_i}{1+r_{i+1}} = Y_i + \frac{G_{i+1}(1+n)}{1+r_{i+1}} + \frac{B_{i-1}}{1+n} \quad (2.160)$$

where G_i is the gift from child to parent at the end of period i. Solving (2.160) for C_i^2, substituting into (2.159), and maximizing with respect to C_i^1, G_i, and B_i one obtains:

$$\frac{\delta V/\delta C_i^1}{\delta V/\delta C_i^2} = 1+r_{i+1} \qquad (2.161)$$

$$\frac{\delta V(C_k^1, C_k^2)}{\delta C_k^1} = \left(\frac{1+r^{k+1}}{1+p}\right) \delta V(C_{k+1}^1, C_{k+1}^2)/\delta C_{k+1}^1, \quad k=i-1,i \qquad (2.162)$$

Equation (2.161) is the familiar condition that, in equilibrium, the slope of an individual's indifference curve should equal to the slope of his budget constraint. Equation (2.162) states that, in equilibrium the intergenerational MRS $(C_i 1, C^i_{i+1})$, which discounts i+1 utility at p, must equal to intertemporal price ratio, $1+r_{i+1}$ (Burbidge, 1983, pp.223–24).

Wealthy households which expect a substantial financial inheritance rate in life when their parents die will probably be reactors for much of their lives. Then, when the inheritance is finally received, diminishing returns will dissuade them from completely making up for lost time. Therefore, capital–market imperfections will induce them to consume less and save more over their lifetimes. Of course, parents can ease these constraints by transferring wealth, but this would simply shift the burden of capital–market constraints onto the parent generation as it sought to accumulate wealth at a much earlier age. Intergenerational transfers of human capital are no doubt much more important quantitatively than are financial inheritances. Further, they have the important characteristic that children must receive them at relatively young ages if they are to do any good. No mention has been made thus for of the number of children. Suppose that people only allocate their own life resources and that the utility function is not necessarily homothetic. The following function is sufficiently general to illustrate the point:

$$U = \frac{C^{1-\delta}}{1-\delta} + \Phi \frac{B^{1-\beta}}{1-\beta} \qquad (2.163)$$

where C is own consumption and B is the bequest. Indifference curves are homothetic if and only if $\delta=\beta$, and in this case the wealth elasticity of bequests is unity (Blinder, 1976, p.89; Goldberger, 1989, p.506). Both of the aforementioned motives, and most others suggest that the taste for bequests—the parameter Φ in the utility function—would rise with the number of children. If this is the case, a slower population growth rate will lead to the lower levels of bequest. However with fewer human beings in which to invest, the composition of intergenerational transfers should shift more from human form to financial form, so financial bequests may not fall. Whether human or financial wealth is the medium for intergenerational transfers is important for macroeconomic reasons largely because bequests in human form usually entail either consumer expenditures in the national income accounting (NIA), or withdrawls from the labor force, where as financial bequests are left sheds insight on the wealth elasticity. Due to finite capacity of human beings, bequests in human form are subject to the law of diminishing returns in that successive increments of financial sacrifice by the parents lead to smaller and smaller financial gains for the children. Financial bequest (F), by definition, cannot be subject to such diminishing return. Optimal behavior then will lead decendents to make all bequests in human form until the rate of return on human capital (r) is reduced to the opportunity cost of funds, and there after to make all bequests in financial form. This is illustrated in Fig. 2.15, where H^* is the critical level of human wealth. Suppose we had data on bequest, and their division between human and non-human form, for a cross-section of families. What would we see? Since, the point H^* varies among families because of differing discount rates, genetic endowments of human capital, numbers of children, and other things, we might observe smoothly concave and convex functions for human and financial bequests respectively, as shown in Fig. 2.16. In a word, the elasticity of financial bequests with respect to total bequests would exceed unity, so the wealth elasticity of financial bequests would exceed the wealth elasticity of total bequests. This is an important point since all efforts to measure the wealth elasticity of bequests have focused on financial bequests (Blinder, 1976, p.90—1).

The variable H is the amount expended by the parents in order to augment the earnings capacity of their children. This would include parental expenditures on food, clothing, medical care, education, etc. The average rate of return yielded from these investments is $\pi(H)$: a decreasing function of H. parents will attempt to invest efficiently, choosing expenditures that yield the highest rates of return for their children. The division of parental investments into the human and financial categories, on the assumption that parents are indifferent between a lira of

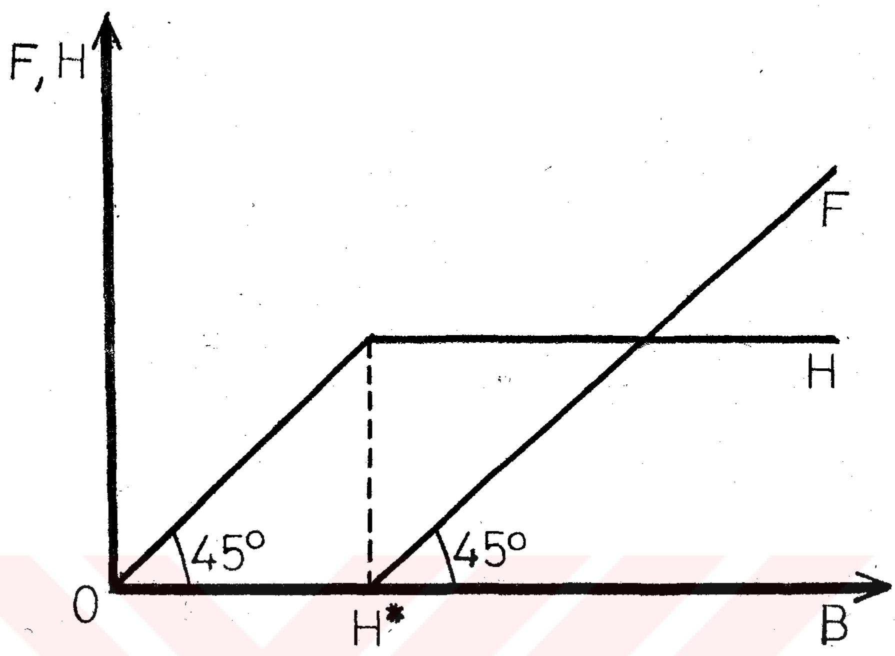

Figure 2.15

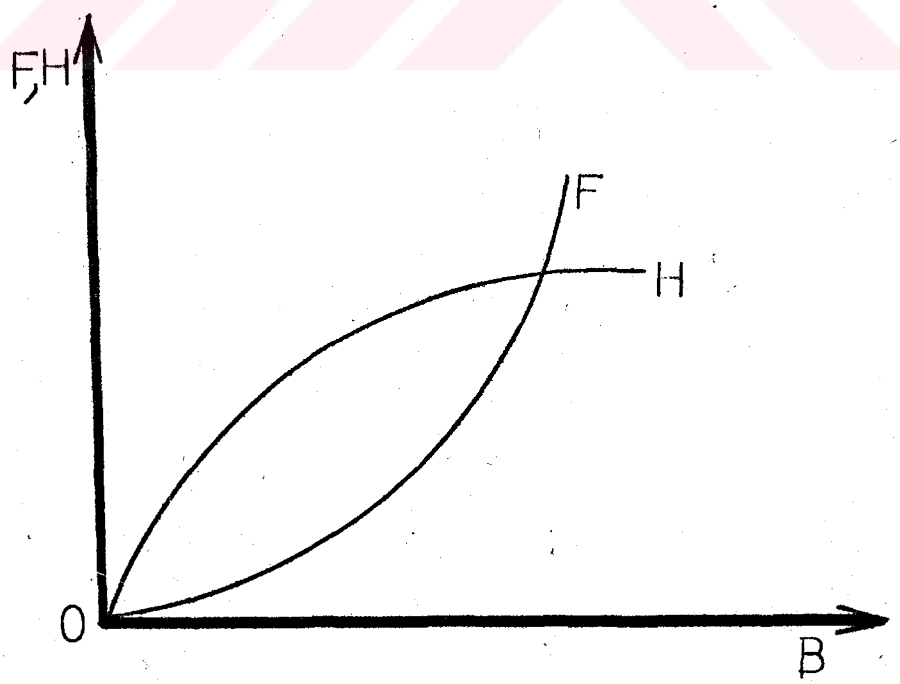

Figure 2.16

labor earnings or property income occurring to the children, and the monotonicity assumption, make it possible to predict the shape of the financial bequest function. Human bequests initially yield a higher return than financial investments. However, as the amount expended on a child increases the marginal rate of return π, falls. When the marginal rate of return on human bequests equals the market return on financial assets, all subsequent investments will be in the form of financial transfers (Menchik and David, 1983, pp.673–74).

If it is assumed that child quality is a normal good, which in this context implies that total transfers to children at time t are monitonically increasing function of parental resources (W^*):

$$H_t + F_t = t(W^*_t) \quad (2.164)$$

$$\frac{d\ t(W^*_t)}{dW^*} > 0 \quad (2.165)$$

In figure 2.17, H and F are human and financial bequests, π indicates the varying marginal rate of return on human bequests, and r is the market return on financial capital.

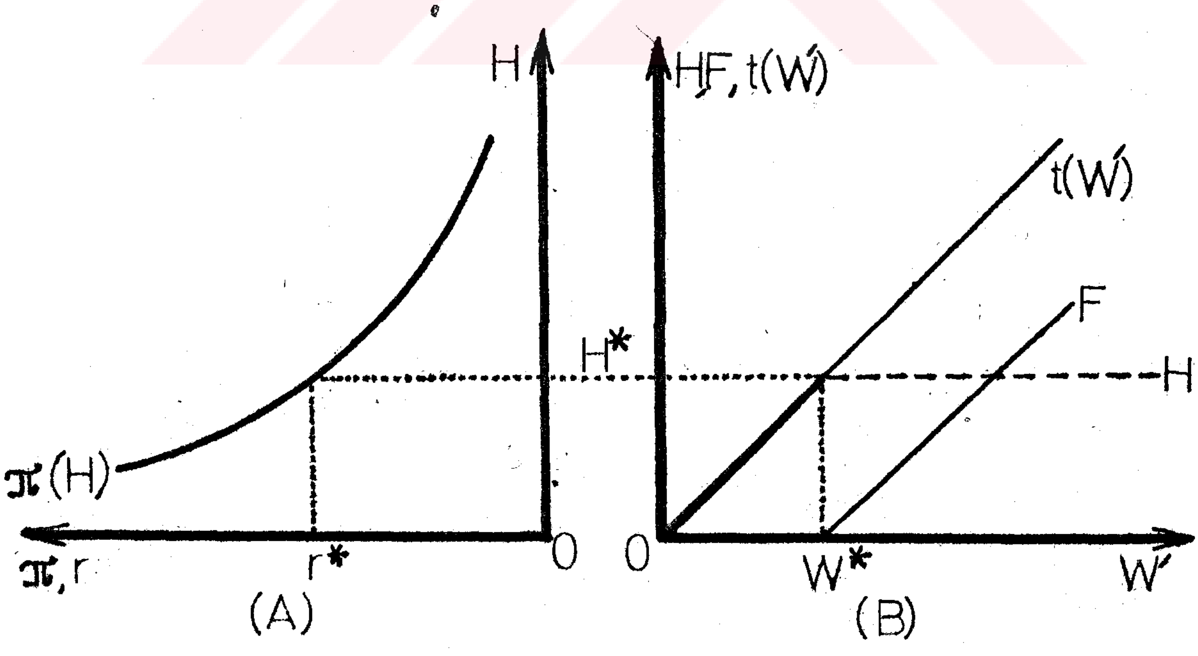

Figure 2.17

Panel (A) relates the marginal return on human bequests to the amount invested. Parents would invest up to but not greater than H^* in human bequests, since additional investments would yield less than r^*, the return yielded by financial transfers. All intergenerational transfers in excess of H^* will be in the financial form. Consequently, the transfer function will appear as presented in panel (B). Human bequests will rise with parental resources, W^*, up to H^* and will then become flat. Beyond W^{**}, financial transfers become positive, giving us:

$$F_t = \max [0, t(W^*_t) - H^*] \qquad (2.166)$$

The formulation of bequest motive given above is <u>ad hoc</u>, and it can be argued that the model should be derived from more basic assumptions about preferences. Thus, $U(C_1, C_2, B)$ may capture the position of a person solely concerned with the size of his estate, but may not allow for the case where bequests are merely an instrument for achieving other objectives. Recent work on the economics of family behavior has emphasized the relationship between altruism, voluntary transfers, and internal resource allocation. Altruism mainly examined in Becker [1973, 1974a, 1974b, 1977] Bernhem and Stark [1988] and further discussed in Bevan [1974], Stiglitz [1978], Hirshleifer [1977], Tullock [1977], and Bernheim, Shleifer and Summers [1985]. Two themes has emerged from this literature. First, since alturists internalize externalities, families that contain altruists should allocate resources efficiently. This principle is most clearly enunciated in Gary Becker's "Rotten Kid Theorem". Second, altruism increases the benefits of group interaction. One consequences of this principle is that one ought to discover altruistic linkages between spouses.

It is now well-established that the first of these results is rather special. Allocative inefficiencies may persist despite the existence of altruistically motivated resource transfers (Bernheim and Stark, 1988, p.1034).

Altruistic models of bequest behavior mean that the utility derived from bequests depends on the expected circumstances of succeeding generations. Thus, parents have to take a view as to the likely earning capacity of their children. Let assume that the utility derived from the lifetime consumption of generation t may be written as $U^*(C^t)$, where C is the present value of consumption at birth. If parents take account of the welfare of future generations, applying a discount factor $(1+\delta)$, then present consumption is chosen by generation 1 to maximize

$$U^*(C^1) + \frac{1}{(1+\delta)} U^*(C^2) + \ldots + \frac{1}{(1+\delta)^{i-1}} U^*(C^i) + \ldots \quad (2.167)$$

The value of this maximand, V, may be written as a function of lifetime income, $Y+I^1$, of generation 1, and the exogenous income of subsequent generations. The latter is assumed to be constant and equal to Y, and the rate of interest is assumed similarly constant. The value of V is therefore, if we suppress the constant Y, simply a function of I^1 (it is independent of time), and must satisfy the following relationship:

$$V(I^1) = \max_{C^1} \{U^*(C^1) + \frac{1}{(1+\delta)} V[(Y+I^1 - C^1)(1+r)]\} \quad (2.168)$$

The altruistic model takes to an extreme the representation of individuals making decision by utility-maximizing calculus, and can be criticized as making quite unwarranted assumptions about the extent of forward planning. Thus, for many people bequests may be largely the product of change; with an imperfect annuity market, people may leave substantial estates if they die unexpectedly young. Alternatively, bequests are governed more by class expectations and attitudes, for example, heirs to large fortunes inherit also the desire to preserve—or augment—their inheritance (Atkinson and Stiglitz, 1987, p.88)

2.1.2.3. Derivation of Consumption Function From Multiperiod Consumption Model

So far, we have examined the consumer's decision making about consumption on the basis of multiperiod consumption model. The last point in the analysis is to show that how can consumption function be derived from this model.

As an initial approach, assume that the household's (or consumer's) utility function is

$$U = U(C_1, C_2) \quad (2.169)$$

The above utility function will be maximized subject to budget constraint

$$C_1 + \frac{1}{(1+r)} C_2 = + \frac{1}{(1+r)} Y_2 \quad (2.170)$$

The right-hand side of (2.170) is referred as the present value of the consumer unit's total resources or total wealth (W^T), and may be written as follows:

$$W^T_1 = Y_1 + \frac{1}{(1+r)} Y_2 \qquad (2.171)$$

Changes in Y_1 and Y_2 that do not affect its wealth do not effect its consumption. To put it differently, it appears at first that we need to know three things to determine C_1, namely, Y_1, Y_2, and r; in fact, we need to know only two, a particular combination of Y_1, Y_2, and r; itself. There are different combinations of Y_1, Y_2, and r that we could use; that is, different ways of collapsing the three original variables into two (Friedman, 1957, p.9). One way, suggested, is to take W^T_1 and r as the two variables and to write the "consumption function" as

$$C_1 = f\ (W^T_1, r) \qquad (2.172)$$

The exact form of (2.172) will depend on the shape of consumer's indifference curves. However, it is easy to see from Fig.2.5 that as W^T_1 increases ($W^T_1 = OY_2 = Y_1A$ in Fig.2.5), than provided the slope of the budget line (and hence the rate of interest) remains unchanged, both C_1 and C_2 rise. Also if r rises with W^T_1 constant, then this reduces the slope of the budget line and we have pure substitution effect with the consumer increasing future consumption at the expense of current consumption.

Suppose it is now assumed that the slopes of all indifference curves are identical along any straight line passing through the origin, i.e., the marginal rate of substitution of C_1 for C_2 depends only on the ratio C_1/C_2 and not on the absolute sizes of C_1 and C_2—formally this means assuming that the consumer's utility function is homogeneous of some positive degree in both C_1 and C_2. This assumption has unreasonable implication that if the consumer received an extra money's worth of resources he would allocate it between C_1 and C_2 in exactly the same proportions as he allocated his original resources. That is, as W^T_1 is increased, with the rate of interest unchanged, the budget line undergoes a parallel shift outwards. Leaving the original C_1/C_2 ratio unchanged no matter what the absolute size of W^T_1. The ratio C_1/C_2 will, however, depend on the rate of interest r and also on the precise form of the consumer's indifference map. The constancy of C_1/C_2 for a given rate of interest means that C_1 and C_2 are in fact constant proportions of W^T_1, i.e.,

$$C_1 = f_1 W^T_1 \qquad f_1 > 0 \qquad (2.173)$$

$$C_2 = f_2 W^T_1, \qquad f_2 > 0 \qquad (2.174)$$

where the f's are independent of W^T_1 but dependent on the interest rate and consumer tastes as represented by his indifference map. (2.173) and (2.174) may be written in the general form as follows:

$$C_t = fW^T_t \qquad f > 0 \qquad (2.175)$$

(2.175) is nothing but a consumption function. In (2.175) W^T_t is the present value of current and future income at time t, and is equal to:

$$W^T_t = \Sigma \frac{Y_t}{(1+r)^t} \qquad (2.176)$$

This simply says that an individual's consumption in time t is an increasing function of the present value of his income in time t (Thomas, 1984, p.60; Branson, 1989, pp.246–47).

Let us consider an even more extreme situation where the rate of interest is zero and where the consumer exhibits an absence of "time preference proper". The absence of such time preference implies that each indifference curve is symmetrical about the 45 line passing through the origin as illustrated in Fig.2.18. This simply means that the consumer is indifferent between, for example, $C_1=80$, $C_2=40$ and $C_1=40$, $C_2=80$. The zero interest rate means that the slope of the budget line is –1, and hence that its point of tangency with any indifference curve will always be on the 45 line. Thus C_1 always equal to C_2 no matter what the size of W^T_1, and the consumer under these conditions always consumes at the same rate in each period. In Fig.2.18 $C_1=OA=OB=C_2$. We shall have reason to refer back to this particular case later (Thomas, 1984, p.60).

To derive the consumption function graphically, let us assume that utility can be represented as a function of current consumption (C_1) and the endowment left for the next period (E_2), thus;

$$U = U(C_1, E_2) \qquad (2.177)$$

The utility function (2.177) thus defined must be expected to vary over an individual's lifetime as E_2 stands as proxy for consumption over a shortening future. However, it is appropriate for the short-run analysis.

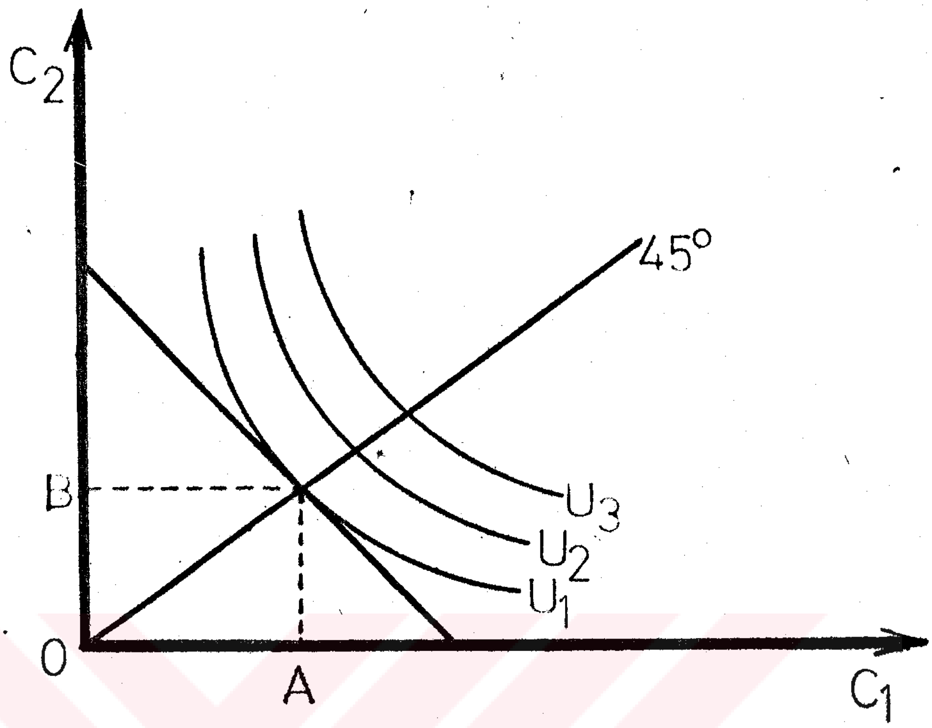

Figure 2.18

There is a budget constraint which is some function of E_1, the initial endowment ($E_1 = A_1 + Y_1$ where A_1 is the initial holding of marketable assets and Y_1 is first period income), and of H_2 the value at time 2 of future labor and other income receipts. H_2 is fixed throughout, reflecting completely inelastic expectations: Thus:

$$E_2 = H_2 + (A_1 + Y_1 - C_1)(1+r)$$
$$= H_2 + (E_1 - C_1)(1+r) \tag{2.178}$$

Now our purpose is to examine the relationship between C_1 and Y_1 when utility is maximized subject to the budget constraint. Fig.2.19 represents the perfect capital market case in which the budget constraint is a straight line of slope $-(1+r)$, through the point (E_1, H_2). In this figure the level of consumption corresponding to a given level of the budget constraint is indicated by the abscissa of the point of tangency of the constraint with an indifference curve, while, as noted, the level of initial endowment is indicated by the abscissa of the point of intersection of the budget constraint with H_2H_2. Consumption, C_1, can thus be drawn as a function of E_1 ($=A_1+Y_1$) as in Fig.2.20: the consumption function CC' has a slope less than unity as

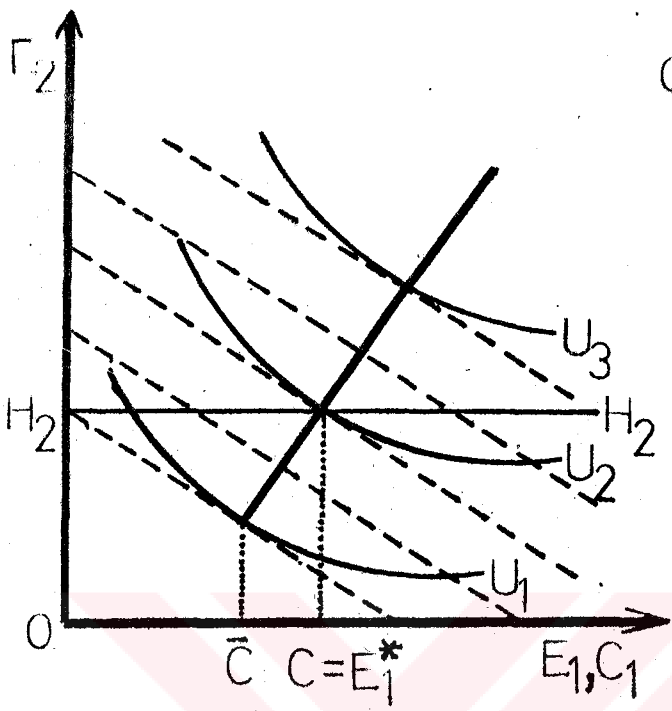

Figure 2.19

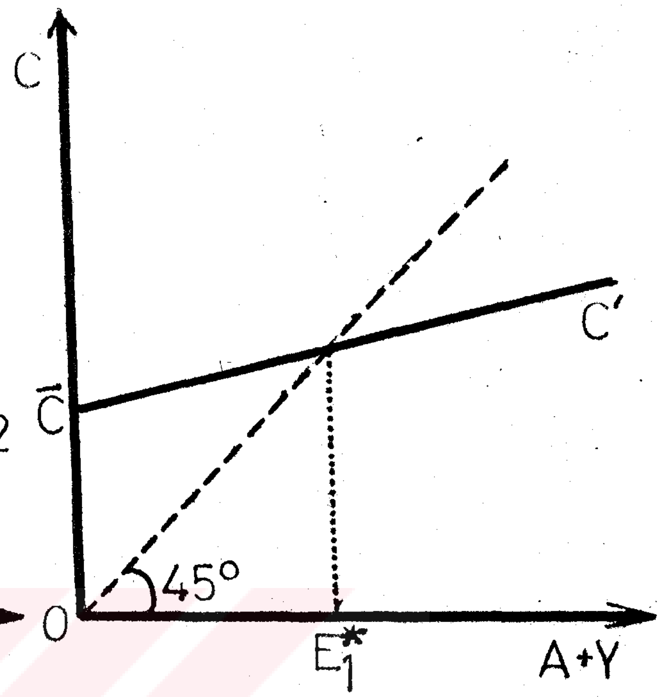

Figure 2.20

long as the expansion path (locus of tangencies) in Fig.2.19 is positively and the budget constraint negatively, inclined (Flemming, 1975, pp.161–62).

The above derivation of the consumption function has some superiority in analyses of the different situations. For instance, we can include the capital market imperfections in this type derivation of the consumption function. In Fig.2.21 the budget line reflects a divergence between lending and borrowing rates of interest, the latter being the higher: This ensures that it pays to sell assets earning the low rate before borrowing at the high rate. The divergence of two rates means that the single point, (E^*_1) in Fig.2.19, at which no financial assets are held (C_1=E_1), becomes an interval (E'E") in Fig.2.22; to this interval there corresponds a section of the consumption function (CC') in Fig.2.22, over which the marginal propensity consume is unity.

Finally, if no borrowing at all possible against H_2 the situation is as in Figs. 2.23 and 2.24, where the marginal propensity to consume is unity up to an endovment E, beyond which it falls to the perfect capital market level (Flemming, 1975, pp.162–63).

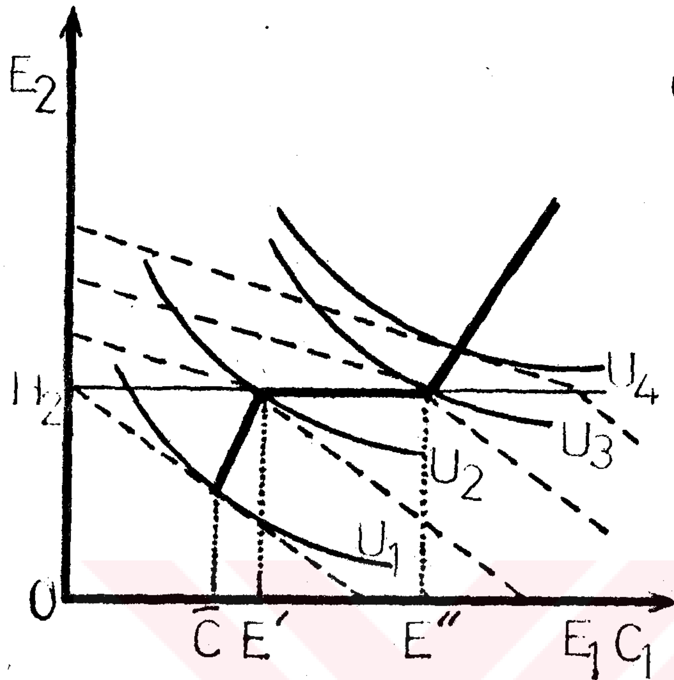

Figure 2.21

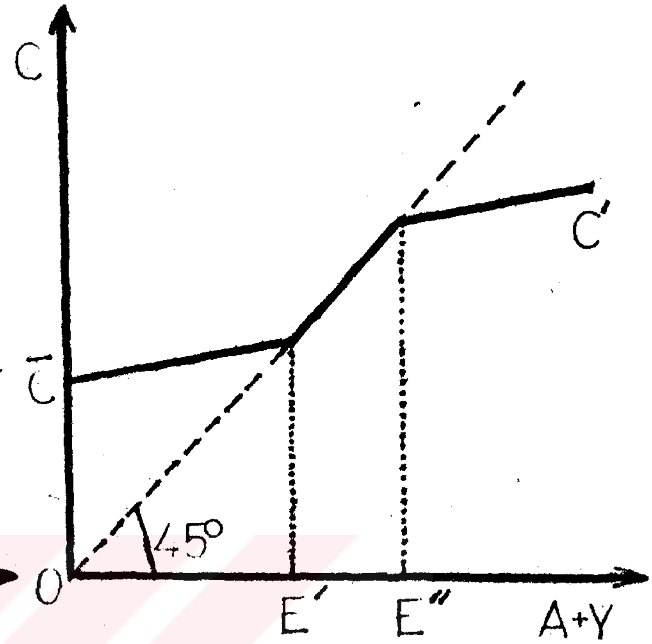

Figure 2.22

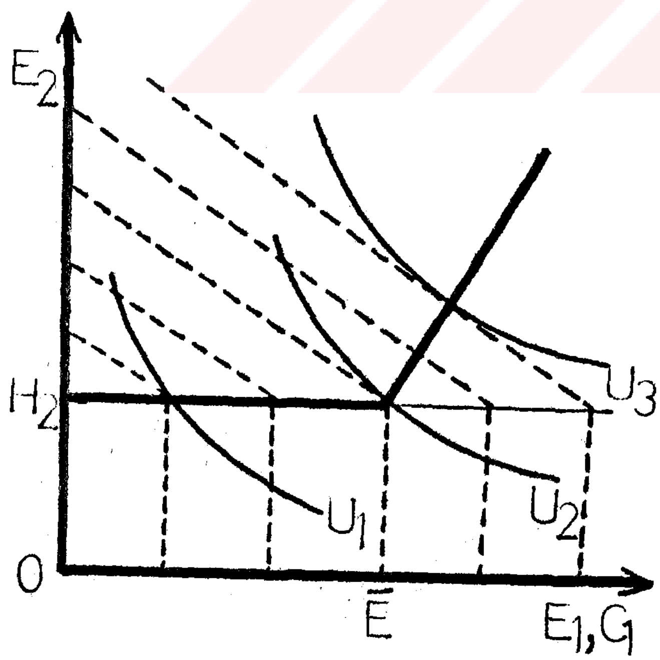

Figure 2.23

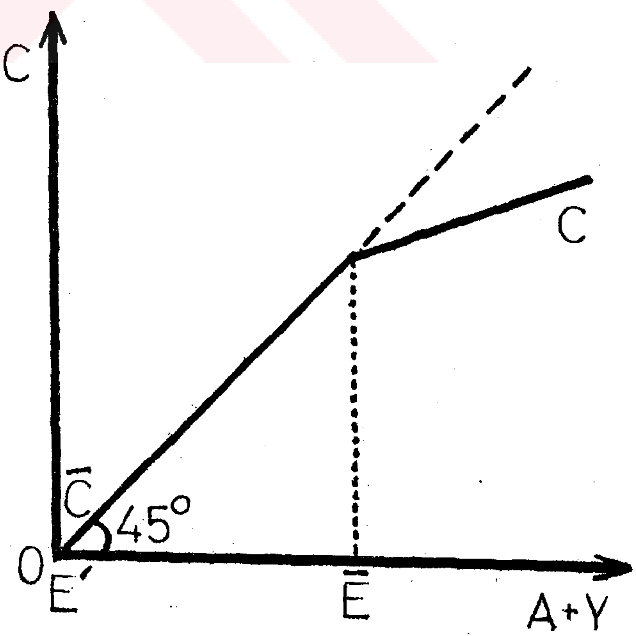

Figure 2.24

Before ending the chapter, we need to say something about the time path of consumption since it will be referred in the next chapter.

For simplicity, let us assume that the underlying utility function is logarithmic, i.e.,

$$U(C) = \ln C \tag{2.179}$$

This utility function has the usual properties that marginal utility is positive, $U'(C)=1/C$, and diminishing in consumption $U''(C)=-1/C^2$. Second we will assume that the utility function is additively separable over time. Third, we assume that future utilities are discounted at the subjective rate, æ. These three assumptions give us the particular specification as follows:

$$U = \sum_{t=1}^{T} \frac{\ln C_t}{(1+æ)^t} \tag{2.180}$$

Under this specification consumer's utility maximization problem may be written in the form:

$$\max_{C_t} \sum_{t=1}^{T} \frac{\ln C_t}{(1+æ)^t} \tag{2.181}$$

Subject to the constraint

$$\sum_{t=1}^{T} \frac{C_t}{(1+r)^t} = \sum_{t=1}^{T} \frac{Y_t}{(1+r)^t} \tag{2.182}$$

To solve this problem we may use the method of Lagrange multipliers:

$$\max_{C_t,\Gamma} L = \sum_{t=1}^{T} \frac{\ln C_t}{(1+æ)^t} + \Gamma\left[\sum_{t=1}^{T} \frac{Y_t}{(1+r)^t} - \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}\right] \tag{2.183}$$

The lagrenge multiplier Γ is a positive constant that will turn out to measure the marginal utility of an additional unit of wealth. For solution we set the first-order conditions as the below:

$$\frac{\delta L}{\delta C_1} = \frac{1}{C_1} - \Gamma = 0 \qquad (2.184)$$

$$\frac{\delta L}{\delta C_t} = \frac{1}{(1+\text{æ})t} \cdot \frac{1}{C_t} - \frac{\Gamma}{(1+r)t} = 0 \qquad (2.185)$$

$$\vdots$$

$$\frac{\delta L}{\delta C_T} = \frac{1}{(1+\text{æ})^T} \cdot \frac{1}{C_T} - \frac{\Gamma}{(1+r)^T} = 0 \qquad (2.186)$$

$$\frac{\delta L}{\delta \Gamma} = \sum_{t=1}^{T} \frac{Y_t}{(1+r)^t} - \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} = 0 \qquad (2.187)$$

First of all, let us compare time 1 consumption C_1 to time t consumption. If we move the terms in Γ to the right-hand sides of (2.148) and (2.185), and then divide equation (2.184) by (2.185), we get

$$\frac{C_t}{C_1} = \left|\frac{1+r}{1+\text{æ}}\right|^t \qquad (2.188)$$

and in general for any two adjacent periods we would have

$$\frac{C_t}{C_{t-1}} = \frac{1+r}{1+\text{æ}}, \text{ or } C_t = \left(\frac{1+r}{1+\text{æ}}\right) \qquad (2.189)$$

In general (2.189) may be written as

$$\frac{U'(C_t)}{U'(C_{t-1})} = \frac{1+\text{æ}}{1+r} \qquad (2.190)$$

In our partcular example, because $U'(C)=1/C$ this ratio in equation (2.190) is the inverse of C_t/C_{t-1} in (2.189). Thus, the first-order conditions give the result that the ratio of marginal utilities of consumption in each two adjacent periods over time is equal to the ratio of the market interest rate to the consumer discount rate (Branson, 1989, pp.248-50).

First of all, from (2.189) or (2.190) we see that whether consumption rises or fall over time depends on whether the market rate of return is larger or smaller than the individual's discount rate, that is, whether $r \lesseqgtr \text{æ}$. From the technical solutions we see that if $r > \text{æ}$, the consumption path would be rising over time. This make sense, the market interest rate r measures the return in additional saving, where as the discount rate æ gives the individual's loss from waiting to consume. If r>æ, it pays to save to consume later:

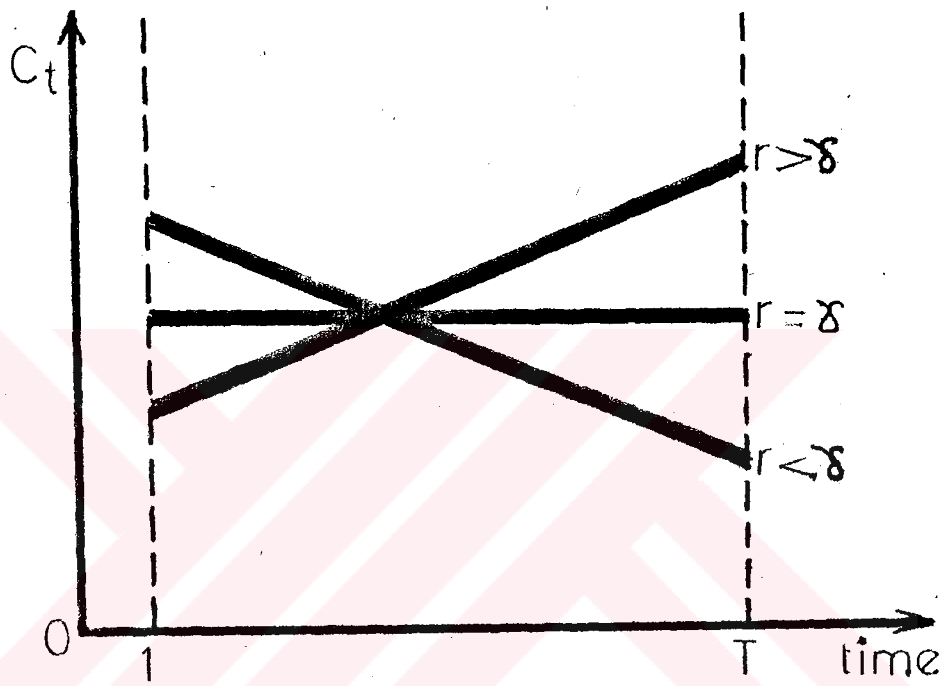

Figure 2.25

If r<æ, it pays to consume more now, less later. This gives us the time profiles of consumption in this simple example as shown in Fig.2.25. Each consumption path is constrained by the period 1 present value defined as

$$W^T_1 = \sum_{t=1}^{T} \frac{Y_t}{(1+r)t} \qquad (2.191)$$

The discounted integral of consumption from time 1 to T cannot exceed W^T_1; this is what the constraint says. Therefore, a consumption path that begins high because r<æ must cross one that begins low because r>æ. Their integrals must equal to the same constraint. This is what is shown in Fig.2.25. A remarkable implication, which we will examine more fully in the discussion of "rational expectations" approach to the consumption function in the next chapter, is that if we know C_{t-1}, we can predict C_t from equation (2.189). If the consumer is on an optimal consumption path at time (t–1), using all the information he or she has about future income prospects, we can use C_{t-1} to predict C_t. There is no need for other variables for forecasting, because all their information is already in the C_{t-1} decision. Finally, it should be intuitively clear that new information about future incomes Y_t would lift the entire consumption path in Fig.2.25. Whether r is greater or less than æ for a given individual, an unexpected increase in present value in equation (2.189) would rise the C_t in all periods. This same point may be represented in discussing the figure at the two-period case. The implication is that current consumption can be stated in terms of W^T_1 since the entire path depends on W^T_1. This result can be obtained from the first-order conditions (2.184)-(2.187) (Branson, 1989, pp.150-51).

To summarize, out of the first-order conditions for the lifetime (1 to T) maximization problem, several results have been obtained that will appear in various forms in the specific theories of consumption that we examine in the next chapter.

1. The slope of the consumption path depends on r relative to æ (Fig.2.15), with any two adjacent consumption related by equation (2.189).

2. Along an optimal consumption path, C_{t-1} is a good predictor to C_t.

3. Consumption at any time t is proportional to the peresent value of future income W^T_1 at that period, from equation (2.175).

CHAPTER III

THEORIES OF CONSUMPTION FUNCTION

In Chapter II, we have examined the consumption behaviour at the microeconomic level and showed how can a consumpion function be derived from the micro level. In this chapter, we will examine the consumption function in details. This chapter traces that sequence. After we introduced basic concepts and look at the background and the facts as they were known around 1945, we examine the theories of the consumption function—some of them finds their roots in the microeconomic theory introduced in Chapter II and others that has no microeconomic foundations. We introduce empirical investigations about the consumption function with the related theory which is currently under the discussion.

3.1 INTRODUCTION

Economists have long been interested in the factors determining the proportions in which a society divides its income between consumption and saving. In the past forty years theoretical and empirical investigation of these factors has been focused by the concept of the consumption function, a list of the variables that influences consumption together with the direction and magnitude of their effects. Since, saving is by definition the difference, positive or negative, between income and consumption whether relationship are summarized in a consumption function can equally well be summarized in a saving function. It is a matter of indifference whether attention is directed to the determinants of consumption or to the determinants of saving; the results of one approach can always be translated into the other.

Why have economists been interested in the division of social income between consumption and saving? There are two main reasons (Tobin, 1968, p.358). The first is the importance of saving for accumulation of the wealth of nations and for growth in their capacity to produce goods and services. Broadly speaking, consumption uses productive resources in the present, while saving enlarges the resources available for production and consumption in the future, by increasing stocks of finished goods or materials, productive plant and equipment, and claims of foregoing countries.

The second principal reason for concern with the consumption function is an outgrowth of the Great Depression of the 1930s, and of the revolutions in economic thought and policy to which it led. An economy will not produce at the rate which its manpower and capital resources permit unless total effective demand for goods and services suffices to purchase its capacity or full employment output. If private consumption demand falls short of capacity output, the difference must be made up by non-consumption spending: private investment at home or abroad, and government expenditure. If these resources of demand do not absorb the saving which the economy would perform at full employment, then output, employment, and the use of industrial capacity will all fall short of their full employment levels. The national propensity to save will not be realized in additions to national wealth but wasted in unemployment and idle capacity.

The study of the "aggregate consumption function" is one of the most important areas of macroeconomics, probably because of the interest given to it by the emphasis on and business cycle models of Keynes and the Keynesians and in the early growth models developed in the Keynesian tradition. This long tradition has produced a good deal of shifting about, as both technique and analysis have firmed up over the years. But it is interesting, nonetheless, that the classic studies (e.g., Keynes's "General Theory") contain many of the elements of our recent theory, without many of the recent econometric refinements, to be sure. Thus, there is a useful continuity to the consumption literature; on the other hand there are also a considerable number of provisional results, especially in the empirical area, and much has been made provisional in recent years on account of the "rational expectations" approach to the traditional problems (Douglas, 1985, p.48).

The consumption function provides an excellent illustration of a typical sequence in the development of knowledge in economics. This sequence involved first a conceptual breakthrough by Keynes in 1936, after which it was fairly obvious that a key relationship in macroeconomic analysis for some time to come would be the relationship between income and consumer expenditure. The importance of the relationship will be clear in the below analyses. The second step in the sequence involved the development of statistical information about consumer behaviour and the relationship among consumption, saving, and income. This work reasonably complete by the end of World Ward II, turned up interesting and seemingly contradictory fact: The ratio of consumer expenditure to income varies inversely with the level of both cyclically and accross families at any given time, but on aveage this ratio does not tend to fall as income rises over a long period. The next step in the sequence of research into the consumption function was the development of more rigorous and elaborate theories that could explain the facts. Three different theories were suggested by Duesenberry in 1949, Friedman in 1957, and a series of papers by Ando, Brumberg, and Modigliani beginning in the early 1950s. These theories have their similarities and differences, and differ in their implications for stabilization policy. The next step in the sequence which began in the mid-1930s was further statistical testing of the theories and the inclusion of statistically estimated consumption function in econometric models of the economy (Branson, 1989, pp.239-40).

3.2. HISTORICAL BACKGROUND

The idea that consumption is a stable function of income was given its first full and clear statement by J.M. Keynes, in his "General Theory of Employment, Interest, and Money" [1936]. It is easy, however, to find others what had come close to stating the same idea earlier.

As Pigou [1952] points out, Alfred Marshall expressly recognized the existence of a relationship between aggregate income and consumption, although admittedly in the context of long-term growth, rather than short-term fluctuation. Others, perhaps stating the idea of the latter context, nevertheless failed to recognize its crucial relevance. However, J.M.Clark, in his "Strategic Factors in Business Cycles" [1934], not only specifically formulated the idea in the context of income fluctuations, but was quite clear as to its, relevance. Nevertheless, the consumption function is properly considered a Keynesian invention, for it lies at the heart of Keynes' theoretical system.

Keynes took it for granted that current consumption expenditure is a highly dependable and stable function of current income-that "the amount of aggregate consumption mainly depends on the amount of aggregate income (both measured in terms of wage units)." He termed it a "fundamental psychological rule of any modern community that, when its real income is increased, it will not increase its consumption by an equal absolute amount", and stated somewhat less definitely that "as a rule,.... a greater proportion of income... (is) saved as real income increases" (Keynes, 1936, p. 96-97).

Keynes laid greatest stress on the above two assumptions and these taken together constitute what is nowadays often termed "Absolute Income Hypothesis" (AIH). In fact, only these two assumptions are necessary for much of the analysis (e.g., the familier multiplier process) in the General Theory.

Theoretical interest stimulated empirical work.

Numerical consumption functions were estimated from two kinds of data. First, economy-wide time series of consumption and income for the period between the two world wars. Lie along a function of the Keynesian type; there are even observations of negative private saving in the depths of the Great Depression. Second, any cross-section survey of household budgets appears to confirm the "psychological law" at a microeconomic level (Tobin, 1975, p.75). Both sources of data seemed at first to confirm Keynes's hypothesis. Current consumption expenditure was highly correlated with income, the marginal propensity to consume was less than unity, and the marginal propensity was less than the average propensity to consume, so the percentage of income saved increased with income. But then a serious conflict of evidence arose (Friedman, 1957, p.3).

Doubts began to arise about this simple form of the consumption function when it was found that it functions fitted to prewar U.S. data were used to forecast post-war levels of consumer expenditure. These functions led to serious underpredictions of such expenditure. A good illustration of this is provided by Davis [1952]. Such underpredictions were clearly in consistent with a stable relationship between income and consumption. First, extrapolations of statistical consumption functions based on prewar US data to potential post-war income levels greatly under estimated the post-war propensity to consume. These extrapolations led some analysts to pessimistic views of post-war economics prospects in the U.S. which were in the event quite unjustified. These extrapolations were based either on interwar time series, e.g., Simithies et al. [1945] or on the Engel curves relating household consumption and income in prewar budget studies, e.g., Cornfield et al. [1947]. Second, when the work of Kuznets [1942 and 1946] and Goldsmith [1955] made available data on aggregate income and consumption from the nineteenth century onwards, it became clear that for the US at least, as real income rose, the average propensity to consume (APC) did not decline but remained relatively constant at about 0.9, suggesting a long run consumption function which was not only linear but possessed no intercept. Other evidence from cross-sectional data produced at this time (e.g., Brady and Friedman [1947]) suggested that, while for any given year a Keynesian type function could adequately describe the data, if data from successive years were employed. This function appeared to be shifting upwards over time.

Recognition of these facts led a number of investigators to formulate and test hypotheses which would explain them-broadly speaking, hypotheses which would reconcile the short-run or cyclical success of the

Keynesian consumption function with its long-run or secular failure in the studies of 1940s. Indeed, as early as 1943 Samuelson [1943] proposed a "ratchet" model: consumption grows in the long-run roughly in proportion to income; but during cyclical interruptions of long-run growth , consumers defend living standards already attained, and consequently consumption follows a flatter (lower MPC) Keynesian path. In independent but similar contributions, Duessenberry [1948] and Modigliani [1949] formalized the ratchet idea and tested it statistically, making the APC depend inversely on the ratio between current income and previous peak income. This formalization has come to be known at the "Relative Income Hypothesis" (RIH). The RIH will be discussed in details in the below. Brown [1952], proposed a slight dedification, using previous peak consumption rather than peak income.

The doubts about the adequacy of the Keynesian consumption function raised by the emprical evidence were reinforced by the theoretical controversy about Keynes's proposition that there is no automatic force in a monetary economy to assure the existence of a full-employment equilibrium position (Friedman, 1957, p.5). A number of writers, particularly Haberler [1941] and Pigou [1943], demonsrated that this analytical proposition is invalid expenditure is taken to be a function not only of income but also of wealth or, tu put it differently, if the average propensity to concume is taken to depend in a particular way on the ratio of wealth to income. This dependence is required for the "Pigou effect". This suggestion was widely accepted, not only because of its consistency with general economic theory, but also because it seemed to offer a plausible explanation for the high ratio of consumption to income in the immediate post-war period.

One empirical study, by William Hamburger [1955], finds that the ratio of wealth to income is closly correleted with the rate of consumption to income, as judged by aggregate time series data for the interwar and post-World War II period. Other studies, particularly Ackley [1951], Katona et.al. [1954], and Klein [1951] have used data to investigate the rate of particular kinds of wealth, especially liquid assets.

Friedman [1957] and Modigliani and Brumberg [1954] have independent contributions offered an alternative explanation of the same phenomena.

According to Friedman's "Permanent Income Hypothesis" (PIH), the consumption of a household is proportional to its "permanent income", i.e., the average income it expects to earn over its planning horizon. Friedman is not definite about either the factor of proportionality—which might vary with the household's stage in the life cycle, its wealth the interest rate and other variables—or about the lenght of planning horizon.

One factor which may have contributed to the growth of permanent income ideas was recognition of the great pervasiveness of the regression toward the mean phenomenon (Mayer, 1972, p.22). Friedman and Kuznets [1945] had demonsrated that the incomes of independent professions showed a definite regression toward the mean, thus focusing the profession's attention on income fluctuations. In addition, the idea that consumption may depend, in part, on the incomes of years other than the current year was gaining more adherents; it was firmly embedded in the RIH and, in addition, was used independently of that theory. Finally, there was the very important fact that Kuznets had shown that the APC had not fallen over time. While this fact could, of course, be explained by the RIH, it probably made most economists more receptive to a new approach to the consumption function.

Accordingly, we find a number of economists in these years stating PIH ideas. For example Kuznets [1943] wrote: "The outlay of a family unit... during a given year (month,week, etc.).. may well be affected by its income over a much longer interval." Vickrey [1947] suggested that, due to the fluctuations of incomes, it would be better in expenditure studies to classify families by total expenditure levels rather than income. In his view: "The usual figures on the concentration of savings greatly overstate the savings of persons at the upper economic levels and marginal propensity to consume figures are generally too low" (p.273). Brady and Friedman [1947] wrote: "Inasmuch as the farm families are entirely in the enterprenurial group, it is not unreasonable to assume that the year to year fluctuations in the income of the individual families are greater for farm than nonfarm families. Expenditures and savings are without doubt dependent upon the expectation of a continuation of a given level of income" (p.262). Hanna [1948] suggested: "The manner in which an individual's or a family's income changes from year to year may have an important bearing upon its economic behaviour" (p.156).

One of the very important economists contributing to the development of the PIH was Margaret Reid. Reid [1952], distinguish clearly between permanent and measured income as follows: "If expenditure curves were available from classifications by what families regard as the permanent companent of their incomes, it might be possible to isolate forth short and long-runs effects of income change.... Without a suitable measure of the permanent component of income it is impossible to measure the effect of income on differences in expenditures among families at a given time or their response to income change when it does occur." (p.146-47).

Between 1952 and 1954 Richard Brumberg and Franco Modigliani wrote two essays, "Utility Analysis and Consumption Function: An Interpretation of Cross-Section Data" [1954] and "Utility Analysis and the Aggregate Consumption Function: An Attempt at Integration" (Published in 1979), which provide the basis for the so-called Life Cycle Hypothesis (LCH). LCH breaks fundementally with the measured income theories by going back, in a Fisherian manner, to the basic theory of consumer behaviour as stated by Modigliani [1986]: "Our purpose was to show that all the well established emprical regularities could be accounted for in terms of rational, utility maximizing, consumer's allocating optimally their resources to consumption over their life, in the sprit of Irving Fisher [1930]" (p.299)

According to the LCH, the hypothesis of utility maximization has, all by itself, one very powerful implication-the resources that a representative consumer allocates to consumption at any age will depend only on his life resources (the present value of labor income plus bequests received, if any) and not all on income occurring currently. When combined with the self-evident proposition that the representative consumer chooses to consume at a reasonable stable rate, close to his anticipated average life consumption. This statement is common to LCH and to Friedman's PIH which differs from LCH primarily in that it models rational consumption and saving decision under the simplifying assumption that life is indefinitely long (Modigliani, 1986, p.229).

More recently, Robert Hall [1978] has reformulated consumption theory by adding the assumption of rational expectations. Hall [1978] stated that "Optimization of the part of consumers is shown to imply that the marginal utility of consumption evolves according to a random walk with trend. To a reasonable approximation, consumption itself should evolve in the same way. In particular no variable apart from current consumption should be of any value in predicting future consumption. This implication is tested with time series data... It is confirmed for real disposable income, which has no predictive power for consumption, but rejected for an index of stock prices." (p.971) The paper concludes that the evidence supports a modified version of life cycle-permanent income hypothesis.

3.3. DEFINITION AND SOME BASIC CONCEPTS OF CONSUMPTION FUNCTION

Consumption function is the relationship between planned consumption expenditures of households and their current income. This relationship between consumption and income, referred to as consumption function, can be simply expressed as:

$$C = f(Y) \tag{3.1}$$

where C is consumption expenditures and Y is disposable income. The f(Y) means a "function of income".

Given the above consumption function we may define marginal propensity to consume (MPC) as: MPC is the change in planned consumption expenditures divided by the change in income. The MPC is expressed as:

$$MPC = \frac{dC}{dY} \tag{3.2}$$

Average propensity to consume (APC) is the ratio between consumption expenditures and income. The APC is expressed as:

$$APC = \frac{C}{Y} \tag{3.3}$$

Using (3.1), again, we may simply define the income elasticity of consumption as:

$$E_y = \frac{dC}{dY} \frac{Y}{C} \tag{3.4}$$

and the price elasticity of consumption may be expressed as:

$$\epsilon_p = \frac{dC}{dP} \frac{P}{C} \tag{3.5}$$

where P is the price.

3.4. TYPES OF CONSUMPTION FUNCTION

In the theory, two types of consumption function are generally mentioned. First one stems from the distinction made between short-run and long-run, and the second one is due to distinction between individual and aggregate behaviors.

3.4.1. Long-Run and Short-Run Consumption Functions

A short-run consumption function is a "nonproportional" consumption function such as:

$$C = a + bY \qquad (3.6)$$

where

$$MPC = \frac{dC}{dY} = b \qquad (3.7)$$

and

$$APC = \frac{C}{Y} = \frac{a}{Y} + b \qquad (3.8)$$

This nonproportional consumption function is shown in Fig. 3.1.

The short-run consumption function that Keynes introduced shown in Fig.3.1 plots real consumer expenditure C against real income Y. This function reflects the observation that as incomes increase people tend to spend a decreasing percentage of income, or conversely tend to save an increasing percentage of income. The slope of a line from the origin to a point on the consumption function gives the APC, or C/Y ratio at that point. The slope of the consumption function itself is the MPC. Using (3.7) MPC=b. From the graph it should be clear that the MPC is less than the APC (i.e., MPC<APC). If the ratio C/Y falls as income rises, the ratio of the increment to C to the increment to Y must be smaller than C/Y. Keynes saw this as the behavior of consumer expenditure in the short-run over the duration of a business cycle. He reasoned that as income falls relative to recent levels, people will protect consumption standards by not cutting consumption proportionally to the drop in income, and, conversely, as income rises, consumption will not rise proportionally (Branson, 1989, pp.240-41). In the late 1930s, empirical studies using both cross-sectional and time series data seemed to verify the above Keynesian short-run consumption function.

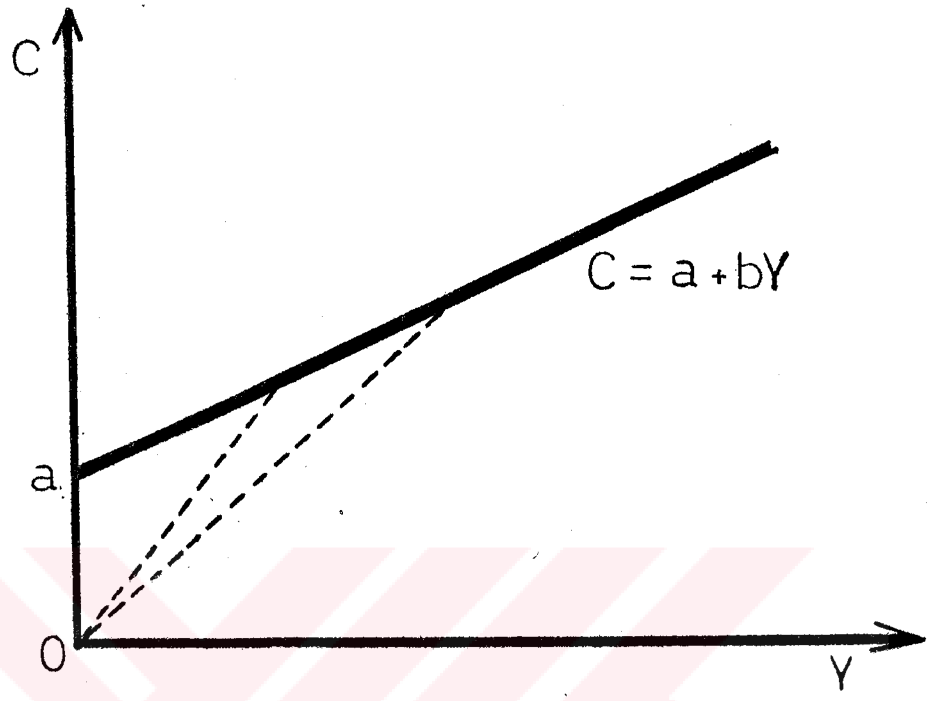

Figure 3.1

It was not long after this simple Keynesian consumption function began to crumble. When it was used to predict post-World War II aggregate expenditures for the US economy, the forecast was high unemployment, while the actual result was excessive demand, a high level of employment, and inflation. Based on the above short-run Keynesian consumption function, the forecast seriously underestimated consumption expenditures (Miller and Pulsinelli, 1986, p.230).

In 1946, Simon Kuznets published a study on consumption and saving behavior dating back to the Civil War for the US. Kuznet's data pointed out two important things about consumption behavior. First, it appeared that, on average, over the long-run the ratio of consumer expenditure to income, APC or C/Y, showed no downward trend so the marginal propensity to consume equals the average propensity to consume (MPC=APC) as income grew along trend. This meant that, along trend, the C=f(Y) function was a straight line passing through the origin, as shown in Fig.3.2. Second, Kuznet's study suggested that years when the C/Y ratio was below the long-run average occurred during periods of economic slump. This meant that the C/Y ratio varied inversely with income during cyclical fluctuations, so that for the short-period corresponding to a business cycle empirical studies would show consumption as a function of income to have slope like that of the short-run functions of Fig. 3.2. rather than the long-run function (Branson, 1989, p.242).

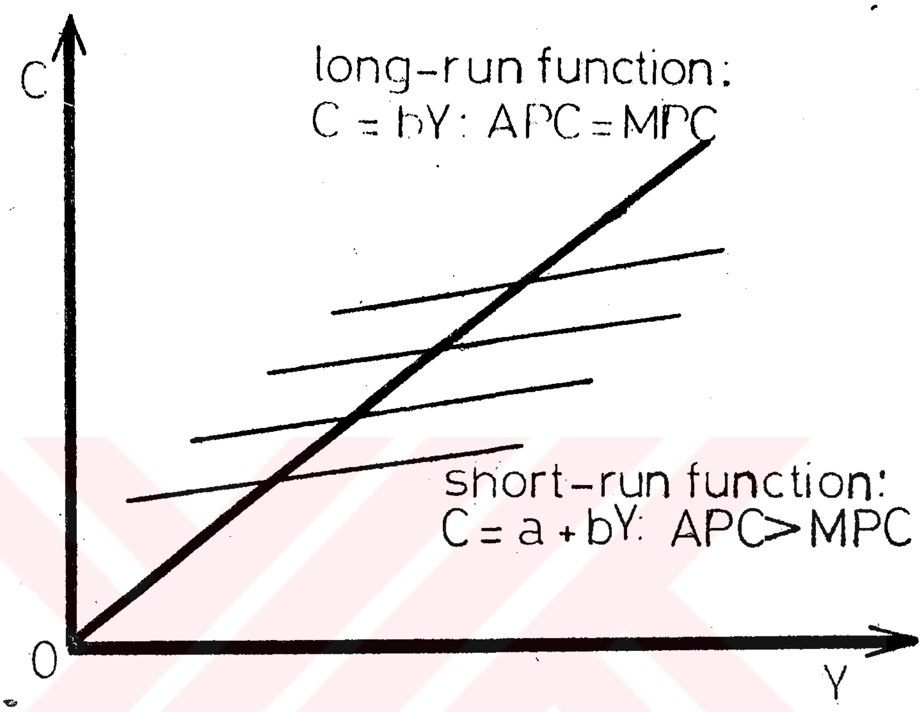

Figure 3.2

Summarizing, a long-run consumption function is a "proportional" consumption function such as:

$$C = bY \qquad (3.9)$$

The MPC for this function is

$$MPC = \frac{dC}{dY} = b \qquad (3.10)$$

and the APC is

$$APC = \frac{C}{Y} = b \qquad (3.11)$$

It can readily be seen that for this type of consumption function MPC = APC = b.

Long-run consumption function with the corresponding short-run consumption function is shown in Fig. 3.2.

It is important to be perfectly clear on this point that consumption functions based on data collected for long periods of time (long-run consumption functions) differ from short-run consumption functions in these observed phenomena by the late 1940s:

1. The long-run consumption function indicates a greater slope (MPC)-about 0.9 versus about 0.75 for short-run functions.

2. Cross-sectional budget studies show C/Y decreases as Y rises, so that in cross-section of the population, MPC<APC.

3. Business cycle, or short-run, data show that C/Y ratio is smaller than average during boom periods and greater than average during slumps, so that in the short-run, as income fluctuates, MPC<APC.

4. The long-run consumption functions show a zero vertical intercept, while the short-run functions tend to show a positive vertical intercept that is, long-run consumption functions show a constant APC as income rises, and short-run functions show an APC that varies inversely with income. Therefore, as income grows along trend, MPC=APC for the long-run functions while MPC<APC for the short-run functions.

3.4.2. Individual and Aggregate Consumption Functions

So far, we have merely discussed the consumption function at the individual level, and we must now pass on from this microeconomic relation to a macro-economic formulation that is amenable to estimation from aggregate date. This is the problem of aggregation, and it is fair to say that it is usually handled by analogy. The consumption function theories that we shall discuss below are as a rule conceived in micro economic terms and subsequently applied to macro-economic variables without much regard for the aggregation involved. While we may set out quite plausible conditions that justify the aggregate relation, it is just easy to think of conditions that would lead to an alltogether different specification.

To reach an aggregate consumption function from an individual consumption, consumption expenditures and incomes are summed. Let us denote by an index i, (i=1,...,n), each of n households which make a group of households. Let Y_{it} and C_{it} be the disposable income and consumption, respectively, of household i during period t. We assume that Y_{it} and C_{it} are related.

Suppose first that the consumption function of each household is linear, say:

$$C_{it} = a_i + b_i Y_{it} \qquad (3.12)$$

where a_i and b_i are coefficients peculiar to household i. To obtain aggregate consumption function from (3.12) aggregation is needed. The simplest form of aggregation is summation. Adding (3.12) over all n households in the economy we obtain:

$$\Sigma C_{it} = \Sigma a_i + \Sigma b_i Y_{it} \qquad (3.13)$$

Thus aggregate consumption depends on the incomes of the n households. With the explanatory variable the model is linear (Malinvaud, 1980, p.135).

Now, although ΣC_{it} equals total consumption this equation does not amount to a simple relation between aggregate variables of the type readily amenable to standard statistical analysis. For one thing we cannot separate total income, ΣY_{it}, from the composite term $\Sigma b_i Y_{it}$. Moreover, unless we pretend that n is constant and that the summation extends for all t over exactly the same households, there is no reason why the aggregate parameters should be at all stable (Cramer, 1971, p.176).

Some of these problems are solved if we make the stringent assumption that all micro-parameters, b_i, are identical (Theil, 1965, p.17) i.e.,

$$a_i = a \qquad b_i = b \quad \text{for all } i \qquad (3.14)$$

this leads to

$$\Sigma C_{it} = an + b\, \Sigma Y_{it} \qquad (3.15)$$

If we consider (3.15) as a stochastic equation and add an error term aggregation will produce more complicated problems. The aggregation problem will be discussed in details later in terms of a stochastic model.

3.4.3. Consumption Function With or Without Consumer Durables

At the outset we must distinguish clearly between purchases of consumer durables and other consumption. Purchases of durables depend on prior stocks and can be postponed or accumulated much more easily than other consumer purchases. It is thus not surprising to find that purchasing patterns for durables are different from those for other consumption (Evans, 1969, p.13). Any set of national income accounting definitions designed to separate these categories of consumption must be somewhat arbitrary. It is not immediately obvious whether a man's overcoat or an automobile is more durable. Although there is little hesitation about characterizing an automobile as a consumer durable, all clothing is treated as a nondurable in the most national income accounts. However, such "borderline" items as overcoats account for a very small percentage of consumption, so that their effect on empirical findings should be negligible. Unless specifically stated otherwise, in this chapter consumption function will refer to consumption function of nondurables and services plus the use value of the services rendered by durables. Consumption of durables themselves are examined separately.

3.5. DETERMINANTS OF CONSUMPTION FUNCTION

There is little doubt that income plays a significant role in determining consumption expenditures. Yet, like so many economic variables, income must be precisely defined before it can become operationally useful. This task is more difficult than it might appear.

The concept of real disposable income is relatively straightforward and was used in our analyses. Even here, however, it is necessary to elaborate: Is it current disposable income that influences consumption, or does it take time for consumers to adjust to changing income levels? If there are lags in the adjustment of consumption to income, perhaps it would be better to write the consumption function as follows:

$$C_t = \alpha + \beta_1 Y_t + \beta_2 Y_{t-1} + \beta_3 Y_{t-2} + \beta_4 Y_{t-3} + \ldots \quad (3.16)$$

which shows that current consumption, C_t, depends upon several different income levels. The strenght of the relation is given by the value of the βs, which are the MPCs of the different income levels. More than likely, the βs are all different in this formulation and probably decline in value the further they are from the current period. In econometrics such a function is called a "distributed lag". Equation (3.16) recognizes that consumers adjust their spending decisions only gradually as they become accustomed to new income levels. For those whose incomes fluctuate widely, the notion of an adjustment period is tenable. For those whose incomes are stable or change very slowly, an adjustment period is irrelevant. Naturally, much depends upon how the income period is defined. It makes a significant difference whether Y is income per month, per quarter, or per year (Campagna, 1981, p.42). Moving to the economy as a whole to aggregate Y and C—there may well be a lag in the response of a community to changes in income. But for a large portion of that community, the lag is likely to be small or nonexistent.

In general, those who spend a large proportion of their income on consumption will adjust to changes rapidly. In sum, although a lag is likely to occur, it does not appear to be overly important, and the use of current disposable income as the main determinant of current consumption is not unrealistic or unwarranted for simple models in the short—run.

Some argue that disposable income is a poor choice as a means of measuring the effect of income on consumption since consumers do not base decisions on it but on income over which they have control. Thus, disposable income must be reduced by the amount of contractual payments—rent, car payments and other fixed items in the household budget and then the remainder related to consumption. This concept of income, called "discretionary income", may useful in some situations or for some purpose , but it does not appear to affect the case for using disposable income in the consumption function. Contractual payments still represent consumption and can be adjusted over time. It is better not to distinguish among consumer goods according income concept (Campagna, 1981, p,42).

Among the main factors affecting consumption apart from income, there are wealth, distribution of income and wealth, interest rate, price changes, consumer credit, liquid assets, stock of consumer durables, and the others that may be classified as social, psychological, demographic, and philosophical factors. These factors will be examined within this chapter, but some points needs to be indicated before going further on.

Observed differences among households in consumption behavior are, of course, attributable to a long list of differences in their circumstances, habits, and preferences. Some of these are, like income and wealth, variables whose influences the major interest of economists. Others are like demographic characteristics, variables which can differ widely among households even though their distribution over the population changes only very slowly. It is nonetheless important to measure their effects, if only to disentangle them from the measurement of the influence of variables more important in economic fluctuations and economic policy. Considerable statistical effort has been devoted "life cycle" variables (age, marital status, family size and composition) and other demographic characteristics (educational attaintment, occupation, race, geographical location). A set of variables of a different nature are the "psychological" ones—attitudes, intentions, expectations, personality attributes. Unlike demographic variables, the distribution of some of these psychological variables in the population may change radically in the short-run, in ways that can be ascertained in our present state of knowledge only by new surveys (Tobin, 1975, p.86). If household surveys are to contribute further to our understanding of the propensity to consume and make possible more powerful tests of competing theories, they will have to take a longer perspective. To measure the effects of past and expected levels of income and wealth, and of retirement, and bequest objectives, it is necessary to observe not only the current status of households but their lifetime histories, plans, and aspirations.

3.6. THEORIES OF CONSUMPTION FUNCTION

Four general theories currently exist on the determinants of total consumer spending i.e., consumption function: the "absolute income hypothesis", the "relative income hypothesis", the "permanent income hypothesis", and the "life cycle hypothesis". Though radically different in interpretation, they nevertheless possess certain properties in common. One such property is their purported generality. Each has been used on time series as well as on cross-section data and to derive macro-as well as-micro relationship. Each was advanced originally in terms of individual behavior and then generalized to aggregate behavior, sometimes with explicit recognition of the aggregation problem, and at other times largely ignoring it on the apparent presumption that nonlinearities or distributional effects are relatively unimportant. Each hypothesis postulates a relationship between consumption and income, though the concepts underlying these terms may vary substantially. In other words, the primary concern is to isolate the influence of income, and occasionally of wealth, on consumer's spending, holding constant the effect of other possibly relevant, less important variables-age, family composition, location of residence, education etc. (Ferber, 1962, p.20). Each is the subject of wide controversy, receiving support from some empirical studies but not from others. Finally, each, when first presented appears deceptively simple, at least in theory, but when it comes to implementation, proponents of the same hypothesis often disagree with each other on appropriate definitions and approaches. This will become clear from a consideration of each hypothesis in turn.

3.6.1. The Absolute Income Hypothesis

Textbooks frequently attribute the absolute income hypothesis to Keynes in the "General Theory" and there is no doubt whatsoever that in that study he put forward a very simple relation between income and consumption, although there is also no doubt that he had much more than that to say on the consumption function-in particular in believing that interest rates, prices, and wealth would affect aggregate consumption. Keynes was the first economist to point out the importance of the consumption-income relationship and to use it as the major building block in his macroeconomic analysis (Douglas, 1985,p.49; Ekelund and Delorme, 1987, p.353).
.L:57

As is so frequently the case, a discussion of a modern economic theory should start with the work of Irving Fisher. Fisher [1930] described the factors causing households to save in the context of a multiperiod model. Two characteristics of Fisher's model relate it to the modern wealth theories. One is Fisher's explicit focus on the rationality of saving decision. Fisher's household save purposefully. This contrasts with the subsequent treatment of saving by Keynes. Fisher's discussion of saving was more or less brushed aside by the Keynesian revolution. To be sure, in the "General Theory" Keynes did devote three pages to a discussion of saving motives, but the main thrust of Keynesian theory dealth with consumption rather than with saving. Hence, there is a tendency in the Keynesian literature to treat saving as a residual rather than as something to be explained by a multiperiod model. And if one focuses on consumption rather than on saving then one is much less likely to concern oneself with the problem of the relevant time period than if one focuses on saving. This is so because the motives for consumption relate to the current period. By stressing consumption rather than saving, Keynes set the stage for ignoring the question of the time period. Hence, economists tended to follow the line of least resistance by using the unit of time in which the data happen to come-usually a year (Mayer, 1972, p.18).

The consumption function, as it exist today, stems from the "fundamental psychological law" stated by Keynes that "The fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* from our knowledge of human nature and from the detailed facts of experience, is that men are disposed, as a rule and on the average to increase their consumption as their income increases, but not by as much as the increase in their income" (Keynes, 1936, p.96).

A simplified version of Keynes's theory of the consumption function, known as the Absolute Income Hypothesis (AIH), is commonly summarized by the following four propositions

(i) Real consumption is a "fairly stable" function of real income, i.e., $C=f(Y)$.

(ii) The MPC lies between 0 and 1, i.e., $0<\delta C/\delta Y=MPC<1$.

(iii) The MPC is less than the APC, i.e., $\delta C/\delta Y=MPC<APC=C/Y$.

(iv) The proportion of income consumed decreases as income rises, i.e., $[\delta(C/Y)/\delta Y]<0$. This proposition means that the income elasticity of consumption lies between 0 and 1, i.e., $0<\delta \log C/\delta \log Y=(Y/C)(\delta C/\delta Y)<1$.

The expression "fairly stable" was indicative of the fact that factors other than real income, e.g. interest rates, windfall changes in capital values, might also influence real consumption but that in the Keynesian scheme of things, the income variable was likely to be of overriding importance (Thomas, 1984, p.53).

The first three of Keynes's propositions can be illustrated with the linear consumption function:

$$C = \alpha + \beta Y \qquad (3.17)$$

MPC corresponds to β in Eq.(3.17), so that the Proposition ii is that $0<\beta<1$. Keynes placed great importance on this "fundamental psychological law". Since he felt β was less than one, Keynes believed than increases in income toward full employment would have to be accompanied by exogenous increases in investment to insure that demand would rise enough to meet the higher level of income. If MPC were greater than or equal to one, the nature of the multiplier, $(1/1-\beta)$, would endanger the stability of the system.

The third proposition is that as income increases the APC decreases. To understand the implication of this proposition it is first necessary to study the relation between marginal values and average values. The relation between MPC and APC can be illustrated with the linear function. APC is C/Y and from (3.17)

$$C/Y = \alpha/Y + \beta \qquad (3.18)$$

or

$$APC = \alpha/Y + MPC \qquad (3.19)$$

As Y increases, APC will decrease if and only if α is positive. Thus, the third Keynesian proposition is consistent with (3.17) if α is positive. Note also that $APC=\alpha/Y+MPC$ and that $\alpha/Y>0$, therefore APC>MPC. This relation between APC and MPC is quite important, for a declining APC is the main proposition challenged by confrontation with empirical evidence (Wykoff, 1976, p.82-83).

Figure 3.3 of the linear consumption function can be used to illustrate the relation between MPC and APC. The slope of the consumption line is MPC. APC can be measured at each point on the consumption line.

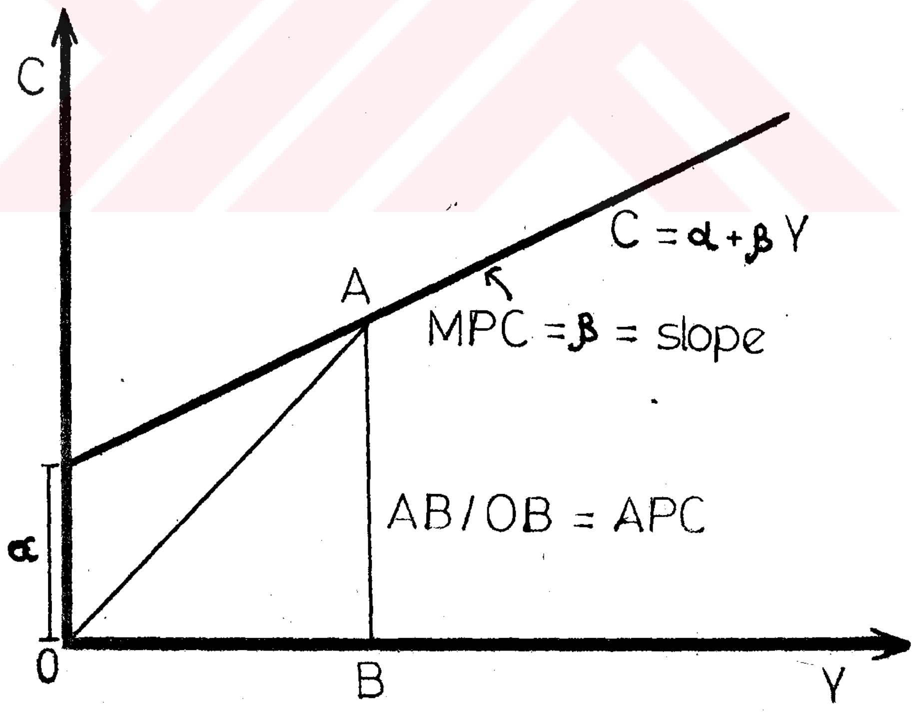

Figure 3.3.

The fourth proposition of the Keynesian hypothesis that MPC declines as income increases, cannot be illustrated with the linear consumption function, because straight lines have constant slopes. However, a relatively simple nonlinear function, a second-degree polynomial, may be employed to illustrate Proposition iv. Consider the following:

$$C = \alpha + \beta_1 Y + \beta_2 Y^2 ; \qquad \alpha>0,\ \beta_1>0,\ \beta_2<0 \qquad (3.20)$$

MPC is linear function of income and as income increases MPC declines. Figure 3.4 illustrates this consumption function. Husby [1971] and Avralıoğlu [1976] empirically estimated (3.20) from cross-sectional data. Estimated function in these studies were generally meaningful except some extreme cases.

Keynes believed MPC would tend to decline during a boom and rise during slowdowns for two reasons. First, during a boom as employment increases relative to available capital, diminishing returns to labor set in. Income to property, relative to labor, increases. Keynes felt that entrepreneurs, whose relative share of income would rise, tend to have a low marginal propensity to consume (Wykoff, 1976, p. 85).

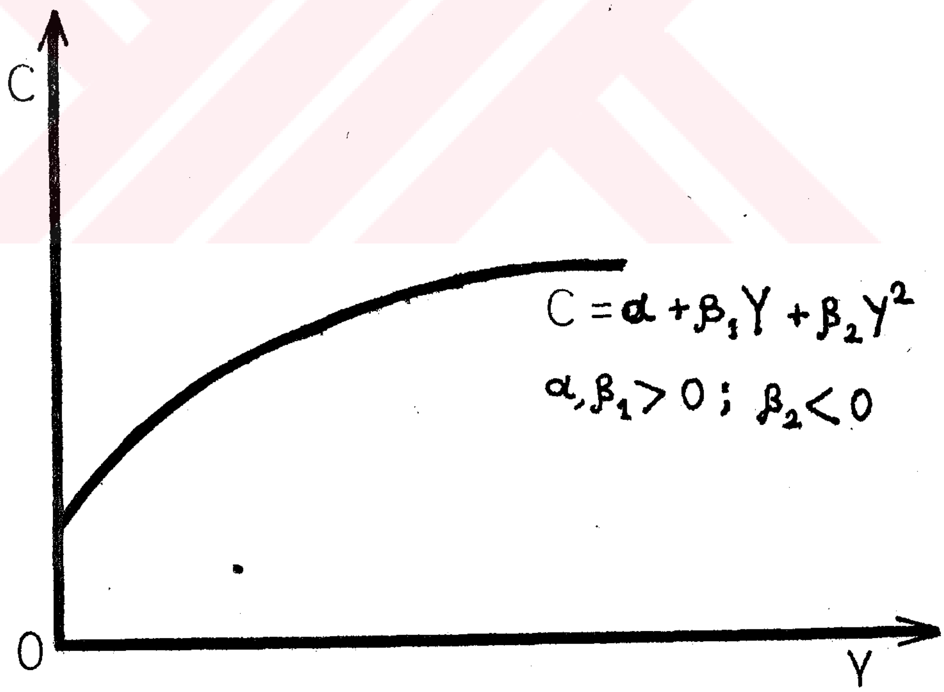

Figure 3.4

Consequently, aggregate MPC would decline during booms. Second, during downturns in the cycle, transfer payments are relatively high, and propensity to spend such income by employed and those on public relief would be high in Keynes's view.

In Eq (3.20), MPC can be obtained as follows:

$$MPC = \beta_1 + 2\beta_2 Y \qquad (3.21)$$

The MPC is declining function of Y since $\beta_1 > 0$, and $\beta_2 < 0$. Keynes expilicitly assumed that the consumption of each consumer is independent of the others (Duesenberry, 1952, p.1). Depending upon this assumption aggregate consumption function may be written as

$$\sum_{i=1}^{n} C_i = \sum_{i=1}^{n} \alpha + \beta_1 \sum_{i=1}^{n} Y_i + \beta_2 \sum_{i=1}^{n} Y^2{}_i \qquad (3.22)$$

where i refers to consumer unit and n refers to number of consumer unit. Let us write $\Sigma C_i = C$ and $\Sigma Y_i = Y$. In addition $\Sigma Y_i{}^2$ may derived from the variance of individual incomes (σ^2) as follows:

$$\sigma^2 = \frac{1}{n} \Sigma(Y_i - Y)^2$$

$$= \frac{1}{n} \Sigma(Y_i{}^2 - nY^2)$$

$$= \frac{1}{n} \Sigma[Y_i{}^2 - \frac{(\Sigma Y_i)^2}{n}]$$

$$= \frac{1}{n} \Sigma(Y_i{}^2 - \frac{Y^2}{n})$$

$$\Sigma Y^2{}_i = n\sigma^2 + \frac{Y^2}{n} \qquad (3.23)$$

substituting (3.23) into (3.22) gives

$$C = n\alpha + \beta_1 Y + \beta_2 (n\sigma^2 + \frac{Y^2}{n}) \qquad (3.24)$$

To calculate the MPC from (3.24 Avralıoglu [1976] assumed that σ^2 equal to Y^2 multiplied by a positive constant, say, k. For simplicity we use the same assumption. Using this assumption we may write:

$$\sigma^2 = k\ Y^2 \qquad (3.25)$$

substituting expression into (3.24) gives

$$C = n\alpha + \beta_1 Y + \beta_2 (nkY^2 + \frac{Y^2}{n}) \qquad (3.26)$$

if we rearrange

$$C = n\alpha + \beta_1 Y + \frac{\beta_2}{n} (n^2 k + 1) Y^2 \qquad (3.27)$$

The MPC for (3.27) is given by

$$MPC = \beta_1 + 2 \frac{\beta_2}{n} (n^2 k + 1) Y \qquad (3.28)$$

Since $\beta_2 < 0$, the MPC is a declining function of income. It can be argued that Keynes' propositions were proved, now at the aggregate level (Avralıoglu, 1976, p.41-42).

Similarly, the proposition that APC>MPC can proved at the aggregate level. In (3.27) the APC is

$$APC = \frac{C}{Y} = \frac{n\alpha}{Y} + \beta_1 + \frac{\beta_2}{n} (n^2 k+1) Y \qquad (3.29)$$

Comparing (3.29) with (3.28) we may write:

$$APC = \frac{C}{Y} = \frac{n\alpha}{Y} + \beta_1 + \frac{\beta_2}{n} (n^2 k+1) Y - \beta_1 - 2 \frac{\beta_2}{Y} (n^2 k+1) Y$$

$$= \frac{n\alpha}{Y} - \frac{\beta_2}{n} (n^2 k+1) Y > 0 \qquad (3.30)$$

The result of the (3.30) is positive since $\alpha>0$, and $\beta_2 < 0$.

The microeconomics of the AIH was not spelled out by Keynes in his book. But assumptions about household behavior were implied. First, each household was assumed to be rational and able to maximize utility subject to the household's income constraint. Second, each household possessed complete information about the market. Finally, each household made its choice of goods and services independently of every other households. Its is especially important to remember with this last assumption that each household has its own that what one affect what another household buys (Ekelund and Delorme, p.354). Household behavior is not a social phenomenon. Thus, we say that each household has a utility function which is independent of every other household utility function.

Rationality of the consumer in the AIH was given support by some economists later. Ackley [1961] stated that "Keynes may also have seen intuitively that his function is consistent with the behavior to rational consumer of given tastes; nevertheless, he failed to provide any detailed <u>a priori</u> argument showing how the behavior he described would necessarily follow from the usual psychological assumptions which economists make. However, numerous later economists have sought to derive the consumption-income relationship from or integrate it with the general analysis of consumer preference which constitutes an important cornerstone of microeconomics." (p.278)

Keynes espoused a "habit-persistence" version of the theory which could be tested with a distributed lag of past values of income. Consider the following quotation from page 97 of the "General Theory". "For a man's habitual standard of life usually has the first claim on his income and he is apt to save the difference which discovers itself between his actual income and the expense of his habitual standard; or, if he does adjust his expenditure to changes in his income he will over short periods do so imperfectly." Douglas [1985] argues that, without a doubt, many of the tests which reject or support the simple AIH in this vast literature do so not on behalf of Keynes himself but on behalf of a simple textbook version of his theory. Keynes's consumption function is also likely to be "non-rational" as is clear from the literature on rational expectations (Douglas, 1985, p.51).

A typical estimated form of (3.19) using annual real consumption and disposable income for the period 1929-40 was reported by Davis [1952]:

$$C_t = 10.69 + 0.80\, Y_t + e_t, \quad R^2 = 0.993 \qquad (3.31)$$

A similar estimation was made by Ackley [1961] for the period 1929-41. The estimated form was:

$$C_t = 26.5 + 0.75\, Y_t + e_t, \quad R^2 = 0.998 \qquad (3.32)$$

These estimated equations appear to explain the data very well and at the same time verifies conditions (ii), (iii) and (iv).

Further support for the Keynesian form of the consumption function came from comparative studies of family budgets. All four Keynesian propositions about consumption behavior are consistent with the budget study evidence.

Despite this apparent confirmation of the AIH, the empirical consumption function such as (3.31) and (3.32) run into various difficulties almost immediately (Spanos, 1989, p.156). The first problem was that when (3.31) was used for prediction in the period 1946-50 it underpredicted systematically (this was reported in Davis [1952]). This was interpreted as a rejection of the AIH stability proposition (i). The second problem for the estimated consumption functions (3.31) and (3.32) was raised by Kuznets [1946]. He argued that when the cyclical changes in consumption and income are ignored their ratio appears to be constant over long periods. Taking averages over overlapping decades between 1869 and 1938 (in order to iron out the cyclical effects) he argued that expect for the last decade the ratio (C/Y) appeared to be constant, varying between 0.84 and 0.89. These findings taken at face value contradicted the AIH underlying (3.19) in so far as the APC implied by the model is a decreasing function of Y. A third problem was raised by studies using cross-section data. The estimates of the MPC based on cross-section data appeared to be invariably lower than the time-series estimates. Moreover, there appeared to be an upward shift of the estimated consumption functions over time. In view of Kuznet's findings the cross-section evidence was taken to imply an apparent contradiction between the long-run (time-series over long time) and short-run (cross-section and short time series) empirical results. By the late 1940s and early 50s the above problems were considered to be "stylized facts" to be explained by further research. In summary these were:

(i) AIH empirical consumption functions were unstable,

(ii) The APC was constant over long periods,

(iii) Short-run consumption functions tended to confirm the AIH but long-run estimates seemed to reject it, and

(iv) Cross-section estimates of the MPC systematically lower than time-series estimates, and appeared to shift upwards over time.

The above four "stylized facts" were strongly criticized by Spanos [1989], and Thomas [1989]. Spanos [1989] argued that ".....the above interpretation of the empirical evidence is very misleading because the empirical models based on [(3.19)] are seriously misspecified (statistically) and thus any conclusion based on such models were invariable erroneous ..... On closer examination the apparent paradoxes of the "stylized history" turn out to be either erroneous interpretations of the evidence or they are easily explainable on statistical ground. In a nutshell the argument is that the textbook methodology led to a search for theory solutions to problems largely statistical in nature." (p.151). Furthermore, he claims that the underprediction for the post-war period can be easily explained as symptomatic of the serious dynamic misspecification the early empirical consumption functions suffered from. A reappraisal of Kuznets findings, using the original data reveals that the APC is not constant but growing steadily over the period in question (Spanos, 1989, p.151).

Thomas [1989] pointed out that despite the existence of surveys of early empirical studies of the consumption function, the stylized history of the early econometrics of the consumption function that has become a fashionable feature of many macroeconomic textbooks and survey articles is far from the historical truth. While the simple consumption function of equation (3.19) may have come to dominate much of the estimation in the 1950s and 60s, it was neither the first consumption function fitted nor the dominant functional form used in the early econometrics of the consumption function. If the wide variety of consumption functions that were fitted from the outset is taken as evidence that equation (3.19) was not generally accepted. It suggests that dissatisfaction with (3.19) occurred much earlier than is suggested by the stylized history. This stylized history is a travesty of what actually happened and that the early work on the consumption function was both much richer, in terms of the insight into consumers behavior it produced and superior econometrically to much of the work that followed. The early response to Keynes's theory of the consumption function did not represent a sudden blossoming of applied macroeconometrics, since neither economists trained in macroeconomic theory nor the relevant time series data were generally available (Thomas, 1989, pp.131-32).

The Keynesian consumption function paradox rejected in a recent study by Bunting [1989]. Bunting argued that "the 'fact' of the consumption function paradox has been little questioned since Friedman's [1957] impressive review of thirty years ago...When the functions are re-estimated using old data, spending patterns still remain significantly different in the cross-section as compared to long-run. However, these differences now seem more the result of statistical considerations than fundamental differences in economic behavior...For valid comparisons of either marginal propensities or income elasticities, the spending unit should be the same. Comparison should be on the basis of household or aggregate spending, not household with aggregate spending ... Important spending caharacteristics could be hidden by aggregation or regression coefficients derived from relatively few observations could be sensitive to grouping criteria." (Bunting, 1989, pp.349-50).

Bunting [1989], first estimated a consumption function using time series for 1929-82. The estimated function was:

$$C = 1.93 + 0.9311\ Y \qquad (3.33)$$
$$(0.14) \quad (105.34) \quad N_{cy} = 1.00$$

Here, Ncy is income elasticity. However, since the function describes aggregate behavior, it cannot be compared with cross-sectional results which involve family or household behavior. To make a valid comparison Bunting converted the time series data to a household basis by dividing both annual consumption (C_t) and income (Y_t) by the number of household (H_t). The re-estimated function then becomes:

$$CH = 1549.6 + 0.8699\ YH \qquad (3.34)$$
$$(2.39) \quad (34.38) \quad N_{cy} = 0.93$$

where $CH = C_t/H_t$ and $YH = Y_t/H_t$

In (3.34) MPC approaches to the MPC derived from cross-sectional data earlier. The difference in Bunting's estimates (3.33) and (3.34) is due to assumption that transformation is linear. If the transformation is linear, than conversion of the data from one form to another will have no effect on the value of the estimated MPC. To illustrate the situation, let us use the formula:

$$\mathrm{var}(a + bY) = b^2\ \mathrm{var}(Y) \qquad (3.35)$$

This is also true for covariances,

$$\mathrm{cov}(a + bC, a + bY) = b^2\ \mathrm{cov}(C,Y) \qquad (3.36)$$

Since the slope of the regression of consumption on income is given by

$$MPC = \frac{\mathrm{cov}(C,Y)}{\mathrm{var}(Y)} \qquad (3.37)$$

conversion of the aggregate data to a household basis will yield the same MPCs only if the transformation is linear; that is, if

$$CH = a + bC \text{ and } YH = a + bY \qquad (3.38)$$

If these conditions exist, then

$$MPC = \frac{cov(C,Y)}{var(Y)} = \frac{b^2 (CH,YH)}{b^2 \; var(YH)} \qquad (3.39)$$

In the case of the different MPCs of (3.33) and (3.34) the differing MPCs indicate the transformation of C_i to CH and Y_i to YH is not linear.

Bunting, also, claims that cross-sectional paradox of low MPC is because of unequal group size problem. He first estimated the consumption function with average income (YA) and average consumption (CA) calculated by dividing each group by its number of household. The equation was:

$$CA = 1035.9 + 0.7840 \; YA \qquad (3.40)$$
$$(6.53) \quad (45.25) \quad Ncy = 0.84$$

To solve the unequal group size problem Bunting, then, excluded the lowest and highest income groups. The resulting equation was:

$$CA = 1005.2 + 0.8028 \; YA \qquad (3.41)$$
$$(6.49) \quad (39.62) \quad Ncy = 0.86$$

When the equation is re-estimated using ungrouped data set of 13.694 observations the cross-sectional function become:

$$CH = 796.04 + 0.8362 \; YH \qquad (3.42)$$
$$(32.07) \quad (295.62) \quad Ncy = 0.87$$

Depending upon these results, Bunting argued that empirical differences between cross-sectional and long-run household spending behavior virtually disappear (Bunting, 1989, p.335). Finally, Bunting has written that: "In conclusion results presented...indicate that Keynes's "fundamental law" is valid, that as a rule and on the average households are disposed to increase their consumption as their income increases, but not by as much as increase in their income."

Arthur Smithies also attempted to reconcile short-run consumption functions that show an inverse relationship between the APC and real national income with Kuznets's data that show that in the long-run the APC is invariant to real national income. Smithies [1945] argued that Keynes was right. The APC does fall as real national income rises, other things constant. But other things are not constant. Between 1869 and 1929 real national income quadrupled and would have caused the APC to decrease. But, during that same period other changes (in urbanization, standard-of-living, and wealth) took place that would have caused the APC to rise. In short, as real national income rises the consumption function shifts upward sufficiently to offset a declining APC; this theory is called the "consumption drift hypothesis" (Miller and Pusinelli, 1986, p. 245).

Consider Fig. 3.5, which shows that the consumption curve shifts upward at the same time that real national income rises.

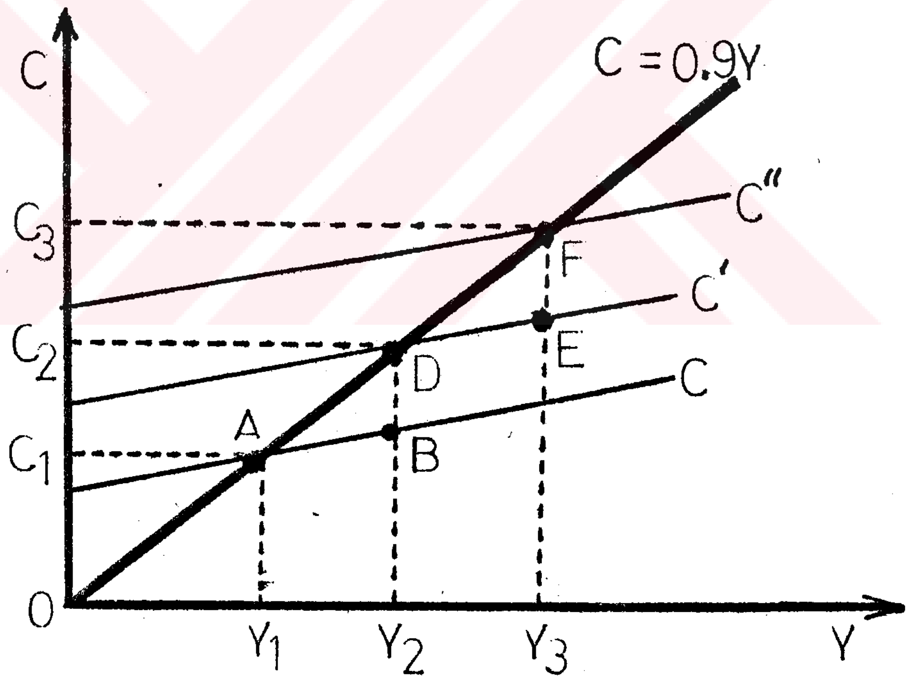

Figure 3.5

As real national income rises, the economy moves along a consumption function and the APC falls. However, the urbanization effect, the standard-of-living effect, and the wealth effect simultaneously shift the consumption curve upward-increase the APC-by just enough the offset the decline in the APC. The net result is that, as real national income rises from Y_1 to Y_2 to Y_3, the economy moves from A to D to F, all points along a ray from the origin that has a slope of 0.9. By coincidence, therefore the consumption function appears to be C=0.9Y

Recently Neary and Stiglitz [1983] reconstructed the Keynesian theory of consumption in terms of expectations. This Post-Keynesian model analogous to the multiperiod—consumption model discussed in Chapter II. In this model, the household sector's utility function (written in additive form) depends on consumption in each period, C_1 and C_2, and on the amount of real money balances held at the and of the second period, M_2/P_2:

$$U = U(C_1) + \alpha\, U(C_2) + \tau(M_2/P_2; \Gamma_v) \qquad (3.43)$$

The function $\tau(\cdot)$ indirectly represents the utility derived from consumption in all periods beyond the first two, and so depends on expectations of prices, incomes, and constraint levels in those periods. Neary and Stiglitz [1983] assumed that these expectations, denoted by the vector Γ_v, are independent of all that happens in the first two periods, and may be treated as exogenous. In the absence of any quantity constraints, maximization of (3.43) is carried out subject only to the budget constraint:

$$P_1 C_1 + P_2 C_2 + M_2 \leq Y \qquad (3.44)$$

where Y is total income received in the first two periods. Maximization of (3.43) subject to (3.44) leads to unconstrained or national demand functions for current and future consumption:

$$\underset{\quad -\ \ ?\ \ +}{C_1(P_1, P_2, Y)} \quad \text{and} \quad \underset{\quad -\ \ ?\ \ +}{C_2(P_1, P_2, Y)} \qquad (3.45)$$

These functions are homogeneous of degree zero in all nominal variables, including the prices expected to prevail beyond period 2 that form part of the vector Γ_v (Neary and Stiglitz, 1983, p.203). The signs of the partial derivatives of the functions in (3.45) are as indicated. Neary and Stiglitz assumed that consumption in each period is a normal good and responds negatively to changes in the price prevailing in that period. However, they have pointed out that the effect on current consumption of a change in the price of future output (i.e., the effect on savings of a change in the interest rate) is indeterminate in general, since, as is well-known the income and substitution effects of such a change work in opposite directions.

Despite these developments in the AIH there is an old problem still remains to be solved. Haavelmo [1943] pointed out that in the context of a simple Keynesian model, the consumption function is not a regression equation, i.e., its disturbance is not orthogonal to disposable income. A version of Haavelmo's model is

$$C_t = a + b\,Y_t + \epsilon_t \tag{3.46}$$
$$Y_t = C_t + I_t \tag{3.47}$$

where I_t and ϵ_t are random variables that satisfy:

$$E\epsilon_t = E\epsilon_t I_t = 0,\ EA^2{}_t < \infty,\ E\epsilon^2{}_t < \infty$$

here C_t is consumption, I_t is investment or "autonomous" expenditures, and Y_t is income.

Solving (3.46) and (3.47) for "reduced forms" for consumption and income gives:

$$Y_t = \frac{a}{1-b} I_t + \frac{1}{1-b} + \frac{1}{1-b}\epsilon_t \tag{3.48}$$

$$C_t = \frac{a}{1-b} I_t + \frac{1}{1-b} + \frac{1}{1-b}\epsilon_t \tag{3.49}$$

Consider the population least squares projection C_t on Y_t:

$$P[C_t \mid 1, Y_t] = \alpha + \beta Y_t \tag{3.50}$$

where $\beta = E(C_t - EC_t)(Y_t - EC_t)/(Y_t - EY_t)^2$. From (3.48) and (3.49) we can calculate

$$Y_t - EY_t = \frac{1}{1-b}(I_t - EI_t) + \frac{1}{1-b}\epsilon_t \tag{3.51}$$

$$C_t - EC_t = \frac{1}{1-b}(I_t - EI_t) + \frac{1}{1-b}\epsilon_t \tag{3.52}$$

Thus it yields:

$$\beta = \frac{E[(1/(1-b)(I_t - EI_t) + (1/1-b)(\epsilon_t))][(b/(1-b)(I_t - EI_t) + (1/(1-b))\epsilon_t]}{E[(1/(1-b)(I_t - EI_t)) + (1/(1-b))\epsilon_t]^2} \tag{3.53}$$

Evaluating (3.53) with $E_{\epsilon t} I_t = 0$ gives:

$$\beta = \frac{bE(I_t - EI_t)^2 + E\epsilon_t^2}{E(I_t - EI_t)^2 + E\epsilon_t^2} \qquad (3.54)$$

or

$$\beta = \frac{b + (E\epsilon_t^2/E(I_t - EI_t^2))}{1 + (E\epsilon_t^2/E(I_t - EI_t^2))} \geq b \qquad (3.55)$$

Expression (3.55) shows that in general the population value of the least squares regressions coefficient β is greater than the marginal propensity to consume (Sargent, 1979, p. 300). Notice that $\beta \longrightarrow 1$ as

$$E\epsilon_t^2/E(I_t - EI_t)^2 \longrightarrow \infty$$

so that when most of the variance in income is due to the disturbance in the consumption function, least squares estimates of the consumption function tend to recover the national income identity (3.47), i.e., the estimated MPC approaches unity. On the other hand, if $E\epsilon_t^2/E(I_t - EI_t)^2$ is small, β will approximate b well (Malinvaud, 1980, p.124-25).

In general, in the context of Keynesian models like (3.46) and (3.47), it is not appropriate to use least squares regression to estimate the consumption function. Even in very large samples (i.e., even if we know the population moments and did not have to estimate them), least squares estimates remain biased estimates of the MPC. The reason can be seen from the reduced form equation for income (3.48). Given that $E\epsilon_t I_t = 0$, equation (3.48) implies that $E\epsilon_t Y_t <> 0$, so that the consumption function (3.46) is not a regression equation; i.e., its disturbances does not satisfy the orthogonality condition that the method of least squares imposes (Sargent, 1979, p.301 ; Wonnacott and Wonnacott, 1970, pp.157-58).

The above fact is shown by Fig. 3.6. Suppose that we have four observed combinations of C_t and Y_t. These are P'_1, P'_2, P'_3 and P'_4. When C_t regressed on Y_t using OLS the result is shown as $C_t = \alpha + \beta Y_t$. When this compared with the true consumption function ($C_t = a + bY_t$), it is clear that the estimation has come up with a bad fit ; the estimation of the slope (β) has an upward bias.

However, OLS applied shrewdly can still be used to recover an estimate of b that will be good in large samples. To see how, notice that the reduced form equations for Y and C are each regression equations. The population projections of C and Y on A thus obey:

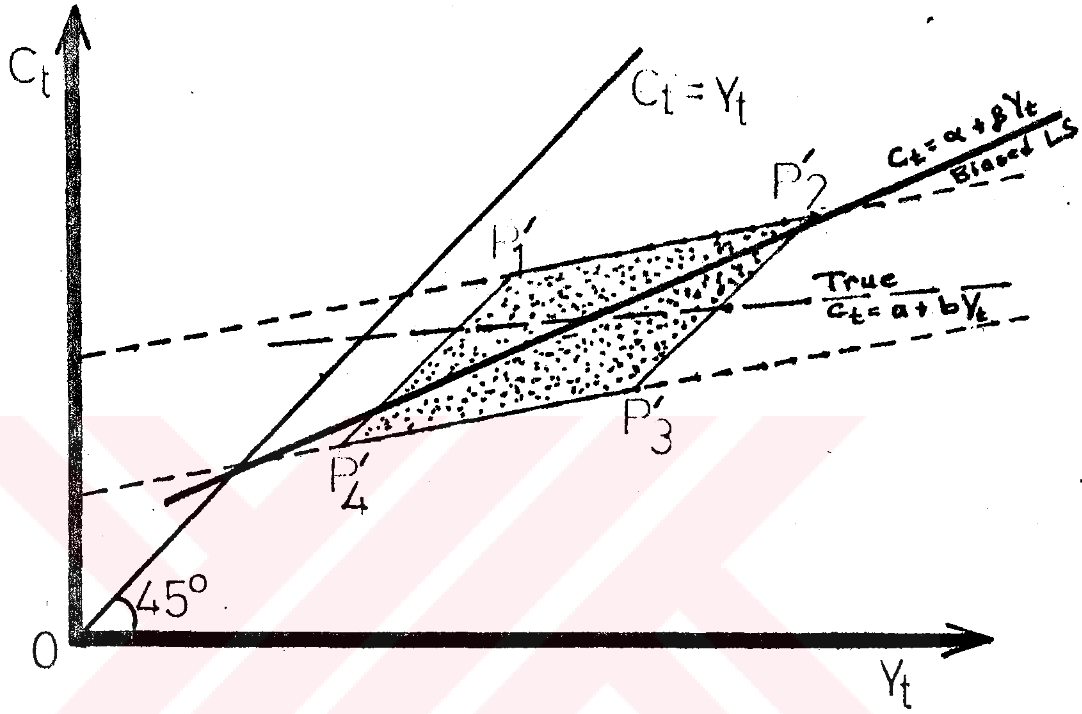

Figure 3.6

$$P[Y_t \mid 1, I_t] = \frac{a}{1-b} + \frac{1}{1-b} I_t$$

$$P[C_t \mid 1, I_t] = \frac{a}{1-b} + \frac{1}{1-b} I_t \qquad (3.56)$$

Either one of these projections be used to estimate (a function of) b.

Whether or not the consumption function can be regarded as a regression equation depends on how one completes the macroeconomic model of which it is a part. For example, in the preceding development it is critical that we specified $E\epsilon_t I_t = 0$. There do exist alternative macroeconomic specifications in which the consumption function can be regarded as a regression equation. For example, consider a version of a classical model in which employment and income are determined in a labor market and are taken as predetermined with respect to current consumption. In such a model it may be reasonable to specify that $E_{\epsilon t}Y_t=0$, while $E_{t\epsilon}I_t<>0$. This illustrates a general point: that in a stochastic model like (3.46) and (3.47), much of the content is supplied by the covariance properties imposed on the random term. What makes (3.46) and (3.47) a Keynesian model is fundementally the specification that $E_{t\epsilon}I_t=0$, which is to say that on average investment is predetermined with respect to the random shock to the consumption function (investment is exogeneous with respect to ϵ_t) (Sargent, 1979, pp.301-2).

Perhaps the most obvious problem of the AIH, aside from an obviously incomplete specification of the wealth–consumption relation, is that the summation over a heterogeneous population might introduce the problem of heteroscedasticity into the (frequent) regression results reported in this literature.

Finally, let us append a note on the relation of Keynes himself to the foregoing. In particular the recent re–evaluation of Keynes's "General Theory" has stressed that both aspect of the modern wealth theories (a) the price–induced wealth effect, and (b) the interest-induced wealth effect–can be found there, even in the context of the short–run consumption function (Douglas, 1985, p.150). Thus, says, Keynes, "Windfall changes in capital-values...should be classified amongst the major factors capable of causing short–period changes in the propensity to consume" (Keynes, 1986, pp. 92-3) and both the stream of expected returns and the interest rate are mentioned as being important. While Leijonhufvud is not actually certain of the role of the price induced wealth effect in Keynes, Pesek and Saving certainly are; they cite the same passage from Keynes, as well as the following: "The consumption of the wealth–owing class may be extremely susceptible to unforeseen changes in the money-value of its wealth" (Keynes, 1936, p. 93), and since the mechanism here is still ambiguous (again from Keynes), "in addition to this, as money–values fall, the stock of money will bear a higher proportion to the total wealth of the community" (Keynes, 1936, p.93). But, on net Pesek and Saving feel that Keynes "let wealth slip through his fingers by his failure to build it into his analysis. Perhaps, quoting Keynes on Pigou, this was on account of the pitfalls of a pseudo-mathematical method, which led Keynes to lay down an equation...which represented only a small part of his thinking on the determinants of consumption." (Douglas, 1985, p.51).

3.6.2. Relative Income Hypothesis

One of the earliest attempts at reconciling the consumption function paradox was that by Duesenberry [1949] and Modigliani [1949] who independently developed what was come to be known as the "Relative Income Hypothesis" (RIH). Despite the much additional theoretical and empirical support of this hypothesis was provided by the work of Modigliani and Duesenberry, it was first propounded by Brady and Friedman [1947].

Modigliani [1949] argued that the extrapolation of simple regression equation of consumption on income entirely misleading and seriously underestimates the future consumption; and in the long run the saving-income ratio tends to fluctuate very slow, if at all. It is entirely possible that this ratio might have a tendency to rise as income gradually rises from a very low level, other things being equal. Even this tendency, however, is probably weak in comparison with, and may obscured by, the "other things" that also change slowly in the long-run-for example, the age structure of the population, degree of urbanization, income distribution. Furthermore, it was suggested that once the saving (consumption)-income ratio has reached a relatively high level, the tendency for a further rise, if present, would be particularly weak under normal conditions (Modigliani, 1947, p.399).

Modigliani's theory, indeed, may called "cyclical income" theory since his hypothesis stated that the proportion of income saved will be possibly related to, and largely explained by, the cyclical income index. This cyclical income index defined as follows: let Y_t denote real income per capita in the year t and $Y_t{}^{o}$ denote highest real income per capita realized in any year preceding t; the quantity $(Y_t - Y_t{}^{o})/Y_t$ may be referred as cyclical income index. Utilizing this index Modigliani [1949] estimated the consumption function:

$$\frac{C_t}{Y_t} = \alpha + \beta \frac{Y_t - Y_t{}^{o}}{Y_t} \qquad (3.57)$$

multiplying both sides of the equation (3.57) by Y_t we may write :

$$C_t = \alpha Y_t - \beta (Y_t - Y_t{}^{o}) \qquad (3.58)$$

In addition the following consumption functions were estimated for the effects of habit persistence:

$$C_t = \alpha + \beta_1 Y_t + \beta_2 Y_{t-1} + \beta_3 Y_t{}^{o} \qquad (3.59)$$

$$C_t = \alpha + \beta_1 Y_t + \beta_2 (Y_t - Y_{t-1}) \quad (3.60)$$
$$C_t = \alpha + \beta_1 Y_t + \beta_2 (Y_t - Y_t^{\circ}) \quad (3.61)$$

Depending upon the estimated parameters of the above equations Modigliani distinguished between short-run and long-run consumption functions. His reasoning, why short and long-run MPCs differ is due to: (a) cyclical change in the income distribution, (b) rigidity of acquired consumption habits, and (c) fluctuations in the level of unemployment. Accordingly, the long-run MPC is higher than the short-run MPC because of (a) a cyclical fall in income will tend to be accompanied by a redistribution of income from groups having a greater propensity to save to groups with a smaller propensity to save, while a cyclical rise in income will have the opposite effect, (b) a marked fall in income below an accustomed level, such as occur during cycle, creates strong pressure on acquired consumption habits. This pressure tends to be met partly maintaining consumption at the expense of saving. Similarly, as income moves back toward the initial level, there is pressure to restore the initial relation between income and saving, and (c) the level of consumption tends to be higher, the greater the unemployment, since the savings of the employed are partly offset by the dissavings of the unemployed (Modigliani, 1949, pp.385-87).

In Duesenberry's analysis the APC of an individual depends on his percentile position in the income distribution of his associates. This is so because Duesenberry [1949] adopts a microeconomic theory substantially different from traditional Hicksian-type demand analysis, and assumes that the individual utility depends not only on his own level of consumption but also on the consumption of his associates.

The dependence of utility function is clear from the Duesenberry's argument: "There is great deal of evidence to show that consumer tastes are socially determined. This does not mean that consumer tastes are governed by considerations of conspicuous consumption. Rather, it means that any individual's desire to increase his expenditure is governed by the extent to which the goods consumed by others are demonstrably superior to the ones which he consumes....The strength of any individual's desire to increase his consumption expenditure is a function of the ratio his expenditure to some weighted average of the expenditures of others with whom he comes in contact" (Duesenberry, 1948, p.77).

To make clear the difference of this analysis' utility function from the utility function of Hicksian consumer, neglecting interdependence preferences let us write the utility function of Duesenberry's original:

$$U_i = U_i(C_{i1},...,C_{in}, A_{i1},...,A_{in}) \qquad (3.62)$$

where C_{ik} is consumption expenditure of (i)th individual in the (k)th period, and A_{ik} is the value of his assets in the (k)th period. The influence of other people's consumption can be taken into account by dividing each of the variables by $R_i = \Sigma a_{ij} C_j$, that is, by weighted average of the consumption expenditures of other individuals. a_{ij} is the weight applied to consumption of (j)th individual by the (i)th individual. We now have:

$$U_i = U_i(C_{i1}/R_i,...,C_{in}/R_i, A_{i1}/R_i,...,A_{in}/R_i) \qquad (3.63)$$

The value of R_i is taken as a parameter by each individual. This is equivalent to measuring everything in units of other people's consumption expenditure (Duesenberry, 1949, pp.34-5). Within his budget, the consumer makes a comparison between his level of consumption and that of other consumers whom he tends to imitate. He will adapt his consumption level until the comparison with the reference consumers leads to the maximum attainable utility level. In this fashion, the consumer determines his C_{ik}/R_i ratio and, by the same decision, his average propensity to consume (Moulart and Canniere, 1988, pp.234-35). Also the utility function will change over time as the individual "learns" new patterns of consumption. The result of the maximization process is to produce a consumption function involving current income, current assets, expected future income and current consumption by other people. A comparative-static analysis shows that a change in aggregate income, <u>ceteris paribus</u>, leaves the aggregate saving (consumption) ratio unchanged, and so we have a proportional long-run consumption function. From the discussion of interdependent utility functions comes the conclusion that an individual with a high income relative to the normal will have a higher savings ratio than those towards the lower end of the income scale-this accounts flat consumption functions estimated from cross-sectional data (Timbrell, 1976, pp.168-69). Suppose that each individual function may be expressed as

$$\frac{C_i}{Y_{it}} = \alpha + \beta \frac{Y_t}{Y_{it}} \qquad (3.64)$$

where Y_t denotes mean income level. Then we may write

$$C_{it} = \alpha \overline{Y}_{it} + \beta Y_t \qquad (3.65)$$

and at any point in time there is a positive intercept, βY_t. This implies that high-income individuals will have higher saving ratios.

Aggregating,

$$C_t = (\alpha + \beta)\ Y_t \tag{3.66}$$

The MPC is $(\alpha+\beta)$ which is greater than found in cross section analysis and the lack of an intercept term gives consumption a constant share of income as income rises.

Duesenberry proposed two hypotheses (Duesenberry, 1968, pp.14-15); (i) that secularly an individual's propensity to consume is a function of his position in the income distribution (which implies that aggregate saving tends in the long-run to be a constant proportion of income) and (ii) that, cyclical, the aggregate propensity to consume depends on the ratio current income to the highest income previously achieved. These two hypotheses are examined in details in the following paragraphs, respectively.

In the RIH, consumers in the lower percentile of an income distribution emulate the standards-of-living of the wealthy and to do so have to spend a larger proportion of their income. This results in a cross-sectional consumption function of typical Keynesian shape with APC declining as income rises. However, Duesenberry's hypothesis also explains the long-run time series findings. If all income increases over time at the same rate, income distribution remains unchanged, each individual's APC therefore remains constant and hence the aggregate APC remains constant. In fact, even if individual incomes do not all increase at the same proportionate rate, the aggregate APC will still remain unchanged, because with the income groups defined in percentile terms, for every consumer moving up one percentile there must be another coming down (Thomas, 1984, p.56).

We should pause here to consider the literature on the effect of changes in the personal distribution of income on the propensity to consume. Keynes seems to be arguing that a more equal distribution will also have higher MPC, and while this obvious to every one it seems, it applies only to an individual (or to identical individuals) (Douglas, 1985, p.52). Bilinder's [1975] empirical results generally show effect (although a slight tendency for a "preserve" results is noted) and explained by recent changes in the composition of the labor force. Blinder suggests that equalizing the distribution of income would either leave aggregate consumption unchanged or diminish it slightly (Blinder, 1975, p.447). Menchik and David [1983] reached a different conclusion against Blinder. They concluded that redistribution of income from the rich to others (if expected and not transitory) will reduce life time saving (Menchik and David, 1983, p.688). Della Valle and Oguchi [1976] also found no distribution effects, but this result was challenged by Musgrave [1980] who used three parameters from the income distribution to the effect that more developed countries show some effect from the "asymmetry" parameter. In an empirical work Borooah and Sharpe [1986] argued that the effects of income distribution (if any) on consumption were being inadequately captured by the inclusion of an income inequality term in the aggregate equations (Borooh and Sharpe, 1986, pp.460-61). A reasoning of this fact was given in a more general study of the distributional effects by Stoker [1986]. It was stated that: "Because of limited distribution movements, distributional effects of lagged variatbles on current variables...beahavirol differences...may not be estimable with aggregate data because of limited distribution movements over time." (Stoker, 1986, pp.790-91).

A slightly deferent interpretation of the term "relative income" is necessary to reconcile the findings of long-run and short-run time-series data. Both Duesenberry and Modigliani suggest that the desire to maintain previous living standards as well as pure habit, means that the individual's current level of consumption depends not only on the level of his current income but also on the relationship between this level and the previous highest or peak income level. Thus, incomes should fall during recession, the community in general may regard such a fall as temporary and offset it by consuming a larger proportion of its income in order to keep its living standards intact. The community's APC therefore depends on the ratio between its current income and previous income peak. Consider Figure 3.7. If income should grow steadily over time, as shown by solid line Y, consumption would grow in the same proportion, as shown by solid line C. But income growth is not steadily; it is bunched in spurts and dips, as shown by broken line Y'. Consumption responds to these spurts and dips in income as C'. If we view the whole history, it is obvious that consumption fluctuates in proportion to income. But if we look at any little piece of history composing only a single "cycle" we lose sight of the longer-run proportionality, and conclude instead that the relationship is nonproportional. The behavior of C' and Y' in a single cycle is shown in Figure 3.8.

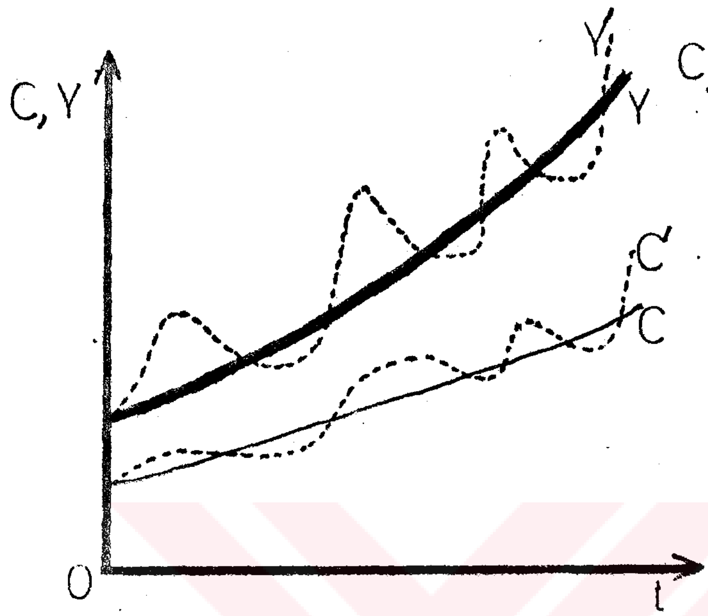

Figure 3.7

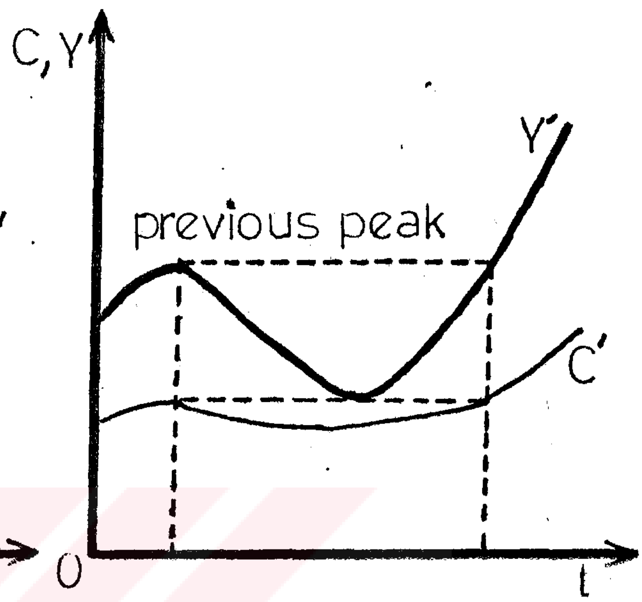

Figure 3.8

The reason why C falls less than Y in the depression is due to "ratchet effect". Consumers find it easier to increase consumption than to reduce it (Ackley, 1961, p.242-43). This ratchet can be seen quite clearly in the C' line of Fig.3.7, where consumption rises almost in stair step fashion.

To illustrate that the APC depends on the ratio current income Y_t and previous income $Y°$, let us write:

$$\frac{C_t}{Y_t} = \alpha + \beta \frac{Y°}{Y_t}, \qquad \alpha > 0 \ , \ \beta > 0 \qquad (3.67)$$

Equation (3.67) may be rewritten as (3.68)

$$C_t = \alpha Y_t + \beta Y°$$

If income were to grow at a constant rate g then $Y_t = (1+g) Y_{t-1}$ and moreover $Y° = Y_{t-1}$ Hence Eq. (3.68) can then be written as

$$C_t = (\alpha + \frac{\beta}{1 + g}) Y_t \qquad (3.69)$$

Eq. (3.69) suggests that long-run time-series data will present us with a consumption function possessing no intercept and with a constant APC and MPC both equal to $[\alpha+(\beta/(1+g))]$. A short-run cyclical fall in income, however, leads to $Y_t<Y^o$ with Y^o remaining constant until Y_t rises to this level again. Under these circumstances Eq. (3.68) can be written as

$$C_t = \beta' + \alpha Y_t \qquad (3.70)$$

Eq. (3.70) has an intercept $\beta'=\beta Y^o$=constant and MPC=α. Hence, the consumption function obtained from short-run time-series data is Keynesian type with an MPC smaller than that obtained from the long-run consumption function given by Eq. (3.69) (Thomas, 1984, p.57).

The relative income reconciliation of long-run and short-run data is illustrated in Fig.3.9. Suppose the initial level of income is Y_1 and that income rises over time until it attains the level of Y^o. Consumption rises along the lung-run function given by (3.69). However, if income begins to decline cyclically once it has reached Y^o, then consumption falls back along the shallover short-run curve $C_t=\alpha Y_t+\beta Y^o$ as consumers attempt to maintain the living standards achieved with the previous peak income level Y^o. Consumption remains on this curve until income reattains the level Y^o. However, once income exceeds Y^o, consumption again begins to rise along the long-run function. If the next cyclical peak level of income is Y^{oo} then once income declines from this level, consumption falls back along the new short-run function $C_t=\alpha Y_t+\beta Y^{oo}$ Since $Y^{oo}>Y^o$, this new short-run function has a larger intercept and therefore lies above the previous short-run function. There is therefore a ratchet effect, with the short-run function shifting periodically upwards. A typical scatter of points generated by such a process is shown by crosses in Figure 3.9.

The RIH's ratchet model used on American data by Smyth and Jackson [1978] was of the form :

$$C_t = \alpha + \beta_1 Y_t + \beta_2 Y^o \qquad (3.71)$$

If income are rising $Y^o=Y_{t-1}$ and (3.71) can be rewritten as

$$C_t = \alpha + \beta_1 Y_t + \beta_2 Y_{t-1} \qquad (3.72)$$

(3.72) was tested with UK data by Mayes [1981], he obtained

$$\underset{(308)}{C_t = 4153} + \underset{(0.11)}{0.93\, Y_t} - \underset{(0.12)}{0.16\, Y_{t-1}} + e_t \qquad (3.73)$$

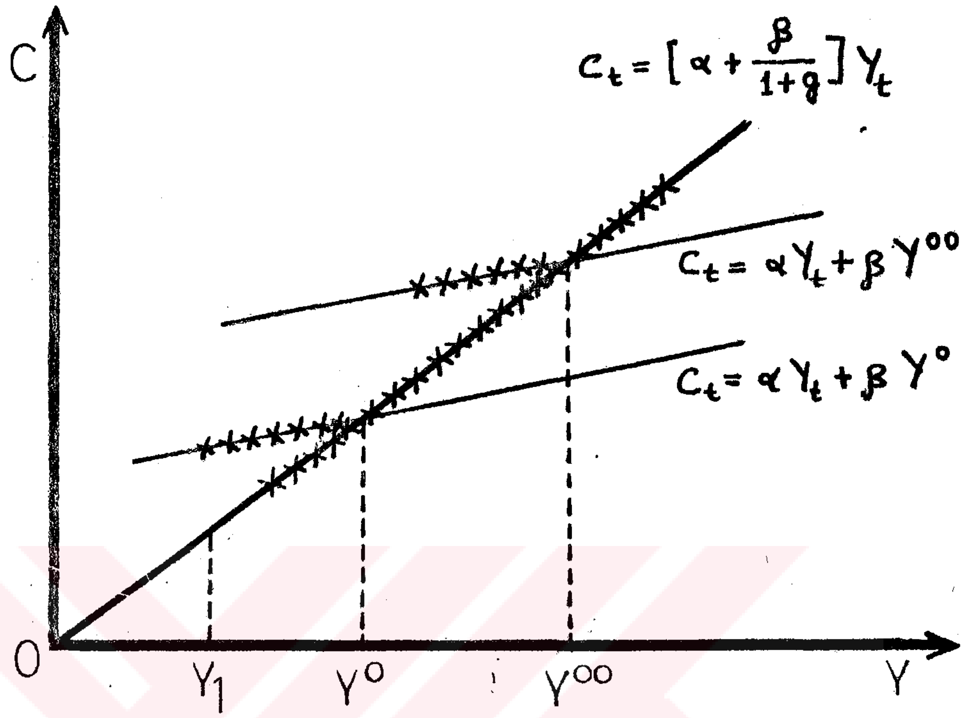

Figure 3.9

This specification is not without its diffuculties as Y_t and Y_{t-1} are highly related. Not only is the coefficient of Y_{t-1} insignificantly different from zero at the 5 per cent level, but its sign is the opposite to that suggested by Duesenberry (Mayes, 1981, p.36).

Duesenberry's model is also non-linear, and, somewhat surprisingly, a successful test of it may actually be consistent with the propositions of the AIH. Thus, rewrite the equation $S_t/Y_t = \alpha + \beta(Y_t/Y^o)$, which was actually tested by Duesenberry [1949], as equation (3.74), where non-linearity is apparent.

$$C_t = \delta Y_t + \beta \frac{Y^2_t}{Y^o} \qquad (3.74)$$

Then, for $1>\alpha>0$ and $\beta<0$, we would get proposition $0<\delta C/\delta Y<1$ for

$$\alpha > 2\beta \frac{Y_t}{Y^o} \qquad (3.75)$$

which is the MPC in this model. For proposition $\delta(\delta C/\delta Y)/\delta Y$ we would have

$$\frac{\delta\left(\frac{\delta C}{\delta Y}\right)}{\delta Y} = \frac{2\beta}{Y^o} \qquad (3.76)$$

which would be negative for $\beta<0$. For proposition $(C/Y)>(\delta C/\delta Y)$ we find that for β negative this proposition would hold:

$$\frac{C}{Y} = \alpha + \beta \frac{Y_t}{Y^o}, \qquad \frac{\delta C}{\delta Y} = \alpha + 2\beta \frac{Y_t}{Y^o} \qquad (3.77)$$

as one can see by comparing C/Y and $\delta C/\delta Y$ directly. Thus a successful test for the relative income model could than also support the AIH-at least for certain values of the parameters and this might well establish that the former is a special case of the relative income hypothesis, at least in the form just laid out. It is a special case, to be explicit, because it holds for Y^o constant; Y^o is actually the additional variable provided by the RIH (Douglas, 1985, p.54).

The RIH reconciliation of the consumption function paradox may also be formulated in terms of previous peak consumption rather than previous peak income. Similar short-run and long-run consumption functions are obtained if equation (3.68) is replaced by

$$C_t = \alpha Y_t + \beta C^o \qquad (3.78)$$

where C^o is the previous peak consumption level. In this context, Duesenberry's original formulation has been developed, with a shift in emphasis, by Brown [1952] who suggested that people only change their behavior slowly and that the previous period's consumption effects current consumption as well as current income. This therefore means that, whether we are considering upward or downword shifts in incomes, consumption changes only slowly towards a new equilibrium value (Brown, 1952, p.359-60). Brown therefore incorporated a lagged value of the connsumption in the consumptios function equation:

$$C_t = \alpha + \beta_1 Y_t + \beta_2 C_{t-1} \qquad (3.79)$$

or in the form of (3.78), we may write

$$\frac{C_t}{Y_t} = \alpha + \beta \frac{C_{t-1}}{Y_t} \qquad (3.80)$$

Dividing both side of (3.80) by $1/Y_t$ we obtain:

$$C_t = \alpha Y_t + \beta C_{t-1} \qquad (3.81)$$

If consmption grows over time, the short-run relationship between C_t and Y_t therefore moves continuously upwards. In fact, if consumption grows at a long-run rate g, then since $C_t=(1+g)C_{t-1}$ a long-run consumption function, again with a constant APC, is obtained (Thomas, 1984, p.58). That is,

$$C_t = \left(\frac{\alpha}{1-(\beta/1+g)}\right) Y_t \qquad (3.82)$$

The RIH consumption function was formulated in a different fashion by Duesenberry, Eckstein, and Fromm [1960]. Despite they have tired to fit six equations the best equation was of the form:

$$\frac{C_t}{Y_{t-1}} = \alpha + \beta_1 \frac{Y_t}{Y^o_{t-1}} + \beta_2 \frac{C_{t-1}}{Y_{t-1}} \qquad (3.83)$$

Two different forms of the RIH equation was employed by Singh, Drost, and Kumar [1978] and gave generally insignificant fits. These were of the form :

$$\frac{C_t}{Y_t} = \alpha + \beta_1 \frac{Y_t}{Y^o} + \beta \frac{C_{t-1}}{Y_{t-1}}$$

$$\frac{C_t}{Y_t} = \alpha + \beta_1 \frac{Y_t}{C^o} + \beta \frac{C_{t-1}}{Y_{t-1}} \qquad (3.84)$$

In a recent test of Duesenberry's RIH, Moularet and Canniere [1988] retains the conclusion that demonstration effects and social indicators effect consumptive behavior. But they have had to reject the validity of Duesenberry's "keeping up with the Joneses"-according to Duesenberry, richer households are the reference for poor households, who seek to keep up with the (richer) Joneses" (Duesenberry, 1949, p.44)-for the Belgium data. A modified version of the RIH was attempted by Fellner [1959] but this attempt has not had a great emphasis.

The RIH, too, bears some similarities to the wealth theories. First it agrees with the permanent income theory in rejecting Keynes's hypothesis that the lower a household's income, the more intensely does it feel current wants relative to future wants. Hence, in their explanation of the secular stability of the consumption-income ratio, there is no real difference between the RIH and PIH. Apart from the proportionality hypothesis the RIH and the PIH approach differ in the lag mechanism they use. The RIH is a habit persistence theory. Expected future income plays no role in the RIH. In the PIH, on the other hand, households have no diffuculty in chaning their past consumption habits-in principle a lira of discounted future income may be just as important as a lira of past or present income. This difference about the role of future incomes is much more important distinction between the two theories than is the fact that the RIH uses as the lagged variable only past peak income whereas the PIH uses a distributed lag (Mayer, 1972, pp.20-1).

A basic theoretical difficulty with the RIH is that it ignores the essential intertemporal nature of the consumption—saving choice. This critics was mainly made by Tobin [1968] and [1951]. If current consumption is the means to social status today, high future consumption is the means to social status tomorrow. Just like the individualistic consumer of traditional theory, Duesenberry's consumer must consult his expectations of future income and his time preference in balancing consumption now against consumption later. The RIH is not really a substitute for the intertemporal analysis explicit in the permanent income and life—cycle theories discussed in the next two sections. The pressures of interpersonal comparison seem more central to other theories: visible and conspicuous consumption against other goods and services.

In conclusion, Duesenberry's theory is ingenious in many ways and represent significant advances over previous consumption functions. However, there are occasional circumstances for which the theory gives somewhat less than satisfactory results (Evans, 1969, p.19). First, given the estimated parameters of the regression equation, this hypothesis states that consumption and income always change in the same direction. Yet, mild declines in income often occur concomitanly with increases in consumption. Second, the function states that increases in consumption are proportional to any size increase in income, no matter how large or small. It seems reasonable to suggest that unexpectedly large increases in income results, at least initially, in less than propotional increases in consumption. Third, one might argue that consumer behavior is slowly reversible over time, instead of being truly irreversible. Then previous peak income would have less effect on current consumption the greater the elapsed time for the last peak. Advances in the theory of the consumption function have been able to resolve these difficulties.

3.6.3. Permanent Income Hypothesis

Milton Friedman presented the "Permanent Income Hypothesis" (PIH) in "A Theory of the Consumption Function" [1957]. The PIH reconciles the apparent inconsistencies in empirical evidence on consumption. However, the PIH is more than an empirical study. In a "tour de force" Friedman challenged the central thesis of Keynesian theory and policy-the stability of the MPC. The PIH is a classic illustration of the interplay between theory and empirical evidence within the scope of positive economics. The PIH is developed from specific microeconomic postulates of consumer behavior. The hypothesis is then utilized to reconcile the empirical observations from short-run and long run evidence. Finally, economic polices which differ from Keynesian policies are shown to drive from the model. Just as the Keynesian consumption model has been carefully studied, the PIH has been continuously evaluated and assesed by economists.

3.6.3.1. Microeconomics of the Permanet Income Hypothesis

Friedman [1957] generalises the two perioded model outlined in Chp. II, but generalization is to an "infinitely long horizon" rather than to a finite life span. Friedman began with Fisher's theory about consumers' saving. Following Fisher, he posited that the representative consumer seeks to maximize utility U, where

$$U = U(C_1, C_2, \dots, C_n) \qquad (3.85)$$

and U(•) satisfies $U_t > 0$, and strictly concave; C_t is the households consumption in period t. The household is assumed to be able borrow or lend all it desires for t periods at the t-period market determined interest rate r_t. The household is then supposed to maximize U(•) subject to constraint:

$$C_1 + \sum_{t=1}^{n} \frac{C_t}{(1+r_t)^t} = Y_1 + \sum_{t=1}^{n} \frac{Y_t}{(1+r_t)^t} \qquad (3.86)$$

where Y_t is the household income in period t, the constraint thus states that the present value of the household's consumption program must equal the present value of its income stream, i.e, its wealth. From the assumption that utility is homothetic in consumption at different points in time, Friedman deduced that current consumption is proportional to wealth, the factor of proportional q depending interest rate

$$C = q(W^T, r) \tag{3.87}$$

where

$$W^T = Y_1 + \frac{Y_t}{(1+r_t)^t}$$

Indeed, Friedman's understanding of consumption differs from the usual term "current consumption". In the PIH consumption is a planned argument and this planned consumption is labeled as "permanent consumption" (C_P). Therefore (3.87) needs to be rewritten as

$$C_P = q(W^T, r) \tag{3.88}$$

The planned or permanent consumption is directly proportional to W^T since the utility function is assumed to be homogeneous in all its arguments. That is, equation (3.88) becomes

$$C_P = qW^T \tag{3.89}$$

Friedman now takes the crucial step of introducing the concept of "permanent income", Y_P. Theoretically, Y_P is the maximum amount a consumer can spend while still maintaining his total wealth W^T intact. It is therefore the rate of return on wealth (Friedman, 1957, p.10), i.e., $Y_P = rW^T$. Equation (3.89) can now be written as

$$C_P = q(\frac{Y_P}{r}) = kY_P \tag{3.90}$$

where k=q/r. Friedman has, in fact, annuitised the wealth concept, since permanent income Y_P can also be regarded as that level of income which, if received in perpetuity, has a discounted present value exactly equal to W^T. To see this the following equation is solved for Y_P,

$$W^T = \sum_{t=1}^{n} \frac{Y_t}{(1+r_t)^t} \tag{3.91}$$

The right-hand side of (3.91) is a convergent geometric series with common ratio $1/1+r_t$. Its sum to infinity is Y_P/r and we obtain $Y=rW^T$ as before. The factor of proportionality k depends on household preferences and on the rate of interest. Friedman, however, introduces a further motive for saving: the need, in a world of uncertainty, to accumulate wealth to safeground against emergencies. Human wealth is less satisfactory than tangible nonhuman wealth for such a purpose, so the larger the proportion of total wealth held as nonhuman wealth, the less the consumer feels the need to save and the greater is k. Friedman in fact makes k dependent on w, which is the ratio of non human wealth to permanent income (Friedman, 1957, p.16-7; Thomas, 1984, pp.65-6); for a given interest rate this ratio is directly proportional to the ratio of non-human wealth to total wealth. Therefore, we obtain:

$$C_P = k(r,w,u)\ Y_P \qquad (3.92)$$

where u is a portmanteau variable representing the consumer's tastes.

Given that the (3.92) applies to every consumer unit in a group, as Friedman suggested, the ratio k of consumption to permanent income will nonetheless vary from consumer unit to consumer unit because of differences among them in the values of r, w, and u, and the absolute amount of consumption will vary because of differences in Y_P as well. Aggregate consumption depends therefore not only on the precise form of equation (3.92) but also on the distribution of consumer units by these variables. Let

$$f(r,w,u,Y_P)drdwdudY_P \qquad (3.93)$$

be the number of consumer units for whom the interest rate is between r and r+dr, the ratio of non-human wealth to permanent income is between w and w+dw, the taste determining factors are between u and u+du, and permanent income is between Y_P and Y_P+dY_P. Then aggregate consumption is

$$C_P{}^* = \int_r\int_w\int_u\int_{Y_P} f(r,w,u,Y_P)k(r,w,u)Y_P\,drdwdudY_P \qquad (3.94)$$

Friedman supposed that the distribution of consumer units by income is independent of their distribution by r,w, and u, so that

$$f(r,w,u,Y_P) = g(r,w,u)\cdot h(Y_P) \qquad (3.95)$$

Equation (3.94) then reduces to

$$C_P{}^* = k^*(\cdot)\ Y_P{}^* \qquad (3.96)$$

where $C_P{}^*$ is aggregate permanent consumption, $Y_P{}^*$ aggregate permanent income; and

$$k^*(\cdot) = \int_r \int_w \int_u g(r,w,u)k(r,w,u)drdwdu \quad (3.97)$$

k^* depends on the function k, and also on the function g which describes the distribution of individuals by r,w,u. As an approximation, k^* could be expressed as a function of the mean values of r,w, and u, their variances, and the co-variances among them, or other similar parametres describing the distrubation. The coefficients of these variables would be determined by the parameters of k. The parentheses containing the variables has been left blank in (3.96) and (3.97) because there is no way of spefiying on the present level of generality of a limited number of variables to stand for the functions k and g (Friedman, 1957, pp.18-9).

3.6.3.2. A Formal Statment of The Peremanent Income Hypothesis

Once an attempt is made to relate the PIH to actual income-consumption data, it is immedialely faced the problem that the theoretical construct "permanent income" bears little relationship to the current or "measured income" on which data are available (Thomas, 1984, p.66). To get around this problem Friedman considers measured income, Y, as being composed of two components—permanent income Y_P and "transitory income" Y_T. Current or measured consumption, C, is also divided into permanent consumption C_P and transitory consumption C_T. Empirically, permanent income is that part of its income which the consumer unit regards as a normal or unfortuitous or expected. This definition is delibaretely vague since, according to Friedman, "the precise line to be drawn between permenent and transitory components is best left to the data themselves, to be whatever seems to correspond to consumer behavior" (Friedman, 1957, p.23). Thus, theoretically, permanent or planned consumption depends on permanent income. In practice, permanent income must be whatever quantity the consumer sees as determining his planned consumption-in effect permanent income is whatever the consumer thinks it to be! Transitory income is the difference between total measured income and permanent income, and can therefore be roughly regarded as income arising from chance occurrences. Since permanent and planned consumption are synonymous transitory consumption is to be regarded as unplanned consumption. That is,

$$Y_i = Y_{Pi} + Y_{Ti} \quad (3.98)$$
$$C_i = C_{Pi} + C_{Ti} \quad (3.99)$$

where the index i serves a reminder that these variables refer to the individual consumer. In order to aggregate individual components of the above two equations, it is assumed that the distribution of income is identical across individuals, we will do this in terms of the mean and variance of a normal distribution of incpme. The aggregation conditions, then, are given by equations (3.100) and (3.101), for variances:

$$var(Y_{Pi}) = \sigma^2_{YP} \qquad (3.100)$$
$$var(Y_{Ti}) = \sigma^2_{YT} \qquad (3.101)$$

and for the means:

$$E(Y_{Pi}) = \mu_Y \qquad (3.102)$$
$$E(Y_{Ti}) = 0 \qquad (3.103)$$

and also it is assumed that

$$cov(Y_{Pi}, Y_{Ti}) = 0 \qquad (3.104)$$

Equation (3.103) requires that transitory income should have zero mean (that is any permanent trend in it should be included in permanent income). If the data are time series equation (3.104) implies that there is a zero correlation between permanent income and transitory income (Cramer, 1971, p.183; Douglas, 1985, p.58; Friedman, 1957, p.26).

Now, we may enter a more empirical restriction of the PIH, that is, an individual's permanent consumption is proportional to his permanent income (this can be seen by Eq. (3.92)):

$$C_{Pi} = k_i Y_{Pi} \qquad (3.105)$$

or at the aggregate level (this stems from Eq. (3.96)):

$$C_P = kY_P \qquad (3.106)$$

As it clear equation (3.106) requires the aggregation condition, that is, all individuals have the same factor of proportionality. Friedman further assumed that, to construct a theory, actual income and actual consumption are distributed jointly in terms of the bivariate normal distributions. This requires following parametres: E(C), E(Y), V(C), V(Y), and cov(C,Y). We may calulate $E(Y_i)$ as

$$E(Y_i) = E(Y_{Pi}+Y_{Ti}) = E(Y_{Pi}) + E(Y_{Ti}) \qquad (3.107)$$

from (3.102) and (3.103)

$$E(Y_i) = \mu_Y \qquad (3.108)$$

Similarly, for C Cramer [1974] derived the followingns: C_i is a directly observable variable and from (3.106), and by the properties of Y_{Pi} we have:

$$E(C_{Pi}) = k\mu_Y \qquad (3.109)$$
$$var(C_{Pi}) = k^2\sigma^2_{YP} \qquad (3.110)$$
$$cov(C_{Pi}, Y_{Pi}) = k\sigma^2_{YP} \qquad (3.111)$$

Transitory consumption is a random variable, that is, independent of all others and zero expectation, so that

$$E(C_{Ti}) = 0 \qquad (3.112)$$
$$var(C_{Ti}) = \sigma^2_{CT} \qquad (3.113)$$
$$cov\ (C_{Ti}, Y_{Ti}) = 0 \qquad (3.114)$$
$$cov\ (C_{Ti}, Y_{Pi}) = 0 \qquad (3.115)$$

We may really compute a variance for actual income as follows. Returning to equation (3.98), we may write out its variance as

$$var(Y_i) = var(Y_{Pi}) + var(Y_{Ti}) + 2\ cov(Y_{Pi}, Y_{Ti}) \qquad (3.116)$$

Considering (3.104) we have

$$var(Y_i) = \sigma^2_{YP} + \sigma^2_{YT} \qquad (3.117)$$

To obtain the covariance between C_i and Y_i, we may write the following expression:

$$cov(C_i, Y_i) = E[(\bar{C}-C_i)\ (\bar{Y}-Y_i)] \qquad (3.118)$$

From equations (3.98) and (3.99) we obtain :

$$cov(C_i, Y_i) = E[(\bar{C}_P+\bar{C}_T-C_{Pi}-C_{Ti})\ (\bar{Y}_P+\bar{Y}_T-Y_{Pi}-Y_{Ti})]. \qquad (3.119)$$

If we reorganize the terms in the square brackets it results in

$$E\{[\bar{C}_P-C_{Pi}) + (\bar{C}_T-C_{Ti})]\ [\bar{Y}_P-Y_{Pi}) + (\bar{Y}_T-Y_{Ti})]\} \qquad (3.120)$$

and further, after multiplication, the expression for the covariance is seen to be the following collection of individual covariances:

$$E[\bar{C}_P-C_{Pi})\ (\bar{Y}_P-Y_{Pi}) + (\bar{C}_T-C_{Ti})\ (\bar{Y}_T-Y_{Ti})$$
$$+ (\bar{C}_T-C_{Ti})\ (\bar{Y}_T-Y_{Ti}) + (\bar{C}_P-C_{P-i})\ (\bar{Y}_P-Y_{Pi})]$$

Now for the last three terms in this expression Friedman has made the following restrictions (stated in terms of assumption about correlations) (Friedman, 1957, p.26):

$$E(C_T, Y_P) = 0 \quad \text{if } r_{C_T Y_P} = 0 \qquad (3.121)$$
$$E(C_T, Y_T) = 0 \quad \text{if } r_{C_T Y_T} = 0 \qquad (3.122)$$
$$E(C_P, Y_T) = 0 \quad \text{if } r_{C_P Y_T} = 0 \qquad (3.123)$$

This leaves only $E(C_P, Y_P)$ which, we can establish the term $k\sigma^2_{Y_P}$ (Douglas, 1985, pp.59-60).

3.6.3.3. The PIH Reconciliation of The Consumption Function Paradox

First we will relate the PIH how can the cross-sectional result, MPC<APC, be explained.

In the equation (3.104) Friedman assumes that there is no correlation between transitory and permanent income. This assumption has the following implication for cross-sectional budget study results (Branson, 1989, p.260): In grouped cross-section data, since Y_P and Y_T are not related, the income class that centers on the population average income will have an average transitory income competent $\overline{Y}_t$ equal to zero, and for that income class $\overline{Y}=\overline{Y}_P$. As we go up from the average in income strata, we will find, for each income classes, more people in that group because they had usually high incomes that year, that is, $Y_{Ti}>0$, than people who were in the class because they had usually low incomes that year. This happens because in a normal distribution, for any income class above the average, there are more people with permanent incomes below that class who can come up into it because $Y_{Ti}>0$ in any one year than there are people about that class who can fall down due to $Y_{Ti}<0$. Thus, for income classes above the population average, $\overline{Y}_T>0$, and observed $\overline{Y}>\overline{Y}_P$. Similarly, below the average income level, for any given income class, there are more people who can fall into it due to having bad year so that $Y_{Ti}< 0$, than people who come up into it by having a good year so that $Y_{ti}>0$. Thus, for income classed below the average, $\overline{Y}_T<0$, and $\overline{Y}<\overline{Y}_P$.

Next, Friedman assumes that there is no relatioship between permanent and transitory consumption, so that C_{Ti} is just a random variable around C_{Pi}, i.e.,

$$\text{cov}(C_{Ti}, C_{Pi}) = 0 \qquad (3.124)$$

The assumption that there is no relationship between transitory consumption and transitory income (equation (3.122)) is intuitively less obvious than the previous one, but it seems fairly reasonable, because we are dealing with consumption as opposed to consumer expenditure. Consumption includes in addition to purchases of nondurable goods and services, only the "use" of durables-measured by depreciation and interest cost-rather than expenditures on durables. This means that if a transitory or windfall income is used to purchase a durable good, this would not appreciably affect current consumption.

The assumptions, than transitory consumption is not correlated with either permanent consumption or transitory income, mean that when we sample the population and classify the sample by income levels, for each income class the transitory variations in consumption will cancel out so that for each income class $C_{Ti}=0$, and average permanent consumption is the population avreage: $\bar{C} = \bar{C}_{Pi}$ (3.125)

Now, we can illustrate the cross-sectional result that MPC<APC. In Figure 3.10 the solid line $\bar{k}$ represent the relationship between permanent consumption and income, the point $\bar{Y}$ is the population average measured income, and if the sample is taken in a normal year when measured average income is on trend, average transitory income will be zero so that $\bar{Y}=\bar{Y}_P$. The point $\bar{C}_P$ is the population average measured and permanent consumption. First, consider sample group i, with average income above population average. This group has a positive average transitory income component $\bar{Y}_{Ti}$ so that $\bar{Y}_{Pi}<\bar{Y}_i$, as shown in figure. To locate average consumption, both measured and permanent, for group i, we multiply $\bar{Y}_{Pi}$ by $\bar{k}$ to obtain $\bar{C}=\bar{C}_P$ along the k line. Thus, for an above-average income group i, we observe $\bar{C}_i$ and $\bar{Y}_i$ at point A which lies below the permanent consumption line $\bar{k}$. Next, observing lower-than-average income group j, we see that the average income of the group is less than the national average income $\bar{Y}$, so that the average transitory income of the sample group, $\bar{Y}_{Tj}$, is less than zero. Furthermore, we observe C_j and know that $\bar{C}_j=\bar{C}_{Pj}=\bar{k}\bar{Y}_{Pj}$ along $\bar{k}$ line. The location of $\bar{C}_j$ and $\bar{Y}_j$ gives us the point B lying above the $\bar{k}$ line for the below-average-income group j. Connecting the points A and B we obtain the cross-sectional consumption function that connects observed average income consumption points. This function has a smaller slope than the underlying permanent function, so that the cross-sectional budget studies, we expect to see MPC<APC if (but not only if) the Friedman PIH is correct (Branson, 1989, p.262; Friedman, 1957, pp.34-5). Over time, as the economy and the national average permanent income grow along trend, the cross sectional consumption function of Fig.3.10 shifts up. What we observe in a long-run time series are

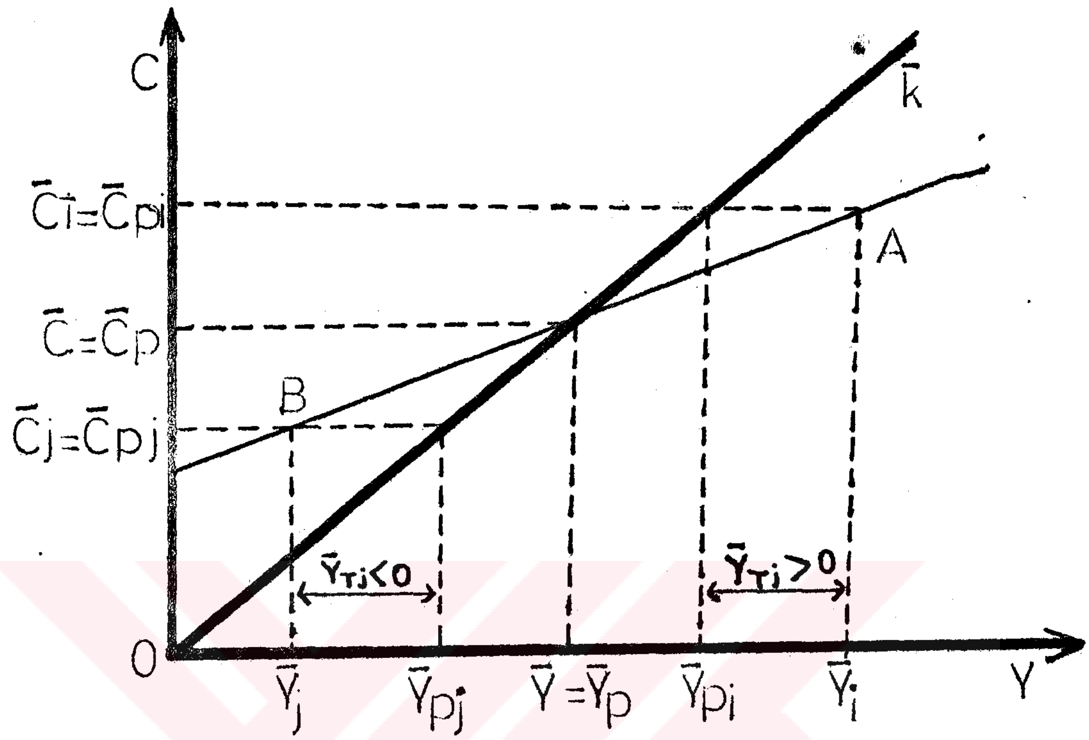

Figure 3.10

movements of national average consumption and income along the line $\bar{k}$, giving a constant C/Y ratio. As the economy cycles about its trend growth path, the average $\bar{C}/\bar{Y}$ ratio point will move above or below the long run $\bar{k}$ line.

The PIH can also explain the findings from long-run time-series data. In Fig.3.11, instead of showing cross-section of income, we interpret it to show national income at various points in time. Now, transitory components are cyclical swings, while permanent income and consumption move up along the trend growth path given by $C_P=kY_P$. In an average year, when $\bar{Y}_T=0$, the $\bar{C}_0,\bar{Y}_0$ point fall on the long-run $C_P=kY_P$ line. In a year with above-trend income $\bar{Y}_1$, transitory income is positive so that $\bar{Y}_{P1}<\bar{Y}_1$, and the $\bar{C}_1,\bar{Y}_1$ is below the C=kY line. In a year with below-trend income $\bar{Y}_2$, the $\bar{C}_2,\bar{Y}_2$ is above the $C_P=kY_P$ line, giving us the short-run function $C=\alpha+\beta Y$ of Fig.3.11. Thus, Friedman's model also explains the cross-sectional budget studies and short-run cyclical observations that indicate MPC<APC, as well as the long-run observations that the C/Y ratio is fairly constant, that is, APC=MPC.

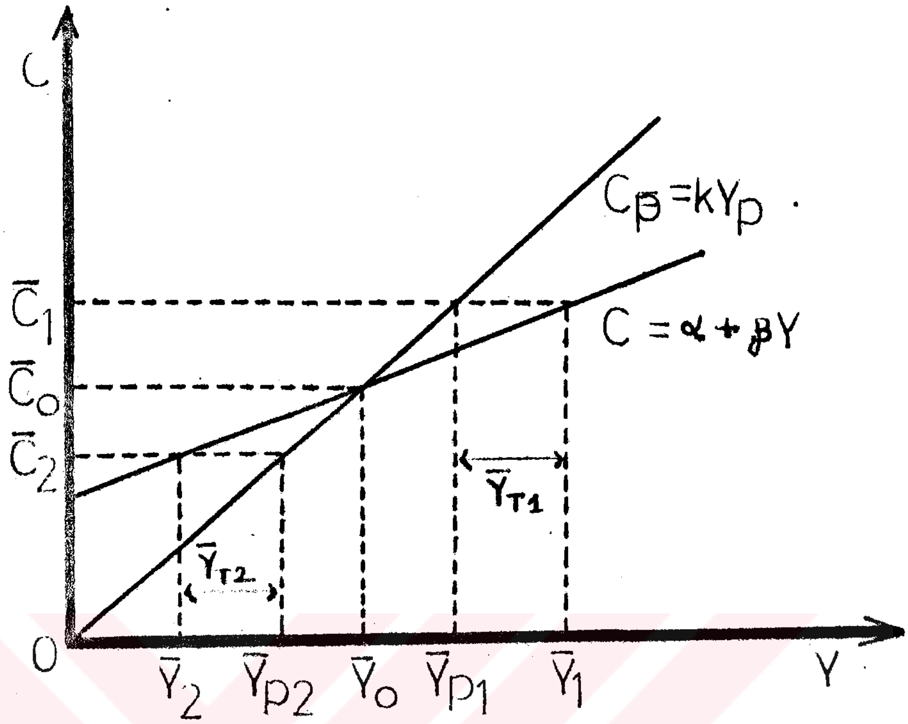

Figure 3.11

In the context of the PIH it can be shown that the regression of measured consumption (C) on measured income (Y) will give a downward biased estimation of the slope. Consider the simple Keynesian consumption function of the form:

$$C = \alpha + \beta Y \qquad (3.126)$$

Using the usual least-squares formula we have

$$b = \frac{\Sigma cy}{\Sigma y^2} \qquad (3.127)$$

where $c=C-\bar{C}$, $y=Y-\bar{Y}$. Considering (3.98) and (3.99) we can write

$$b = \frac{\Sigma(c_P + C_T)(y_P + y_T)}{\Sigma(y_P + y_T)^2} \qquad (3.128)$$

so that

$$b = \frac{\Sigma c_P y_P + \Sigma c_P y_T + \Sigma c_T y_P + \Sigma c_T y_T}{\Sigma y^2}$$

By the assumptions of the PIH, listed above, however, we can write the last three terms in the numerator as zero. Thus we obtain

$$b = \frac{\Sigma c_P y_P}{\Sigma y^2} \qquad (3.129)$$

But, the PIH states that $C_P = kY_P$ so that $c_p = ky_P$, so we may substitute to obtain

$$b = \frac{\Sigma y_P{}^2}{\Sigma y^2} = kP_y \qquad (3.130)$$

The ratio $\Sigma y_P{}^2/\Sigma y^2$-which we call P_y-is the fraction of the total variance of income regarded as permanent. It is the ratio of the variance of permanent income to the variance of measured income, i.e.,

$$Py = \frac{var(Y_P)}{var(Y)} = \frac{var(Y_P)}{var(Y_P)+var(Y_T)} = \frac{\sigma^2 Y_P}{\sigma^2{}_{YP}+\sigma^2{}_{YT}} \qquad (3.131)$$

Therefore, P_y is always less than unity-by virtue of the assumption that Y_P and Y_T are uncorrelated (Friedman, 1957, pp.31-2; Walters, 1968, pp, 250-51). If mean transitory income and mean transitory consumption are zero, estimated intercept of (3.126) will be

$$\bar{C} - b\bar{Y} = (\beta - b)\bar{Y} + \alpha$$

$$b = \beta + \alpha(1-P_y)\bar{Y} \qquad (3.132)$$

where $\bar{Y}$ is the mean value of income in the sample

The important conclusian is that the regression of measured consumption on measured income will produce a slope coffecient of regression which is always lower than the permanent k (Sargent, 1979, p.306) and this regression has greater intercept than the true relationship (Malinvaud, 1980, p.149). The downward bias in b as an estimate of k will be the more important the smaller the variability of permanent income relative to total variance of income.

We may also see the bias directly in terms of income elasticity of consumption, and this gives us a clear proof of the proposition; this, in fact, is the examination of the proportionality hypothesis (n=1) in which way Friedman looked at the data. Define:

$$n = \frac{d \log C}{d \log Y} = \frac{Y}{C} \frac{dC}{dY} = \frac{Y}{C} \frac{\Sigma cy}{\Sigma y^2} \qquad (3.133)$$

Following the discussion in Cramer [1971], we may write the following expression for the probability limit of (2.133) as

$$\text{plim } n = \text{plim } \frac{\bar{Y}}{C} \text{ plim } \frac{\Sigma cy}{\Sigma y^2} \qquad (3.134)$$

Upon directly substituting our expected values from the permanent income hypothesis, the following derivations hold

$$\text{plim } \frac{\bar{Y}}{C} = \frac{\mu_Y}{k\mu_Y} = \frac{1}{k} \qquad (3.135)$$

$$\text{plim } \frac{\Sigma cy}{\Sigma y^2} = \frac{\text{plim } (1/n)\ cy}{\text{plim } (1/n)\ y^2} = \frac{k\sigma^2_{YP}}{\sigma^2_{YP}+\sigma^2_{YT}} \qquad (3.136)$$

Upon substituting, this yields

$$\text{plim } n = \frac{\sigma^2_{YT}}{\sigma^2_{YP}+\sigma^2_{YT}} \qquad (3.137)$$

By this result plim n is less than unity, and in Friedman's view n cannot therefore be a consistent estimate of the permanent income elasticity of consumption. This under-estimation is entirely due to the under estimation of k by the estimated slope coffecient; in this respect transitory income has exactly the same affect as errors of observation in income. There is a difference, however, in that in Friedman's theory the true value of the elasticity is known to be unity. Consequently, n is not merely known to be underestimate of an otherwise unknown permanent but by (2.137) is soon to reflect the relative parts of permanent and transitory income in the total income variation (Cramer, 1971, p.186). We recall that by the followings

$$E(Y_i) = \mu_Y, \qquad E(C_i) = k\mu_Y \tag{3.138}$$
$$var(Y_i) = \sigma^2_{YP}+\sigma^2_{YT}, \qquad var(C_i) = k^2\sigma^2_{CP}+\sigma^2_{CT} \tag{3.139}$$
$$cov(C_i, Y_i) = k\sigma^2_{YP} \tag{3.140}$$

the latter can be partitioned into these two components. On this view n should thus vary inversely with the relative importance of transitory elements in the total observed income variation, and this turn depends on the consumption of the sample, on the method of data collection, the definition of income employed and the like.

It is frequently asserted that the above permanent income model is an "errors in variables" problem and this, indeed, provides a clue to how it might be distinguished from the absolute income hypothesis (Douglas, 1985, p.69). First, let us write the AIH in the form of

$$C = \beta Y + n \tag{3.141}$$

Then assuming the correct model is the permanent income model we can substitute to obtain

$$C = \beta(Y_P+Y_T) + n \tag{3.142}$$

Here, of course, Y_T is a type of "error" if Y is actually used as the independent variable. In addition, by assumption, Y is randomly distributed with a zero mean. In this model if

$$r_{YPYT} = r_{YP\epsilon} = r_{YT\epsilon} = 0 \tag{3.143}$$

which we would argue form the PIH, then the

$$\text{prob. limit of b is } \beta\left(\frac{\sigma^2_{YP}}{\sigma^2_{YP}+\sigma^2_{YT}}\right) \tag{3.144}$$

that is, b is asymptotically biased (unless $\sigma^2_{YT}=0$); indeed, the direction of the bias is clearly downward as shown in the above. To put it another way, the MPC will appear lower for certain types of spending units if they are approached by means of the AIH when there are actually subsantial transitory elements in their income. There have been a number of directly emprical studies of this "errors in variables" model, mostly favorable to the PIH.

3.6.3.4. Testing the Permanent Income Hypothesis

A major problem that arises when attempts are made to test the PIH, or to estimate equations concerning it, is that the key variables involved-particularly permanent income—are unobservable. Actual data, of course, refer to measured income and not permanent income. This means that, prior to any testing or estimating procedure, some proxy variable for permanent income or some method of estimating it must be found (Thomas, 1984, p.72). Now permanent income is income which is expected to be earned or received regularly, and, presumably, it is composed of the systematic component of the income expected from both human and non-human activities. It is a forward-looking concept, and like much of modern expectations-oriented macroeconomic theory, provides us with a concept which is intrinsicially not observable directly. Any direct test of the theory will necessarily (because of the unobservable permanent component in it) be the test of a joint hypothesis: this joint hypothesis is an aggregate consumption theory plus a practical expectations-generating mechanism. Note that so long as we do not put any limit on the proliferation of "expectations-generating mechanism" then the permanent income hypothesis cannot be practical: this may well seem to make it more of a "non-theory" even by Friedman's rules (Douglas, 1985, p.62; Evans, 1969, p.22).

Friedman's approach to the problem of weighting past observations is to form a measure for permanent income as exhibited in equation (3.145).

$$Y_{Pt} = Y_0 e^{\alpha t} + \int_{-\infty}^{t} \beta e^{\beta(\tau - t)} (Y_\tau - Y_0 e^{\alpha\tau}) e^{\alpha(t-\tau)}\, d\tau \quad (3.145)$$

Here, t represents the present and τ the past observations on income (Friedman, 1957, p.144). This is a trend adjusted weighted average (the trend rate of growth is α), written in continuous form which introduces a weighting parameter β. The weights are "trend weights" of

$$e^{\alpha(t-\tau)}$$

and "observation weights" of

$$\beta^{\alpha(\tau-t)}$$

After some manipulation, which involves evaluating the integral at t=τ, Friedman modified (3.145) as

$$Y_{Pt} = \beta \int_{-\infty}^{t} e^{(\beta-\alpha)(\tau-t)} Y_\tau \, d\tau \quad (3.146)$$

This produces a consumption function as

$$C_{Pt} = k\beta \int_{-\infty}^{t} e^{(\beta-\alpha)(\tau-t)} Y_{\tau} \, d\tau \qquad (3.147)$$

We may write (3.146) in the discrete form as

$$Y_{Pt} = \beta \, [Y_t + e^{(\beta-\alpha)} Y_{t-1} + e^{2(\beta-\alpha)} Y_{t-2} + \ldots] \qquad (3.148)$$

or as it is usually preferred to write:

$$Y_{Pt} = \beta Y_t + \beta(1-\beta) Y_{t-1} + \beta(1-\beta)^2 Y_{t-2} + \ldots \qquad (3.149)$$

Equation (3.149) stresses the "expected" nature of permanent income, implying that Y_P depends on current and past measured income with consumers giving most weight their current income and successively declining weigh to past incomes.

Friedman's procedure was to use real per capita US data for 1905-1951 to compute alternative time series for Y_{Pt}, using different values of β truncating equation (3.149) after sixteen terms. Measured consumption was then regressed on each such series in turn and a set of estimated equations of the form $C_t = a + bY_{Pt}$ obtained. Friedman found that the closest fit was obtained for a value of β=0.33. For this equation, the intercept, a, was not significantly different from zero so that the proportionality of the relationship between C_P and Y_P appeared to be confirmed. The estimate of k was b=0.88 but of the great importance was the low value obtained for β (Friedman, 1957, pp.146-49). β=0.33 suggested that only one third of the total weight used to assess permanent income is attached to income of four or more years ago. Such result, if correct, constituted strong evidence in favuor of the PIH over the AIH since the latter implies β=1 and there is no difference between Y_P and Y. A low β implies a low MPC. This means low impact values for the various Keynesian multipliers. This has obvious implications for the efficiency of fiscal policy (Thomas, 1984, p.72; Walters, 1968, pp.254-55).

Friedman [1963] further developed the analysis and stated that "β is a direct estimate of [the interest rate] r, which, as it happens, yields an estimate of the horizon closer to that yielded by other evidence than did my earlier assertion that 2/β was an estimate of the horizon. As I have noted β turned out to be 0.4, which is certainly rather close to the value for r of 0.33..." (Friedman, 1963, p.23).

The evidence concerning the size of β is not, however, clear-cut and has been disputed by other writers. For

example, Zellner et.al.,[1965] and particularly Zellner and Geisel [1970], using US quarterly data, obtain estimates of β which when converted into annual terms are much closer to unity. Furthermore, Wright [1969] using virtually identical data to Friedman but merely treating vartime years slightly different, obtains a value for β of 0.8. Such values suggest that the use of measured income in the .L:56
consumptian function is much less serious miss-specification that originally suggested. In contrast, however, Darby [1972 and 1974] obtains a value for β as low as 0.1. Darby [1974] argues that the econometric procedures that have been utilized in the estimation of permanent income have biased upwards the estimates of the weight of current income in the determination of permanent income. This bias is due to specification error inherent in the errorneous omission of transitory income and it corelates from consumers' expenditure equations when these expenditures include inventory adjustments associated with receipts of transitory income. The estimated permanent income based on such an expenditures equation will be a mixture of the true values of permanent and transitory income (Darby, 1972, p.928; Darby, 1974, p.226). If there is a suspicion that some of the consumption expenditures are really depositories of wealth for the reasons just given, we might well wish to explain actual total consumption as in equation (3.150).

$$C_t = k_1 + k_2 Y_{Pt} + k_3 Y_{Tt} + e_t \qquad (3.150)$$

This can be explained as follows. In the event that C_t contains consumer "investment", then, since Y_P alone will not explain it (it only explains consumption in the sense of the using up of the durables), it will appear in the residuals of the equation. Since this residual item then contains (new) wealth, it will be correlated with Y_P (an alternative measure of wealth). Thus, equation (3.150) without Y_T, will show bias. If Y_T is calculated by subtracting Y_P from Y-which is the usual method-then the resulting variable can be included as an argument in the consumption function as it is in equation (3.150). Darby, indeed, finds that Y_T is significant (when long lags occur) and its significance diminishes as one moves toward a measure of consumption more like the preferred theoretical construct (which is the using up of consumer goods).

In estimating Y_P, Friedman finds a seventeen-year lag which also seems too long (Friedman, 1957, p.145); thus some effort has been directed toward using the more flexible schemes such as the Almon or Pascal lags. Both Mayer [1972] and Boughton [1976] have done this, with the latter finding a very short lag (within a year) using

Pascal lags. Boughton also argues; (a) that there is an unexplained non-proportionality in the US short-run consumption function, (b) that the functional form might be different for the different types of consumer goods included in the aggregate, and (c) that there are omitted variables in the usual simple test. Boughton feels that while his test meets the minimum conditions of the permanent income model, the short lags and the non-proportionality do not favor its general acceptance.
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3.6.3.4.1. Adaptive Expectations Hypothesis

Indeed, Friedman proposes a simple method for estimating permanent income that may approximate the method by which people themselves estimate their permanent income. This method is now referred as the "adaptive expectations hypothesis", first developed by P.Cagan.

Let us now derive a very simple adaptive expectations model in which an individual (or a community) already has an estimate of permanent income. The model shows how an adjustment in expected permanent income can be made as a result of comparing this (previously established) permanent income to current income (Miller and Pulsinelli, 1980, p.235). If equation (3.149) is multiplied by $1-\beta$ and lagged one period we obtain

$$(1-\beta)Y_{Pt-1} = \beta(1-\beta)Y_{t-1} + \beta(1-\beta)^2Y_{t-2} + \dots \qquad (3.151)$$

Subtracting this equation from (3.149) eventually yields

$$Y_{Pt} - Y_{Pt-1} = \beta(Y_t - Y_{Pt-1}) \qquad (3.152)$$

Rearranging

$$Y_{Pt} - Y_{Pt-1} = \beta(Y_t - Y_{Pt-1}),\ 0 < \beta < 1 \qquad (3.152)$$

Equation (3.153) is an example of what is normally referred as the adaptive expectations hypothesis (Griliches, 1967, p.16).

Equation (3.153) suggests that if this year's measured income is the same as last year's estimate of permanent income, then the estimate of permanent income will not be revised. If this year's measured income exceeds last year's estimate of permanent income, then the estimate of permanent income will be revised upward by β (a fraction) times the difference. If this years measured income is less than last year's estimate of permanent income, then the estimate of permanent income will be revised downward by β times the difference. The extent of the upward or downward adjustment depends on the magnitude of β, which is called the "adjustment coffecient". The larger is β the greater is the adjustment. At one extreme $\beta=1$ and adjustment is complete, there being no difference between measured and permanent income; while at the other extreme, $\beta=0$, no adjustment takes place at all and permanent income remains unchanged regardless of the size of measured income.

We are now ready, using a simple adaptive expectations model, to relate permanent consumption to permanent income. Substituting equation (3.153) into equation (3.106) yields

$$C_{Pt} = k[Y_{Pt-1} + \beta(Y_t - Y_{Pt-1})] \quad (3.154)$$

Rearranging yields:

$$C_{Pt} = kY_{Pt-1} + k\beta(Y_t - Y_{Pt-1}) \quad (3.155)$$

Equation (3.155) yields important conclusions, even though it is based on a very simple theory of how people behave. It suggests that individuals (or a community) will respond only slightly to changes in measured income if they do not know to what extent that change is permanent or transitory. By assumption, people change their consumption only in response to changes in permanent income, transitory income changes will have no effect on consumption, given sufficient assets. Note that permanent consumption depends on permanent income, and permanent income depends only partly on current income (Branson, 1989, p.265; Miller and Pulsinelli, 1986, p.237).

3.6.3.4.2. Partial Adjustment Hypothesis

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Nerlove combined the Cagan adaptive expectations model with Koyck's reduction procedure to provide both an acceptable rationale and a feasible estimation procedure applicable to a wide range of problems. In addition, he suggested an alternative justification for the assumed form of the lag: the partial adjustment model. In this model, current values of the independent variables determine the "desired" value of the dependent variable (Griliches, 1967, p.17).

Consider a model in which optimal or "desired" consumption, C_t^*, depends on current measured income, i.e.,

$$C_t^* = kY_t \quad (3.156)$$

and suppose that actual consumption only partly adjust to changes in optimal consumption (Thomas, 1984, p.74), i.e.,

$$C_t - C_{t-1} = \beta(C_t^* - C_{t-1}), \quad 0 < \beta < 1 \qquad (3.157)$$

Equations (3.156) and (3.157) represent what is commonly called the "partical adjustment hypothesis". When optimal current consumption exceeds the actual level of consumption in the previous period, current consumption is increased beyond its previous level. However, because of "habit persistence" the increase in actual consumption is less than the full difference between C_t^* and C_{t-1}. The size of β, again known as an adjustment coffecient, determines the extent to which actual consumption is pushed towards the optimal. Substuting equation (3.156) into equation (3.157) yields:

$$C_t = k\beta Y_t + (1-\beta)C_{t-1} \qquad (3.158)$$

Except that there are now no problems of least squeres bias (serial correlation), equation (3.158) is identical to Koyck transformation-examined in the next section-even as far as the coefficients on Y_t and C_{t-1} variables are concerned. Yet, the interpretation we place on k and the adjustment coefficients β depends crucially on which underlying hypothesis is valid, the PIH or the habit persistence of the RIH.

3.6.3.4.3. Distributed Lags

It is possible to simplify Friedman's somewhat cumbersome procedure for estimating the consumption function by making use of the so called Koyck transformation.

Formally, let us assume that equation (3.159) represents the permanent income hypothesis,

$$C_t = k(r,w,u)f(\beta L)Y_t \qquad (3.159)$$

where the k function is that which we attributed to Friedman and $f(\beta L)$ represents some arbitrary (or derived) weighting scheme for actual income Y_t. Note also that L is a "lag" operator. The most often used weighting scheme is the Koyck. For this we have (Mayes, 1981, p.126),

$$f(\beta L)_i = (1-\beta)\beta^i L^i \quad \text{for } i = 0, 1, 2, \ldots \qquad (3.160)$$

Since

$$f(\beta L) = \frac{L-\beta}{1-\beta L} \qquad (3.161)$$

when the right-hand term of equation (3.160) is summed (it is an infinite series which approaches zero as t approaches infinity assuming $\beta<1$), we can use this expression directly in our consumption function. We assume $k(r,w,u)=k$ for simplicity and the result is an expression for the permanent income consumption as expressed in equation (3.162) (Evans, 1969, p.23; Douglas, 1985, p.63).

$$C_t = k\left(\frac{1-\beta}{1-\beta L}\right) Y_t \qquad (3.162)$$

which produces an estimating equation of

$$C_t = k(1-\beta)Y_t + \beta C_{t-1} + e_t \qquad (3.163)$$

with an error term (e_t) tacked on arbitrarily. Here, the specific Koyck weighting hypothesis is represented by the parameter β, a parameter which is also justified by the permanent view that expected income calculations are based on (averages of) past incomes.

It must be noted that the distributed lag form of the consumption function is an approximation to Friedman's expected income form. To see this, let us substitute equation (3.149) into the basic relationship $C_{Pt}=kY_{Pt}$. This yields

$$C_{Pt} = k[\beta Y_t + \beta(1-\beta)Y_t + \beta(1-\beta)^2 Y_{t-2} + \ldots] \qquad (3.164)$$

Lagging this equation by one period and multiplying by $1-\beta$ yields

$$(1-\beta)C_{Pt}-1 = k[\beta(1-\beta)Y_{t-1} + \beta(1-\beta)^2 Y_{t-2} + \ldots] \qquad (3.165)$$

Subtracting the equation (3.165) from the equation (3.164) leads to

$$C_{Pt} = k\beta Y_t + (1-\beta)C_{Pt-1} \qquad (3.166)$$

Finally, by making the use of the fact that $C_{Pt}=C_t-C_{Tt}$, equation (3.166) can be written as

$$C_t = k\beta Y_t + (1-\beta)C_t + [C_{Tt} - (1-\beta)C_{Tt-1}] \qquad (3.167)$$

where the last expression of the right-hand side is error term, i.e., unknown disturbance (Zellner et.al., 1965, p.572).

At this point, we should note that equation (3.163) has a complication arising from the fact that it is a reduced form equation (with the consequence that OLS estimate of the coefficients are in general inconsistent-this can be seen from (3.167), the disturbance term is correlated with C_{t-1} and if a random disturbance is added to the basic relationship the composite disturbance term in the equation is likely to be autocorrelated) (Pagano and Hartley, 1981, p.171). Equation (3-162), indeed, is the structural equation, and error (ϵ_t)is tacked on there, the correct interpretation of the error term in equation (3.163) is

$$e_t = \epsilon_t - \beta\epsilon_{t-1} \qquad (3.168)$$

While the point at which the error term appears is often taken to be arbitrary, there are some real issues here, especially involving the estimates of propensity to consume (Douglas, 1985, p.64). There is, however, a more fundemental problem concerning both Friedman's method and equation (3.163). Apart from the error term, equation (3.168) has exactly the same form as the habit persistence version of the RIH, i.e., both give C_t as depending on Y_t and C_{t-1} (Evans, 1969, p.24; Thomas, 1984, p.74).

There is the problem that the Koyck lag, while giving one structural form for estimating β (if it is less than unity, it is a readily estimable structural parameter), may run into trouble from serial correlation (Lütkepohl, 1981, pp.212-13), affecting either the short-run or the long-run estimates of the propensity to consume (and the mean lag), depending on how one estimates the model (Douglas, 1985, p.67). With regard to this problem, Zellner and Geisel have compared a general distributed lag model-of the Koyck form-under four assumptions about the error terms. The consumption fonction is

$$C_t = \beta C_{t-1} + k(1-\beta)\,Y_t + u_t - \beta u_{t-1} \qquad (3.169)$$

and the four assumptions are that

(1) $u_t - \beta u_t = E_t$ with E_t normally distributed;

(2) u_t are normally distributed;

(3) $u_t = \phi_a u_{t-1} + \epsilon_{3t}$ with ϵ_{3t} normally distributed and

(4) $u_t - \beta u_{t-1} = \phi_a(u_{t-1} - \beta u_{t-2}) + \epsilon_{4t}$ with ϵ_{4t} normally distributed.

here (1) represents the usual procedure and (2)-(4) represent somewhat more realistic alternatives; indeed, both (3) and (4) allow for some "structural" autocorrelation in the residuals. Note that if any of (2)-(4) are appropriate, the estimates in (1)-the usual form—will be inconsistent. Zellner and Geisel use maximum likelihood and Bayesian methods on quarterly US data and conclude (mostly) in favor of model (1), with an unstable short-run but not long-run propensity to consume. An even more careful comparison of the various procedures (and, incidentally, the model) is by Davidson et.al. [1978] utilizing British data (on a wider range of topics including seasonality and multicollinearity).

3.6.3.5. The Relation Between the Permanent Income and Relative Income Hypotheses

Friedman [1957] also shows that a basic equation arising out of the RIH explanation of cross-sectional data can be derived under the PIH. One way of summarising Duesenberry's cross-sectional argument is to express the APC of a household as

$$\frac{C}{Y} = \alpha + \beta \frac{\bar{Y}}{Y} \qquad \alpha > 0, \quad \beta > 0 \qquad (3.170)$$

where C and Y are household consumption and income and $\bar{Y}$ is the mean income of the household and its associates. Thus, as the income of household rises relative to mean income, i.e., as we move up the income distribution, the APC declines (Friedman, 1957, pp.160-63). The above equation can be regarded as the cross-sectional analogue of equation, $C_t / Y_t = \alpha + \beta(Y^o/Y_t)$.

Under the PIH, if a consumption function estimated by ordinary least squares from cross-sectional data, then provided the mean transitory components of income and consumption are zero, the equation obtained can be written as

$$C = k(1-P_y) + kP_y \qquad (3.171)$$

Dividing by Y, we then obtain

$$\frac{C}{Y} = kP_y + k(1-P_y) \frac{\bar{Y}}{Y} \qquad (3.172)$$

an equation identical in form to (3.170) obtained under the RIH. Thus, the PIH is able to explain a basic empirical relationship of the RIH, and moreover, unlike the RIH it is also able to tell us something about what determines the size of estimated coffecients in such relationship (Thomas, 1984, p.71). Since the PIH implies that in equation

(3.170) $\alpha=kP_y$ and $\beta=k(1-P_y)$, these coefficients clearly depend on the proportion of the total cross-sectional variation in income that is the result of variations in the transitory component. In effect, Friedman's hypothesis not only predicts that the cross-sectional consumption function will have an intercept but, unlike the RIH, is also able to make some prediction about the size of this intercept and slope of the function that will be obtained (Friedman, 1957, p.164; Thomas 1984, p.71).

It must be pointed out that the principal way one might prefer to test the PIH directly is to compare its predictions with those of the obvious alternatives, but there are several problems which emerge immediately. The first of these is that the theories we have listed as alternatives have been shown to have considerable overlap. Indeed, we cannot compare Y_P with Y and Y/Y^0 as predictors of consumption both because each of this is merely one particular representation of the general theory propesed and because not only does Y/Y^0 contain Y, but so does Y_P as usually calculated.

3.6.3.6. An Evaluation of the Emprical Studies on the Permanent Income Hypothesis

Since the publication of Friedman's "A Theory of the Consumption Function" in 1957, a great bulk of empirical study has emerged to test the PIH. While some of these studies favoring the PIH, others unfavored it.

Friedman, in his 1957 book, suggests a series of additional tests of his own hypothesis, one of which involves an attempt to test directly the assumption of a zero correlation between transitory consumption and transitory income. Such tests concentrate on the influence on consumption of "windfall gains". We may describe a "windfall" gain as a payment to consumer that was completely unexpected, which is not expected to recur and, moreover, does not recur.

An early study of the influence of windfall gains was undertaken by Bodkin [1959] who considered the effect on a group of US "war veterans" of the receipt of a totally unexpected National Life Insurance Dividend in 1950. Bodkin regressed the non-durable consumption expenditure of such veterans on both their regular income, Y, and the size of the windfall, d, with the following result.

$$C = 959.3 + 0.56Y + 0.72d + e \quad R2 = 0.60$$
$$(56.6) \quad (0.01) \quad (0.11)$$

Thus, the MPC windfalls appeared to be not only greater than that suggested by the PIH but even greater even than the MPC regular income-a result that apparently contradicted the PIH. Friedman, however, pointed out that since permanent income also tends to depend on age, the windfall might in fact be acting as a proxy variable for the apparently high MPC windfalls. In response to Friedman's criticism, Bird and Bodkin [1965] re-examined the problem, including, in the above equation, extra variables to represent permanent income. Their final results were inconclusive and could be interpreted in terms of either the AIH or the PIH. A windfall study by Kreinin [1961] obtained lower MPC out of windfall income while obtaining a MPC of 0.8-0.9 out of regular income and agreed with the PIH. Landsberger [1965] tried to reconcile the discrepancy between the results of Bodkin and Kreinin and concluded that the MPC out of windfall income decreases strongly as windfall income rises. Bodkin [1966] in replying the findings of Landsberger, argued that Landsberger's results do not constitute a particular strong confirmation of Friedman's permanent income hypothesis and this results appear to be supplement, rather than contradict, the findings of Bodkin [1959], and Bird and Bodkin [1965]. In another empirical test using dividend payment to veterans Lee [1957] reached the result that the MPC out of transitory income is not zero, thereby suggested that the original version of the PIH may not be entirely correct. Indeed, Lee's result tends to support a modest version of the PIH in which consumption is assumed to be effected positively by transitory income, but not as much as by permanent income. Darby [1972, 1974] regressed the consumption expenditures on transitory and permanent income. There are two main points of interest in the results. First, as predicted by the PIH, the estimated coefficient of transitory income is invariably smaller than that on permanent income. Second, the less inclusive the definition of consumption expenditure used, the smaller the size of the coefficient on transitory income. For non-durable expenditure only, this coefficient is about one fifth of the size of the permanent income coefficient. This is again as expected under the PIH since, because spending on durables is more correctly classified as saving, its exclusion from consumption expenditures should reduce the responsiveness of consumption to changes in transitory income. Reid [1962] also examined the same problem using cross-sectional data. Her findings are consistent with Friedman's hypothesis and with Kreinin's findings, but are inconsistent with the findings of Bodkin.

With reference to a paper by Friedman [1963] we also have to clear up the theoretical and empirical issues relating to the "horizon" to which consumers hold their expectations. If the consuming unit has a three year horizon, then it could be argued that his personal rate of discount is approximately 33 1/3 percent. That is, if r is an individual's rate of time preference, then 1/r=H defines his horizon. We can obtain r from observing that $Y_P=rW^T$, where W^T is the consumer's wealth. Then since a windfall adds to wealth, there will be observable a spurious connection between a windfall and actual consumption because of the correlation between permanent and transitory income. In the case of k=0.9 and the 33 1/3 percent discount rate, about \$.30 per dollar of windfall-oriented consumption would a rise from this violation of basic assumptions of the theory. For a longer horizon, this bias would approach zero. On this subject, Mayer [1972] found a longer horizon. We must also consider the "length of horizon" question together with the "proportionality" question. Friedman actually found in favor of three-year horizon and proportionality, but latter was questioned by Levitian [1963] who used the "errors in variables" approach on data for which the horizon turned out to be at most two years. In addition to horizon critics Levitian [1963, p.29] has following conclusion on the PIH: "The empirical result show that...Friedman's test is a rather roundabout way of attacking the problem...On the basis of our tests, one may conclude that although the traditional income elasticities are indeed likely to be downward biased, the size of the bias has been exaggerated by the PIH." More recently, Bhalla [1979] looked at Indian rural data and used a procedure which corrects for joint "measurement" and "hypothesis" errors (recall that the PIH can be interpreted as an "errors in variables" problem which creates a nice mess if there are also measurement errors in variables). Bhalla finds an upper limit of three years and non-proportionality; a similar method, used by Musgrove [1978, 1979] on South American data, also finds non-proportionality.

On the measurement problem of permanent income Ramathan [1971] pointed out the weaknesses of common method of estimating permanent income in cross-section studies, since, in these studies (i) no account is taken of expected future receipts, and (ii) households in the same group may have different permanent incomes because of differences in factors other than those used in forming the groups. Ramathan estimated permanent income in two-stage. First, grouping households according to some control variables. And second, eliminating the "pseudo estimate" for the effects of wealth and number of earners. He concluded that his method gave better results than the common method of using the mean values. Reid [1985], to distinguish between permanent and transitory income used cycle-averaging method and argued that the results obtained better.

In an early test of the PIH, Friend and Kravis [1957] found that the PIH generally provides a better explanation of household behavior, but the margin of superiority is small and not consistently maintained. Arak and Spiro [1971] found the relationship implied by Friedman insignificant and proposed the hypothesis that the difference between realized and measured income depends upon changes in the unemployment rate does yield significant results. In a sure conclusion, Laumas and Mohabbat [1972] stated that the findings of the PIH cannot be accepted.

In a critical review article, Houthakker [1958a] reported that an important testable implication of Friedman's theory that is the numerical value of 'permanent income must be more uniform in the minor than in the major subcells—of the consumption function is contradicted by statistical data. Houthakker views his results as particularly significant because, he believes the test he performed to have been suggested by Friedman. In a comment paper, Eisner [1958] argued: (i) the test actually suggested by Friedman is an appropriate one. (ii) Houthakker has not performed the test correctly. (iii) When the test is performed correctly, the results are entirely consistent with Friedman's PIH. (iv) A more powerful test gives results strikingly consistent with the predictions of the Friedman,s model. And also in his comment, Friedman [1958] made the above critics about the Houthakker's paper. In his reply, Houthakker [1958b] accepted Eisner's results as correct.

Mayer [1966] tested the PIH using cross-section data which is covered a dozen countries. Mayer argued that the data disconfirm the PIH in the strict sense, i.e., the marginal propensity to consume out of permanent income is equal to the average propensity. On the other hand, Mayer's tests confirmed to looser version of the PIH, namely that the marginal propensity to consume is greater for permanent than for measured income, though even for permanent income, the marginal propensity to consume is less than the average. Mayer [1972] employed various test for the PIH and concluded that the proportionality hypothesis of the PIH is thoroughly disconfirmed. Another hypothesis, the zero transitory income elasticity, in so far as it is testable it, too, is disconfirmed. In addition, Mayer argued that the various test suggest that it greatly overestimates the lag. However, nearly all the tests which have been performed by Mayer relate to the conventional definition of consumption. One could, therefore, argue that the permanent income theory as formulated rather than as tested by Friedman has not really been disconfirmed. A similar result was obtained by Simon and Aigner [1970].

In Holbrook and Stafford [1971], a multivariate "errors in variables" model was used to analyze the MPC from each of several sources of income for a sample of 621 families in a three year panel study. The finding of the study is that the total family income is much more stable than its components, as there is a tendency for changes in head's income to be offset by opposite changes in wife's and transfer income. The MPC out of the permanent component of both the head's and wife's labor income is 0.9, a result consistent with Friedman's for aggregate income, and implying that growing labor force participation of wives should have no effect on the long-run saving rate.

Taubman [1975] concluded that if cross-section studies are to be used to butters Friedman's contention that the consumption-permanent-income elasticity is one, then the interest elasticity of savings must be zero. As far as we aware, extensive cross-section testing of the PIH has indicated that the elasticity is higher with respect to the permanent income than to current income. However, no one has yet reliably estimated the permanent income elasticity to be greater than one.

Singh et al. [1978] employed a different approach to test the PIH. The parameters of the consumption function have been estimated by the Nonlinear Iterative Least Squares (NILES) method. The NILES method reduced serial correlation to a remarkable low level, thus, increased the confidence in the estimates of the parameters. Sing et al. estimated consumption functions by the NILES method and concluded that the PIH provides a satisfactory explanation of the consumption behavior in Canada, India, Netherlands, and West Germany.

Among the more recent studies, Bernanke [1985] examined consumer purchases of non-durables and durables as the outcome of a single optimizing problem. It was shown that, with non-separability in utility, the presence of adjustment cost of changing durables stocks may effect the time series properties of both components of expenditure. An econometric test of the PIH based on the model developed in this paper was both more efficient and less prone to bias than those in some previous studies. However, this test confirmed earlier rejections of the PIH in aggregate quarterly data.

The permanent income hypothesis implies that people save because they rationally expect their permanent income to decline; they save "for a rainy day". It follows that saving should be at least as good a predictor of declines in labor income as any other forecast that can be constructed from publicly available information. Campbell [1987] tested this hitherto, ignored implication of the permanent income hypothesis, using quarterly aggregate data for the period 1953-84 in the US. By contrast with much of the literature, for example Bernanke [1985], Flavin [1981], Hall [1978], Hall and Mishkin [1981], and Muelbaur [1983], the results obtained by Campbell are valid when income is stationary in first differences rather than levels. Geweke and Singleton [1981], using latent variable model for time-series data, tested the PIH and the implication of the test was the PIH seemed to provide a reasonable, if rough, description of the behavior of aggregate consumption over time, but its specification of the exact, temporal relation between consumption and permanent income should perhaps not be taken literally.

In another recent empirical study, Moulaert and Canniere [1988] tested the PIH using 1978-79 household budget survey data of Belgium. They were not able to reject that the permanent income is a determinant of consumption. But they have rejected the PIH in another core feature, that is the independence of APC of income inequality.

The tests concerning the PIH were not only made on the its core features. For example Fry [1979], Peterson [1972], Thurston [1977], and more recently Peel [1986] test and discuss the PIH in the context of the demand for money.

In a recent paper, Miron [1986] claims that the poor performance of the permanent income model of consumption might be attributable to the use of seasonally adjusted data. Indeed, he estimates a version of the model using not seasonally adjusted data and obtains results superior to those from estimating the same model with seasonally adjusted data. Unfortunately, in a later paper English et al. show that there are two important problems in Miron's execution of the tests that he reports. First, the test statistics for the overidentifying restrictions are miscalculated because of a "bug" in the software program (TSP) used to estimate the model. Second, the timing of the price series used to construct the real not seasonally adjusted consumption series and the real interest rate series are incorrect because of a second "bug" in Miron's program.

3.6.3.7. Policy Implications of the Permanent Income Hypothesis

The theoretical and policy implications of the PIH are far-reaching. Friedman has shown that current measured income may not correspond to the income concept upon which consumers base their decisions. A change in measured income may not completely correspond to a change in permanent income. If a measured income change is viewed by individuals as transitory the MPC will be zero. If the measured income change is viewed as permanent, then MPC will be large (Friedman, 1957, pp.236-38). Thus MPC in response to an income change will depend upon the perception of the individual about the nature of the income change. MPC is not stable. The stability of the MPC was a central reliable feature of behavior in Keynesian theory and thus the PIH dealt this relation a severe below.

The PIH suggests that the private economy is inherently stable for two reasons. First, because permanent income is a wealth concept, then the extent to which the PIH is valid, it provides support for the Pigou (wealth) effect. This means that price flexibility is capable of restoring the economy to a full-employment equilibrium after the economy has been shocked. Second, when the economy strays from its natural growth path during booms and recessions, the PIH implies that consumers will respond only in part to such transitory changes in national income. Temporary booms, therefore, will not be fueled by large increases in consumption; and temporary recessions will be cushioned somewhat by consumers who maintain most of their consumption expenditures. Stated differently, the PIH implies that the APC falls in booms and rises in recessions; this countercyclical tendency is inherently stabilizing.

Another implication is that how much reliance should be placed on using temporary tax changes for stabilization policy depends on how correct the PIH is. "The debate about tax cuts centers around an argument originally noted and rejected by Ricardo in the nineteenth century, but revived and supported by Barro [1974]. When the budget is balanced initially, and the government cuts taxes, there will be a budget deficit, financed by borrowing. The debt that is issued today must be retired next year or in some future year along with the interest that it carries. To repay the debt the government will have to rise taxes in the future. Hence changes in taxes should have no effect on consumption because permanent income is really uneffected by this intertemporal jiggling of tax rates" (Dornbusch and Fischer, 1987, pp.278-79).

On the other hand, there are theoretical reasons to believe that income tax changes labeled as temporary might indeed have important effects on consumption and on aggregate expenditures. Blinder [1981] lists the followings: (i) A temporary reduction in taxes may induce households to save largely by purchasing durable goods, which will significantly effect the economy. Similarly, a temporary rise in taxes may induce households to postpone their purchase of durable goods, even though consumption will not be reduced by as much. (ii) Some households currently may not be able to spend as much as they wish because they cannot borrow on their future earnings. Such liquidity constrained households may spend all of the reduced income tax—whether it is temporary or permanent. (iii) People may not "believe" that tax changes are temporary; presumably, they base their consumption on what they believe the government will do rather than on what the government says it will do. (iv) If people are very short sighted (or, to put it more objectively, if they have very high subjective discount rates), they may respond significantly to temporary tax changes.

The dynamics of adjustment to a shift in investment demand may also be differently evaluated in the context of the PIH. In Fig. 3.12, autonomous investment demand rises by amount ΔI, but it is not known whether the shift is permanent or transitory.

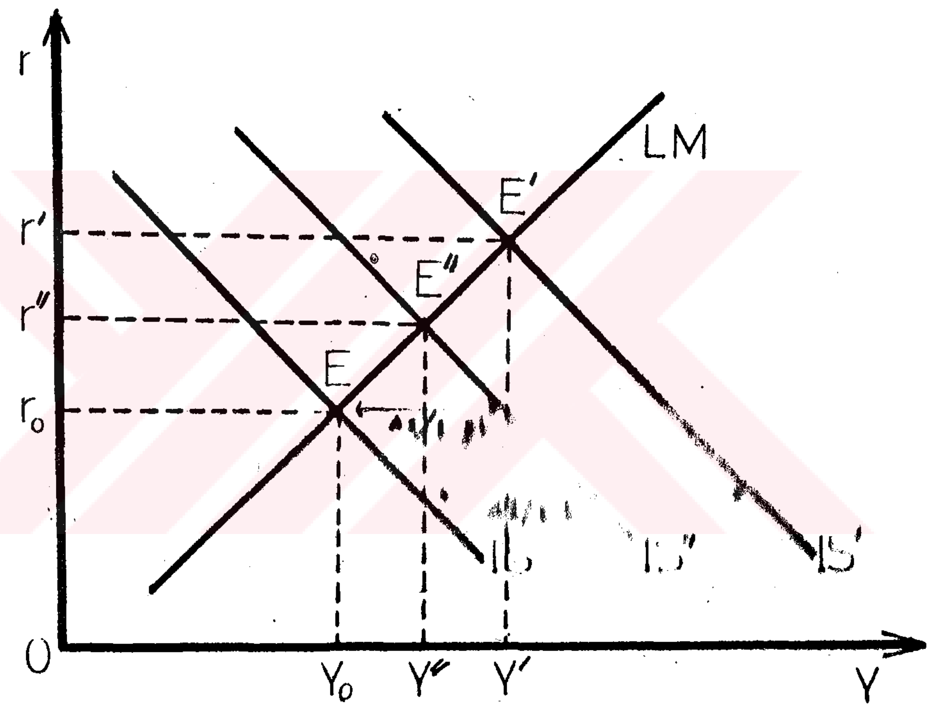

Figure 3.12

It is in fact permanent, so that the IS curve will eventually be at IS, shifted to the right by an amount $\Delta I(1-k)$, where $1/(1-k)$ is the long-run multiplier. But in the first period, the IS curve shifts only to IS", by amount $\Delta I/(1-\beta k)$, determined by the short-run consumption function and multiplier. Over time, the economy moves gradually from E" to E', as individuals come to recognize that the shift in investment demand is permanent (Dornbusch and Fischer, 1987, p.382).

Another point is that inclusion of real assets as a determinant of consumer demand probably increases the effectiveness of monetary policy relative to fiscal policy through the interest rate effect on asset values, which flattens the IS curve (Branson, 1989, p.282). The expansionary monetary policy will reduce the interest rate. In addition to its effect on investment, the fall in the interest rate will increase the value of real assets, stimulating consumption. Thus, the asset effect complements to effect of monetary policy and provides a link from monetary policy changes to consumer demand through the interest rate.

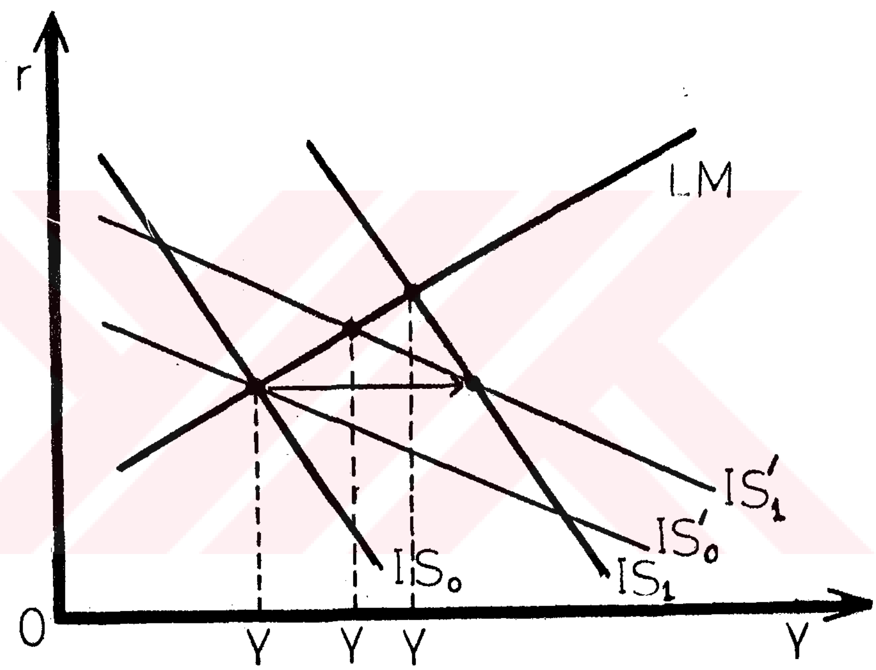

Figure 3.13

On the other hand, an expansionary fiscal policy tends to raise interest rates, reducing the real value of assets and consumption spending, partially offsetting the effect of the original fiscal policy expansion. In Fig. 3.13 a given shift is shown in two pairs of IS curves: the steep IS_0 and IS_1, flat IS_0' and IS_1', as government spending is increased. With the steeper IS curves, omitting the asset effect, Y rises from Y_0 to Y_2. With the flatter curves, including the asset effect, Y only rises to Y_1 with the postulated g increase. Thus, the asset effect, through the interest rate creates a consumption demand change that complements the effects of monetary policy but tends to offset partially the effects of fiscal policy.

3.6.4. Life-Cycle Hypothesis

We have made a distinction between the absolute income hypothesis on the one hand, and the relative income and the permanent incone hypotheses on the other, also suggested that the permanent income hypothesis actually involves a more explicit role for wealth than one generally finds in the relative income hypothesis. Yet, we have also argued, Keynes himself included wealth in his discussion (and Duesenberry did in his) although both omitted wealth in their more exact formulations. Along these lines we should note that as we progress to more general models and tests, the role of wealth becomes more and more complicated. The life-cycle hypothesis is a case in point; indeed, as it has grown, it has developed from more specific early forms into generalized dynamic consumption model. In the final analysis it has turned out to be a very flexible and useful model.

To begin, we should point out that there is a considerable overlap between the life-cycle model and Friedman's model which occurs over the underlying economic process which produces the calculations of permanent income (Thomas, 1985, p.73). As it was noted above Friedman presents a visualization of his permanent theory based on the Fisherian theory of interest. This was a two period consumption model in which a consumer who expects to receive income over two periods may choose an optimal C_1, C_2 different from Y_1, Y_2 by borrowing or lending at the going interest rate. His motives, says Friedman, are (a) to straighten out his stream of consumption expenditures and/or (b) to earn interest. We may then, also define the life-cycle hypothesis as a generalization of the Fisherian consumption model involving the age of consuming unit as an additional influence on aggregate consumption. We will begin with an early version of the theory which basically concentrates on the age aspect, before considering several more general formulations.

3.6.4.1. Theoretical Foundations of the Life-Cycle Hypothesis

The "Life-Cycle Hypothesis" (LCH) developed by Modigliani, Ando, and Brumberg, assumes that people allocate their income between consumption and saving to maximize "lifetime" economic well-being, or utility.

In the LCH, it is assumed that the individual receives utility only from present and prospective consumption and from assets to be bequeathed. It is assumed further that the price level of consumables is not expected to change appreciably over the balance of the life span, so that the volume of consumption is uniquely related to its value, then for an individual of age t, the utility function can be written as

$$U = U(C_t, C_{t+1}, \ldots\ldots C_L, A_{L+1}) \qquad , \qquad (3.173)$$

This function is to be maximized subject to the budget constraint, which if the rate of interest r, is not expected to change appreciably over the balance of life span, can be expressed by means of the equation

$$A_t + \sum_{\tau=t}^{N} \frac{Y_\tau}{(1+r)^{\tau+1-t}} = \frac{A_{L+1}}{(1+r)^{L+1-t}} + \sum_{\tau=t}^{L} \frac{C_\tau}{(1+r)^{\tau+1-t}} \qquad (3.174)$$

For the above equation and in coming sections we use following symbols:

C_t = consumption of the individual during the t(th) year (or other specified interval) of his life, where t is measured from the beginning of the earning span;

Y_t = income (other than interest) in t(th) year (for an individual of age t, Y_t and C_t denote current income and consumption, while C_τ and Y_τ, for $\tau > t$, denote planned consumption and expected income in the τ(th) year);

S_t = saving in the t(th) year;

A_t = assets at beginning of age period t;

r = rate of interest;

N = the earning span

M = the retirement span

L = the life span of economic significance in this context, that is N+M.

For the utility function (3.173) to be maximized, the quantities C_τ and A_{L+1} must be such as to satisfy the first order conditions.

$$
\left.
\begin{aligned}
\frac{\delta U}{\delta C_\tau} &= \frac{¥}{(1+r)^{\tau+1-t}}; \quad \tau=t,\ t+1,\ldots,L \\
\frac{\delta U}{\delta A_{L+1}} &= \frac{¥}{(1+r)^{L+1-t}} \\
\frac{\delta U}{\delta ¥} &= [\cdot]
\end{aligned}
\right| \qquad (3.175)
$$

where ¥ represents Lagrange multiplier. The equation (3.175) together with (3.174), yields a system of $L-t+3$ simultaneous equations to determine $L-t+1$ C_τ^* s, A^*_{L+1} and $¥^*$, the * symbols being used to characterize the maximizing value of the corresponding variables.

If current income, Y_t+rA_t, is unequal to C_t the individual will be currently saving (or dissaving); and similarly, if $Y_\tau+rA_\tau$ is not equal to C_τ^*, the individual will be planning to save (or dissave) at age τ (Modigliani and Brumberg, 1954, p.391).

Modigliani and Brumberg [1954] and [1980 paper was completed in 1954 and, as I know, published in 1980], "trim" their general function until they get to a considerably simpler version of their basic model. To begin with they assume that initial wealth is zero (no inheritance), and that final wealth is also zero (no bequest). That is

<u>ASSUMPTION I</u>: $A_t = 0$, $A^*_{L+1} = 0$

From Assumption I and Equation (3.174), it follows immediately that current and future planned consumption must be function of current and expected (discounted) income plus initial assets, i.e.,

$$C^*_\tau = f(V_t, t, \tau), \qquad \tau = t\ t+1,\ldots,1 \qquad (3.176)$$

where

$$V_t = \sum_{\tau=t}^{N} \frac{Y_\tau}{(1+r)^{\tau+1-t}} + A_t \qquad (3.177)$$

combines the two items of wealth; and t denotes again the present age of the individual.

ASSUMPTION II: The utility function is such that the "proportion" of his total resources that an individual plans to devote to consumption in any given year τ of his remaining life is determined only by his tastes and not by the size of his resources (Modigliani and Brumberg, 1980, p.131). This assumption can be represented by the following equation:

$$C^{*}_{\tau} = \Omega^{t}_{\tau} . V_{t} \qquad (3.178)$$

where for given t and τ the quantity Ω^{t}_{τ} depends on the specific form of the function U and on the rate of interest r, but "is independent of total resources", V_t.

As a result of well-known properties of homogeneous functions, it can readily be shown that a sufficient condition for Assumption II to hold is that the utility function U be homogeneous (of any positive degree) in the variables $C_t, C_{t+1}, \ldots, C_L$.

It may also be shown that a simple form of the utility index U satisfying Assumption II is the following:

$$U = \log U = \alpha_0 + \sum_{\tau=t}^{L} \alpha_{\tau} \log C_{\tau} \qquad (3.179)$$

Shortly, the above assumption means that if the individual receives an additional monetary worth of resources, he will allocate to consumption at different times in the same proportion in which he had allocated his total resources prior to the addition (Ando and Modigliani, 1963, p.56). Of course, this equivalence holds on the assumption that consumers deal in perfect markets.

The original Modigliani and Brumberg papers [1954] and [1980] have contained additional two assumptions. These two assumptions are not essential to the argument, but are introduced for convenience of exposition.

ASSUMPTION III: The interest rate is zero, i.e., r = 0,

As a result of this assumption, the expression

$$V_t = \sum_{\tau=t}^{N} \frac{Y_{\tau}}{(1+r)^{\tau+1-t}} + A_t \qquad (3.180)$$

can be written as $Y_t + (N-t)Y_t^{e} + A_t$, where,

$$Y_t^e = \left(\sum_{\tau=t+1}^{N} Y_\tau \right) / N-t \qquad (3.181)$$

represents the average income expected over the balance of the earning span.

Equation (3.178) now reduces to

$$C_\tau^t = \Omega_\tau^t [Y_t + (N-t) Y_t^e + A_t] \qquad (3.182)$$

which implies

$$\sum_{\tau=t}^{L} C_\tau = [Y_t + (N-t) Y_t^e + A_t] \sum_{\tau=t}^{L} \Omega_\tau^t \qquad (3.183)$$

From (3.182) and (3.183) it then follows that

$$\sum_{\tau=t}^{L} \Omega_\tau^t = 1 \qquad (3.184)$$

<u>ASSUMPTION IV</u>: All the Ω_τ^t are equal; i.e., our hypothetical prototype plans to consume his income at an even rate throughout the balance of his life.

Let Ω_t denote the common values of the Ω_τ^t for an individual of age t. From (3.184) we then have

$$\sum_{\tau=t}^{L} \Omega_\tau^t = (L+1-t)\Omega_t = 1 \qquad (3.185)$$

or,

$$\Omega_\tau^t = \Omega_t = \frac{1}{L+1-t} \equiv \frac{1}{L_t} \qquad (3.186)$$

where $L_t \equiv L+1-t$ denotes the remaining life span at age t.

Substituting for Ω_τ^t in equation (3.182) the value given by (3.185), it can immediately to established the individual consumption function, i.e., the relation between current consumption and the factors determining it.

$$C = C(Y, Y^e, A, t) = \frac{1}{L_t} Y + \frac{N-t}{L_t} Y^e + \frac{1}{L_t} A \qquad (3.187)$$

where the undated variables are understood to relate to the current period.

According to the equation (3.187) current consumption is a linear and homogeneous function of current income, expected average income, and initial assets, with coefficients depending on the age of the consuming unit (Modigliani and Brumberg, 1954, p.389; Modigliani and Brumberg, 1980, p.133).

Note that the marginal propensity to consume in the above LCH model is

$$\frac{\delta C}{\delta Y} = \frac{1}{L_t} + \frac{(N-t)}{L_t} \frac{\delta Y^e}{\delta Y} > 0 \qquad (3.188)$$

and tends to fall with increasing age (both $1/L_t$ and $(N-t)/L_t$ get smaller with age), given $\delta Y^e/\delta Y$.

In the original paper in which the LCH appeared, Modigliani and Brumberg discussed empirical tests at great length, although they did not carry out. They note that "A household whose current income unexpectedly rises above the previous 'accustomed' level...will save a proportion of its income larger than it was saving before the change and also larger than is presently saved by the permanent inhabitants of the income bracket into which the household now enters" (Modigliani and Brumberg, 1954, p.406).

One important implication of equation (3.178) is that a change in current income will effect current consumption only by the extent that it effects wealth. This is the key implication of the LCH and distinguishes it sharply from the AIH since normally changes in current income, unless they lead to similar changes in expected future incomes, will have little influence on wealth-the household's total life time resources. Hence, except when a household is near "death", changes in current income have little effect on current consumption. Another important aspect of the LCH is that Ω's are independent of the size of wealth. The household keeps the ratios of its planned current and future consumption expenditures unchanged no matter what the size of its total resources. In particular, current consumption is a constant proportion of these resources. This is the well known and much criticized "proportionality postulate" and it follows from the assumption that marginal rates of substitution depend only on consumption ratios (Thomas, 1984, p.62). However, it must be stressed that the convenient proportionality postulate is in no way vital to the central implication of the LCH. As can be seen from the two-period case (examined in Chapter II), the dropping of this assumption would still leave current consumption as a function of total lifetime resources although the relationship would no longer be one of proportionality. Hence, a change in current income would still only effect current consumption via its probably small effect on total lifetime resources, i.e., wealth. The contrast with the AIH therefore remains.

Consider a household at the beginning of its career anticipating a sequence of labor incomes and deciding on a sequence of consumption rates within the limits set by its income prospects. In Fig. 3.14. an expected income sequence is illustrated, and along with it a chosen consumption plan. Both the income sequence and the consumption plan are pictured in two ways; in current real liras (dashed curves) and liras discounted to the decision date (solid curves).

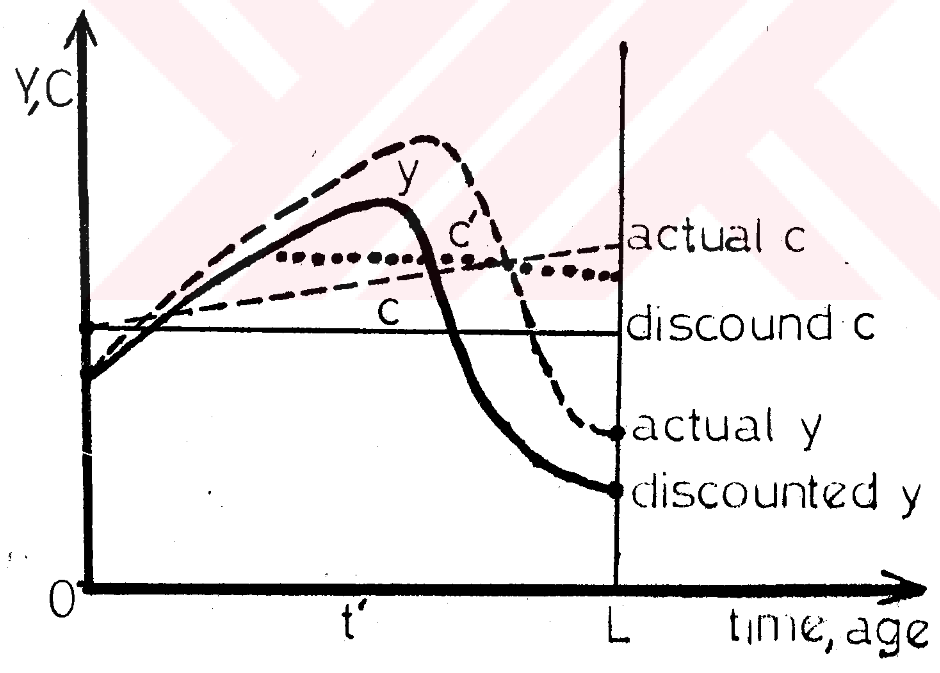

Figure 3.14

The consumption plan is shown as smoother than the income sequence. The spirit of the LCH is that consumers prefer steadily consumption to fluctuating consumption. The one-period marginal utility of consumption is declining. Households save and dissave in order to smooth out their income paths. Saving for retirement is the clearest example of such behavior but certainly not the only one. Another example is debt financing by young people to obtain a standard of life beyond their current means but consistent with their occupational status and income prospects (Tobin, 1975, p.186). Of course, the household is not free to choose any paths for C that it desires. It is limited by its income sequence. Specifically, the sum of the differences between discounted Y and discounted C—the present value of its savings and dissavings from labor income, must add up to zero over the lifetime. Figure 3.15 provides the same information as Figure 3.14 in a different form. The curves are the integrals of "discounted Y" and "discounted C" curves. The Y curve shows for each age the cumulative total of labor income earned until that age discounted to household age zero. Similarly, the C curve shows the present value, as of age zero, of consumption through the age. At the terminal age L, Y and C meet. This is the budget constraint.

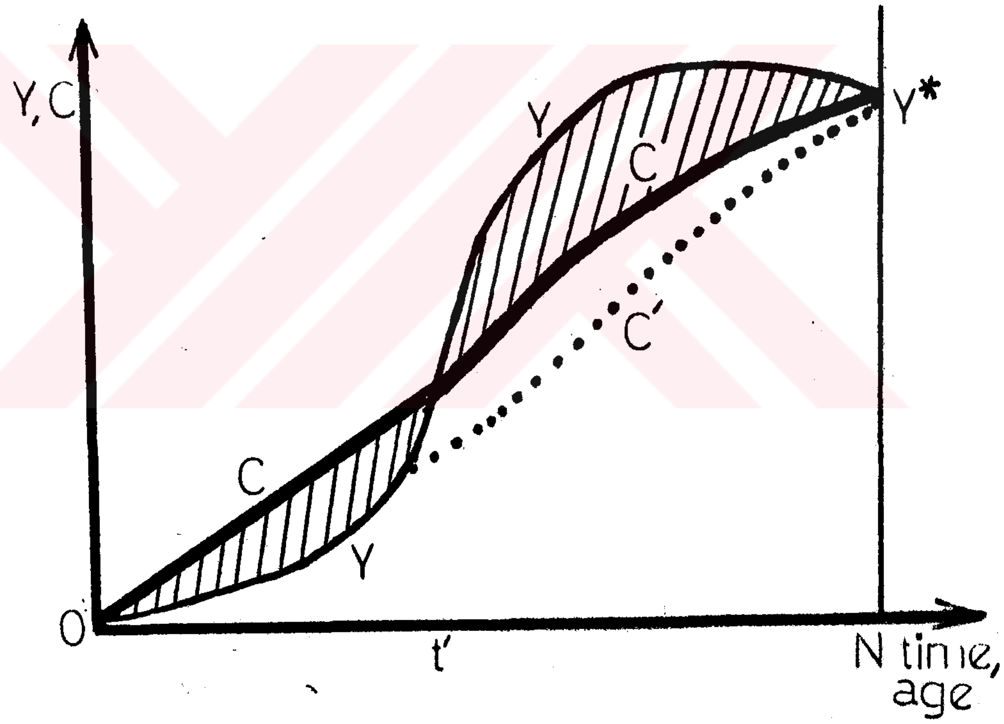

Figure 3.15

From the income and consumption paths the wealth profile of the household can easily be derived. In present value terms, non human wealth W is just the vertical difference, positive or negative, between Y and C. These differences are shaded in Fig. 3.15 and plotted in Figure 3.16 as discounted wealth. By putting the discounting process in reverse, this present value wealth profile can be converted into a current lira wealth profile-the dashed curve "actual W" in Fig. 3.16.

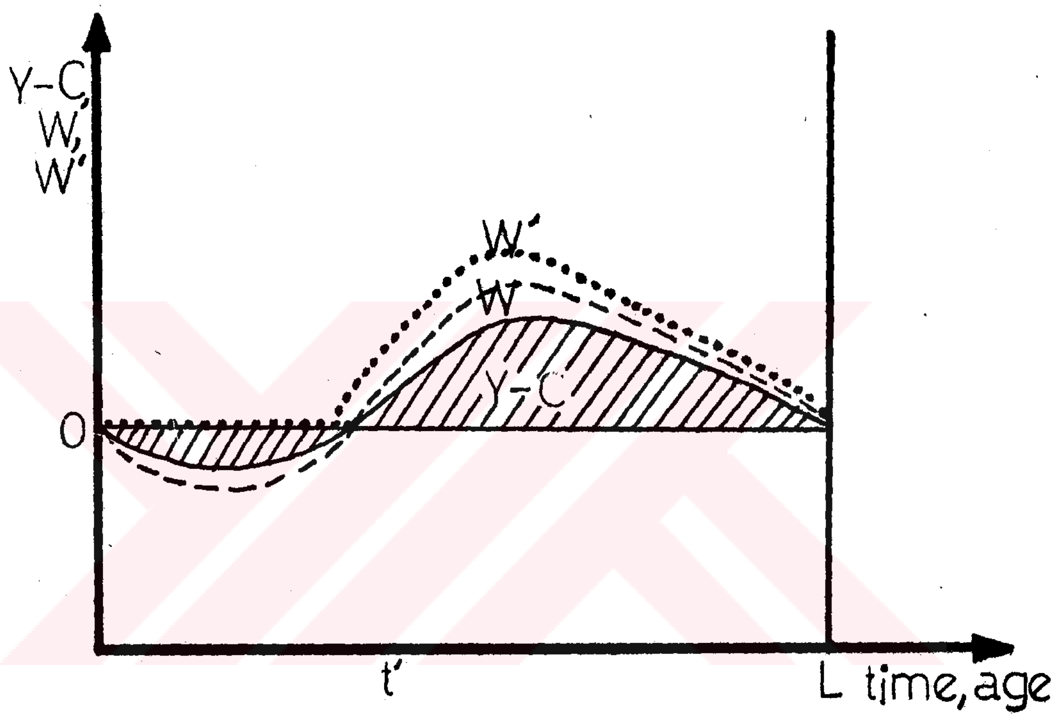

Figure 3.16

This account has assumed that the household can save and dissave in a perfect capital market-in particular, that the household can borrow against future labor income at the same interest rates at which it can save. The only constraint has been the lifetime budget constraint. Terminal wealth must not be negative, a restriction that limits total lifetime consumption but not its allocation among ages. In Fig. 3.15, curve C must start at 0 and at Y*, but in between it may have any shape the household desires (Tobin, 1975, p.187).

Consider, on the other hand, a simple liquidity constraint, that non-human wealth W can never be negative. The best the household, so constrained, can do is to consume its cash income in early years until t' and then follow the dotted curves C's in Figs. 3.14 and 3.15.

Correspondingly, in Fig. 3.16, discounted W will be 0 until age t' and then follow the dotted path. The less drastic constraint of a penalty borrowing rate, finite instead of infinite, would move the household in the same direction. In general, as the example illustrates, liquidity constraints raise the household's wealth profile.

3.6.4.2. The Macro Model of the Life-Cycle Hypothesis

So far we have applied the LCH to individual behavior. Our major concern, however, is with the macroeconomic models. In the below, what are the macro implications of the LCH is examined.

To begin, let us write the equation (3.178) as

$$C_T(t) = \Omega_T(t)\ V_T(t) \tag{3.189}$$

This equation implies that, in any given year t, total consumption of a person of age T (note that we have changed the notation-now, t refers to time and T refers to age) will be proportional to the present value of total resources occurring to him over the rest of his life (Modigliani and Brumberg, 1980, p.135). The present value of resources at age T, $V_T(t)$, can be expressed as the sum of net worth carried over the previous period, $A_T(t-1)$, and the present value of non-property income the person expects to earn over the remainder of his earning life, i.e.,

$$V_T(t) = A_T(t-1) + Y_T(t) + \sum_{\tau=T+1}^{N} \frac{Y_T^{e\tau}(t)}{(1+r(t))^{\tau-T}} \tag{3.190}$$

where $Y_T(t)$ denotes current nonproperty income; $Y_T^{e\tau}(t)$ is the nonproperty income an individual of age T expects to earn in the (th) year of his life; N stands for the earning span and r(t) the rate of return on assets.

In order to proceed further, Ando and Modigliani [1963] introduced the notion of "average annual expected income", $Y_T^{e}(t)$, defined as follows:

$$Y_T^{e}(t) = \frac{1}{N-T} \sum_{\tau=T+1}^{N} \frac{Y_T^{e\tau}(t)}{(1+r(t))} \tag{3.191}$$

Making use of this definition and of (3.190) we can write equation (3.189) as

$$C_T(t) = \Omega_T(t)Y_T(t) + \Omega_T(t)(N-T)Y_T^{e}(t) + \Omega_T(t)A_T(t-1) \tag{3.192}$$

To obtain an expression for aggregate consumption, following Ando and Modigliani, we proceed to aggregate equation (3.192) in two steps, first within each age group and then over the age groups.

If the value of $\Omega_T(t)$ is identical for all individuals in a given age group T, then it is a simple matter to aggregate equation (3.192) over an age group, obtaining:

$$C^T_t = \Omega^T_t Y^T_t + (N-T)\Omega^T_t Y_t^{eT} + \Omega^T_t A_{t-1} \qquad (3.193)$$

It has been shown by Theil [1954] that under a certain set of conditions the coefficients of (3.193) can be considered as weighted averages of the corresponding coefficients of (3.192).

Next, taking equation (3.193) as a true representation of the relationship between consumption and total resources for various age groups, we can aggregate them over all age groups to get the consumption function for the whole community. Consider the equation:

$$C_t = \beta_1' Y_t + \beta_2' Y_t^e + \beta_3' A_{t-1} \qquad (3.194)$$

where C_t, Y_t, Y_t^e and A_{t-1} are obtained by summing, respectively, C^T_t, Y^T_t, Y_t^{eT} and A^T_{t-1} over all age groups T, and represent therefore aggregate consumption, current nonproperty income, "expected annual nonproperty income", and net worth (Ando and Modigliani, 1963, pp.57-58).

In equation (3.194) there is a variable which is not yet measurable-average expected annual nonproperty (labor) income. We now need a final hypothesis linking average expected labor income to a current variable-current labor income.

Several assumptions might be tested to see how they fit the data coming from observations of the real world. These simplest assumptions would be that average expected labor income is just a multiple of present labor income:

$$Y_t^e = \theta Y_t, \quad \theta > 0 \qquad (3.195)$$

This assumes that if current income rises, people adjust their expectation of future incomes up so that Y_t^e rises by the fraction θ of the increase in Y_t. We might note here that, this assumption assigns great importance to movements in current income as a determinant of current consumption (Branson, 1989, p.255). If an increase in current income shifts the entire expected income stream substantially it will have a much larger effect on current consumption than it would if the expected income stream did not shift, leaving the increment to current income to be allocated to consumption over the remaining years of life.

Ando and Modigliani [1963] tried a number of similar assumptions, and found that the simplest assumption represented by equation (3.195) fits the data as well as any other (Ando and Modigliani, 1953, p.63). Substituting the equation (3.195) into (3.194), we obtain the aggregate consumption function.

$$C_t = (\beta_1{}'+\theta\beta_2{}')Y_t + \beta_3{}'A_{t-1} = \beta_1 Y_t + \beta_3 A_{t-1} \qquad (3.196)$$

Both Modigliani [1975] and [1986] written (3.196) in a some different (but in the same meaning as (3.196) implies) way:

$$C_t = \alpha Y_t + \delta A_t \qquad (3.197)$$

An equation of this type had been proposed by somewhat earlier by Ackley [1961], though both the functional form and presumed stability of the coefficients rested on purely heuristic considerations.

As one might expect, in view of the steady-state results, an equation of the form (3.197) with α, δ constant implies in turn that, with a constant rate of growth of income, g, both the saving-income and the wealth-income ratios remain constant in time. Assuming that $YT_t = Y_t + r_t A_t$ and that in steady-state, unexpected capital gains can be ruled out, while expected gains must be included in r_t and thus in $Y_T t$ (Modigliani, 1975, p.13). Hence, in steady-state, we must have

$$\Delta A_t = S_t = YT_t - C_t = gA_t \qquad (3.198)$$

Making use of (3.197) to substitute for C_t, we deduce:

$$\frac{A_t}{Y_t} = \frac{1-\alpha}{g+\delta-r_t}; \quad \frac{A_t}{YT_t} = \frac{1-\alpha}{g+\delta-\alpha r_t}; \quad \frac{S_t}{YT_t} = g\frac{A_t}{YT_t} \qquad (3.199)$$

Modigliani [1975] stated that it is possible to verify, with the help of numerical calculations, that the coefficients of the (3.198) would not be very sensitive to variations in the rate of population or productivity growth, and hence in their sum, g, nor the short run departures of income from its growth trend. The first result together with (3.199), implies that, according to the LCH, the wealth ratio should tend to decline with the growth trend. It also confirms that the saving ratio is zero for zero growth and increases with, g, though at a decreasing rate. The second result suggests that, for an economy fluctuating about a reasonably stable growth trend, the coefficients of (3.197) could be taken as constant-except possibly for the effect of variations in r, to which we shall come back later (Modigliani, 1975, p.13; Modigliani, 1986, p.302).

As we have noted in Chapter II, the coefficient α and δ should in principle, depend also on r. The effect of r on the LCH consumption function might be approximated by rewriting (3.197) in the form

$$C_t = \alpha Y_t + (\delta^* + \mu r)A_t \qquad (3.200)$$

However, the value of μ would not necessarily be 1 but would depend on the strength of the substitution effect between current and future consumption. If (3.200) holds, then equation (3.199) can be rewritten as

$$\frac{A_t}{Y_t} = \frac{1-\alpha}{g+\delta^*+(\mu-1)r}; \quad \frac{A_t}{YT_t} = \frac{1-\alpha}{g+\delta^*+(\mu-\alpha)r}; \quad \frac{S_t}{YT_t} = g\,\frac{A_t}{YT_t} \qquad (3.201)$$

A_t/YT_t and S_t/YT_t would rise or fall with r, depending on whether μ is smaller or larger than α. Tobin [1975] assuming an isoelastic additive utility function with an elasticity of 1.5 reported that a value of μ close to zero appeared consistent with S_t/YT_t is an increasing function of r, i.e., C_t/YT_t is a decreasing function of r. Unfortunately, there is no way to establish <u>a priori</u> just how strong the substitution effect might be in reality. Thus, while it is hypothesized that equation (3.200) provides a reasonable approximation to the role of r in the aggregate consumption function, there is little one can say "a priori" about the value μ of except that it should not exceed unity.

3.6.4.3. The LCH Reconciliation of the Consumption Function Paradox

So far, we have explained the LCH theoretically but have not pointed out how the conflicting results of cross-sectional and long-run time-series data can be explained in terms of the LCH.

If the LCH is correct, if one is to undertake a budget study by selecting a sample of the population at random and classifying the sample by income level, the high-income groups will contain a higher-than-average proportion of persons who are at high-income levels "because" they are in the middle years of life, and thus, have a relative low C/Y ratio. Similarly, the low income groups will include relatively more persons whose incomes are low because they are at the ends of the age distribution, and thus have a high C/Y ratio. Thus, if the "life-cycle" theory is true, a cross sectional study will show C/Y falling as income rises, explaining the cross-sectional budget studies showing MPC<APC.

Turning to the time-series data, the LCH function of equation (3.197) is shown in Figure 3.17 which graphs consumption against labor income. The intercept of the consumption-income function is set by the level of assets A_t. The slope of the function-the MPC out of labor income—is the coefficient of Y_t in the LCH consumption function. In short-run cyclical fluctuations with assets remaining fairly constant, consumption and income will vary along a simple consumption-income function.

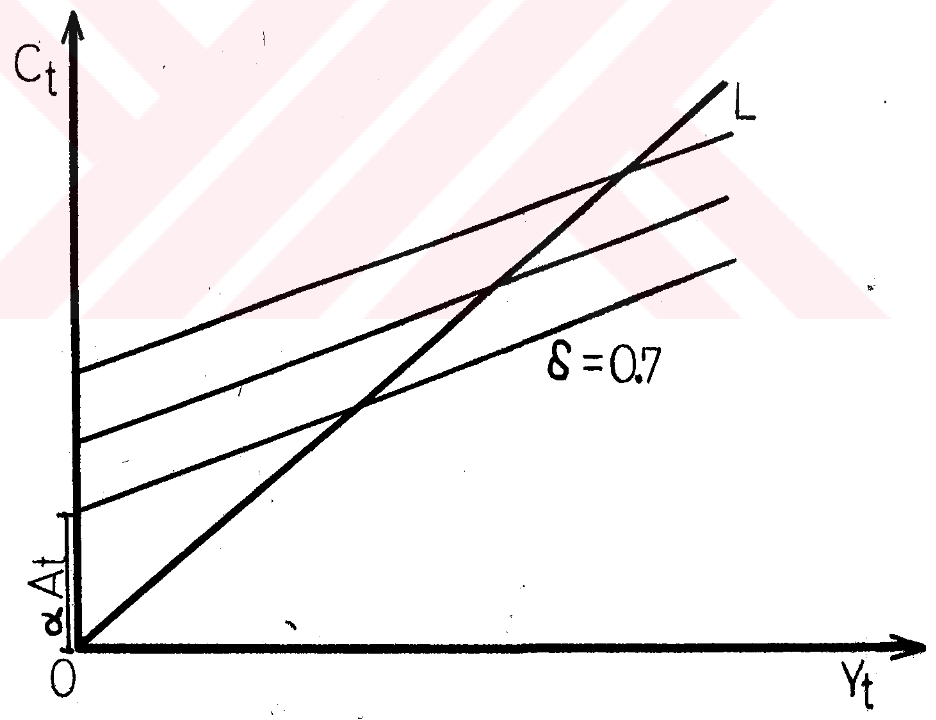

Figure 3.17

Over the long-run as saving causes assets to rise, the consumption-income function shifts up as A_t increases. Thus, over time we may observe a set of points such as those along the line OL in Figure 3.17, which shows a constant consumption income ratio along trend as the economy grows. This constancy of the trend C/Y ratio can be derived from the LCH function (Branson, 1989, pp.256-57) as follows. We can divide all the terms in equation (3.197) by total real income to obtain

$$\frac{C_t}{Y_t} = \alpha \frac{Y_t}{YT_t} + \delta \frac{A_t}{YT_t} \qquad (3.202)$$

A similar function was empirically estimated by Ando and Modigliani [1963] and the resulting equation was

$$\frac{C_t}{Y_t} = 0.7 \frac{Y_t}{YT_t} + 0.06 \frac{A_t}{YT_t} \qquad (3.203)$$

If the C/Y ratio given by this equation is constant as income grows along trend, then the line OL, which gives the APC, will go through the origin in Fig. 3.17.

Thus, the LCH model of consumption behavior explain all three of the observed consumption phenomena. It explains the MPC<APC, result of cross-sectional budget studies. It provides an explanation for the cyclical behavior of consumption with the consumption-income ratio inversely related to income along a short-run function, and it also explains the long-run constancy of the C/Y ratio. In addition, it explicitly includes assets as an explanatory variable in the consumption function, a role that was observed in the post-World War II inflation (Branson, 1989, p.258).

3.6.4.4. Relations of the Life-Cycle Hypothesis to the Other Hypotheses

So far, we have discussed the theories of consumption functions separately. Now, we will present what kind of differences or similarities exist between these theories.

3.6.4.4.1. Relation to the Keynesian Consumption Function

According to the Keynesian hypothesis, consumer expenditure habits are sticky and only adjust with a lag to the changed circumstances; in the meantime, savings which are considered as passive residual, absorb a large share of the changed income. In the LCH model, on the other hand, savings tend to go up either because the new level of income is regarded as (partly or wholly) transitory or, to the extent that it is regarded as permanent, because the initial asset holdings are now out of line with the revised outlook. If the outlook has improved, assets are too low to enable the household to live for the rest of its expected life on a scale commensurate with the new level of income; if the income outlook has deteriorated, then, in order for the household to achieve the optimum consumption plan consistent with the new outlook, it is not necessary to add the assets at the same rate as before, and perhaps even an immediate drawing-down of assets to support consumption may be called for (Modigliani and Brumberg, 1954, p.407).

A more sophisticated variant of the AIH, which has become quite popular in 1960s, consists in separating income into two parts, disposable labor income Y, and disposable nonlabor or property income, which we shall denote by P. Thus,

$$C = \beta_0 + \beta_1 Y + \beta_2 P \qquad (3.204)$$

This variant, which reduces to standard Keynesian consumption function when $\beta_1 = \beta_2$ is usually advocated on the ground that property income occurs mostly to higher-income and/or enterpreneurial groups who may be expected to have a lower marginal propensity to consume. Accordingly, β_2 is supposed to be smaller than β_1 and this supposition appears to be supported by empirical findings. It is immediately apparent that (3.204) bears considerable similarity to the LCH function of the form (3.197), i.e.,

$$C = \alpha Y + \delta A \qquad (3.205)$$

The main difference lies in the constant term which appears in (3.204) but not in (3.205), and in the fact that the wealth variable in (3.205) is replaced in (3.204) by a closely related variable, income from wealth, P. These functions tested by Ando and Modigliani [1963] in the first difference form, i.e.,

$$\Delta C = \beta_1 \Delta Y + \beta_2 \Delta P \qquad (3.206)$$

$$\Delta C = \alpha \Delta Y + \delta \Delta A \qquad (3.207)$$

Comparison of the estimated results suggested that net worth is definitely not a mere proxy for current property income. While the coefficient of P was positive and smaller than that of Y as expected, this variable was much less useful than A in explaining the behavior of consumption (Ando and Modigliani, 1963, p.74).

3.6.4.4.2. Relation to the Dusenberry-Modigliani Consumption Function

The LCH model may be expected to generate a behavior of consumption which is very similar to that implied by the earlier Dusenberry-Modigliani (RIH) type of hypothesis, in which consumption was expressed as a function of current income and the highest previous peak income (or consumption). To exhibit the relation, let us suppose that Y were to grow at a constant rate g, in which case Y can be taken as equal or proportional to Y. Suppose further that rate of return on assets r is reasonably stable in time. Then, the consumption function (3.194) implies that the income-net worth ratio, Y^{*}_{t}/A_{t-1} will tend to a constant h, related to the parameters of the consumption function by the equation:

$$h = \frac{g + \beta_3 - \beta r}{1-\beta}, \qquad \beta = \beta_1 + \beta_2 \qquad (3.208)$$

When the ratio Y^{*}_{t}/A_{t-1} is in fact equal to h, then income and net worth grow at the same rate, g, and the consumption-income will be a constant given by:

$$\frac{C_t}{Y_t} = \frac{Y_t^{*} - S_t}{A_{t-1}} \frac{A_{t-1}}{Y_t} = \frac{h - g}{h - r} \qquad (3.209)$$

Thus, the model implies that if income fluctuates around an exponential trend the income-net worth ratio will tend to fluctuate around a constant level h, and saving-income ratio around a constant g/h. The same argument is implied by Duesenberry-Modigliani consumption function (Modigliani and Brumberg, 1980, p.177).

If we interpret the role of highest previous income as that of a proxy for net worth, then the Duesenberry-Modigliani consumption function can be considered as providing an approximation to the consumption function implied by the LCH (Ando and Modigliani, 1963, p.80).

3.6.4.4.3. Relation to the Permanent Income Hypothesis

In the original paper in which the LCH appeared, Modigliani and Brumberg discussed empirical tests at great length, although they did not carry out. They note that "A household whose current income unexpectedly rises above the previous 'accustomed' level...will save a proportion of its income larger than it was saving before the change and also larger than is presently saved by the permanent inhabitants of the income bracket into which the household now enters" (Modigliani and Brumberg, 1954, p.406). This is interesting because it makes the life-cycle and permanent income theories sound very similar (Douglas, 1985, p.76). The life cycle hypothesis in its broadest form is clearly hard to distinguish from the broad form of the PIH. Actually, as pointed out, both the life-cycle and permanent income hypotheses are dynamic consumption problems and both emphasize the role of wealth in straightening out the discrepancies between the consumer's consumption plans and the consumer's expected stream of income (from all sources). The upshot is that many of the general tests described in earlier sections of this chapter which compare the relative value of a wealth formulation to that of a simple income or relative income formulation, are also germane to the topic of the life-cycle model. The results, quite simply, were (1) that many "relative" aspects do appear to matter; (2) that simple income, possibly surprisingly, often does as well as smoothed income; (3) that certain anamolies in the actual long-run behavior of the APC are effectively explained by the wealth model; (4) the "non-proportionality" exists between consumption and permanent income; and (5) that when there are significant transitory factors in income, the wealth model might well perform relatively better than its rivals.

The point of departure of both LCH and PIH can be paraphrased-if only loosely-in terms of the following propositions (Modigliani and Ando, 1960, pp.74-6).

(i) The scale of living adopted by a household is determined by their perception of their current and prospective resources:

$$C_p = f(W) \qquad (3.210)$$

(ii) The actual consumption expenditure of the household over some arbitrary interval of time, such as month or a year, will tend to fluctuate around the permanent level of consumption, or, equivalently, is determined by the permanent level of consumption up to a stochastic component:

$$C = C_p + u \qquad (3.211)$$

where C denotes the measured consumption expenditure and u denotes the stochastic component.

(iii) The income received by the household over some arbitrary interval of time will obviously bear some relation to the overall level of resources to which the standard of living is anchored:

$$Y = g(W) + u \qquad (3.212)$$

where Y denotes the current measured income

(iv) In addition to the above propositions the PIH and the LCH model share in common a fourth hypothesis which is really controversial one:

$$f(W) = kW \tag{3.213}$$

where W is wealth. By substituting (3.213) into (3.111) we obtain

$$C = kW + u \tag{3.214}$$

which is the basic hypothesis of PIH and one of the major implications of the LCH in its simplest version.

Like similarities, there are some differences between the PIH and LCH. First, the PIH differs from the LCH primarily in that it models rational consumption and saving decisions under the simplifying assumption that life is indefinitely long. Accordingly, the notion of life resources is replaced by that of permanent income while the discrepancy between current and permanent income is labeled transitory income (Modigliani, 1986, p.199). Second, in the life-cycle model, net saving is composed of three components: i) there is one component which is equal to a constant proportion of lifetime income. This component is independent of the level of lifetime income and of age. ii) households save a part of their transitory receipts, a part which depends upon the household's age but not on its income. The reason why households consume a part of their transitory receipts is that they plan to run down their assets to zero at the time of death. Hence, a household with, say ten years to live, will consume one tenth of the windfall each year. By contrast, in the permanent income theory, households do not consume any part of the windfall because they plan to pass assets onto their heirs. iii) the third component of saving is the component which depends upon the difference between the household's actual and desired stock of assets (Mayer, 1972, p.30). Finally, there is one significant difference between the two theories. Since in the LCH households consume all their assets over their lifetime, this hypothesis has a testable implication for the relation between age and consumption which it does not share with the permanent income theory. As already mentioned, in the life-cycle model consumption out of windfall is a function of age where as in the permanent income theory (where households do not consume their wealth but pass it onto their heirs) it is not. But there is a serious complication here. As Landsberger [1970] pointed out, the proposition that consumption out of windfalls is a function of age is not a necessary implication of a utility function homogeneous in consumption (Landsberger, 1970, pp.175-77). Rather, it follows from a much less basic assumption model by Modigliani and associates, the assumption that households plan to consume their wealth at an even rate over their remaining lifespan. Consequently, if the empirical data were to refute the postulated relationship between the propensity to consume windfalls and age, only a particular specification, rather than a basic point, of the life cycle hypothesis would be damaged. Hence, the proposition that the MPC varies with age does not actually provide a good way of testing the LCH vis-a-vis the PIH. This is not be surprising. The two theories are essentially similar and differ only in details. Hence, any test which tries to distinguish between them cannot deal with a basic issue, but most focus on their detailed specification.

3.6.4.5. The Effect of Dropping the Simplifying Assumptions

So far, the LCH was examined under some simplifying assumptions. In this section, we will show that how dropping of these assumptions effect the basic life-cycle model.

3.6.4.5.1. Nonzero Interest

In the LCH, r, has two effects. One effect is on income as we must distinguish between labor income, say Y, and property income, say PY, whose permanent component may be approximated by rW, and total income:

$$YT = Y + PY = Y + rW \qquad (3.215)$$

If we continue to assume a constant labor income till retirement, then the graph of income in Fig. 3.14 is unchanged (Modigliani, 1986, p.303; Modigliani and Brumberg, 1980, p.160). However, the graph of consumption changes through an income and substitution effect: the addition of rW increases income, but at the same time r also effects the opportunity cost of current, in terms of future consumption (Evans, 1983, pp.398-99). It is possible that the consumer would still choose a constant rate of consumption over life (if the elasticity of substitution were zero). In this case, in Fig. 3.16, consumption will still be a horizontal straight line, but at a higher level because of the favorable "income effect" from rW. As for saving, it will be the difference between Y and C. The former differs from the (piecewise) Y in the figure by rW, which is proportional to W. As a result, the path of W will depart somewhat from the typical shape of Fig 3.16, and, in particular, the overall area under the path can be shown to decline with r. This means that W and, <u>a fortiori</u>, w=W/Y, will fall with r. Carlino [1982] derived a consumption function to include the effect of interest on consumption. He defined consumption function as

$$Ct = k \, [W_t + \sum_{t=1}^{n} Y^e_t (1+r)]^{-t} \tag{3.216}$$

where k defined as

$$k = \alpha + \beta r_t \tag{3.217}$$

substituting (3.217) into (3.216);

$$C_t = (\alpha+\beta r_t) \, [W_t + \sum_{t=1}^{n} Y^e_t (1+r)]^{-t} \tag{3.218}$$

Carlino concluded that "while there has existed a theoretical tradition concerned with the relationship between consumption and the rate of interest, there has been little empirical analysis to date. Unfortunately, the empirical results reported regarding interest rate effects in spending equations have been rather inconsistent. This is all the more regrettable since the interest elasticity of consumption (saving) is germane to the analysis of a wide variety of contemporary issues of economic policy" (Carlino, 1982, pp.233-34). Boskin [1978] has demonstrated that the question of interest sensivity has important implications for the effects of tax policy on income, welfare, and income distribution. Moreover, the interest responsiveness of consumption has well known implications for the effectiveness of macroeconomic policy (Boskin, 1978, p.25).

3.6.4.5.2. Allowing for the Life-Cycle of Earning and Family Size

Far from being constant, average labor income typically exhibits a market hump pattern which peaks somewhat past age 50, falls thereafter, partly because of the incidence of retirement, and does not go to zero at any age, though it falls sharply after 65 (Modigliani, 1966, p.165; 1986, p.304). However, consumption varies with age, largely reflecting variations in family size, as one might expect if the consumer smoothes consumption per equivalent adult. Now, the life-cycle of family size has a very humped shape rather similar to that of income, though with a somewhat earlier peak. As a result, one might expect, a fairly constant rate of saving in the central age group, but lower saving or even dissaving in the very young or old. Thus, the wealth of a given cohort tends to rise to a peak around age 60 to 65 (Masson, 1986, p.175; Davies, 1981, p.568).

It is also worth nothing that available evidence supports the LCH prediction on that the amount of net worth accumulated up to any given age in relation to life resources is a decreasing function of the number of children present in the household and to rise with the number of children no longer present (Sheldon, et.al., 1982-83, p.224-25; Modigliani, 1986, p.304).

3.6.4.5.3. Length of Working and Retired Life

One can readily drop the assumption that the length of retired life is a given constant. As is apparent from Fig.3.16, a longer retirement shifts forward, and raises, the peak of wealth, increasing W/Y and the saving rate. It is possible, in fact, that, in an economy endowed with greater productivity (and, hence greater per capital income) households might take advantage of this by choosing to work for fewer years. This, in turn, would result in a higher national saving rate. Note, however, that this scenario need not follow. The increase in productivity raises the opportunity cost of an extra year of retirement in terms of consumables, providing an incentive to shorter retirement. Thus, the saving rate could, in principle, be effected by per capita income, but through an unconventional life-cycle mechanism, and, furthermore, in a direction unpredictable a priori (Modigliani, 1986, p.304; Modigliani, 1988, p.23).

In the stylized, pure life-cycle model, wealth must be clearly declining after retirement, and at a sufficiently fast pace to reach exhaustion at the end of life. The actual behavior of wealth by age seems quite different, especially after correcting for the fact that successively older households belong to cohorts which typically enjoyed a smaller life income (Modigliani, 1988, p.23). Aside from income, any other variable that effects the length of retirement, through this channel, effect saving. One such variable, that has received attention lately, is Social Security. Several studies have found that the availability of social security, and terms thereof, can encourage earlier retirements (such studies are Felstein, 1974, 1976; Williamson and Jones, 1981; and Wilcox, 1989). To this extend, Social Security tends to disencourage saving, through this effect may be offset, and even more than fully, by the fact that it also reduces the need for private accumulation to finance a given retirement.

3.6.4.5.4. Liquidity Constraint

Imperfections in the credit markets as well as uncertainty of future income prospects may, to some extent, prevent households from borrowing as much as would be required to carry out the unconstrained optimum consumption plan. Such a constraint will have the general effect of postponing consumption and increase W/Y as well as S/Y.

In the presence of nonnegativity constraint on net worth, consumption cannot exceed current resources in any period. As shown in Fig. 3.14, consumption tracks earnings during youth, when the constraint is binding, then increases relative to the perfect-capital-markets profile thereafter (Hubbard and Judd, 1986, p.6). This pattern is also reflected in the individual wealth-age profile in Fig. 3.16. Lifetime utility from consumption is reduced by the constraint with the magnitude of the reduction increasing the flatter is the desired consumption profile (or for an isoelastic utility function, the lower is the intertemporal elasticity of substitution in consumption [Pissarides, 1978, p.283]). To the extent that desired consumption is even more age-related-increasing, for example, in middle age as children are being reared-the same intuition applies. The constraint will be less binding in youth, more binding in middle age. Tax policies that depress consumer's net earnings during their constrained periods will depress consumption lira for lira (Rossi, 1986, p.112; Scheinkman and Weiss, p.25-6). But, clearly, these are not essential modifications, at least with respect to the aggregate implications-on the contrary, they contribute to the insure that productivity growth will increase the saving rate. However, significant liquidity constraints could effect quantitatively certain specific conclusions, for example, with respect to the temporary tax changes. Zeldes [1989] examined the liquidity constraint empirically.He concludes that results he obtained generally supported the hypothesis that an inability to borrow against future labor income effects the consumption of a significant portion of the population (Zeldes,1989, p.305).

3.6.4.5.5. Myopia

The LCH presupposes a substantial degree of rationality and self-control to make preparations for retired consumption needs. It has been suggested that households, even if concerned in principle with consumption smoothing, may be too myopic to make adequate reserves. To the extent that this critics is valid, it should effect the wealth-income ratio in the direction opposite to the liquidity constraint, though the effect of transitory changes in income from any source would go in the same direction. However, such myopia is not supported empirically (Shefrin and Thaler, 1988, p.609). The assets held at the peak of the life-cycle are found to represent a substantial multiple of average income and an even larger multiple of permanent income which, in a growing economy, is less than current income. Such a multiple appears broadly consistent with the maintenance of consumption after retirement. This inference is confirmed by recent studies which have found very little evidence of myopic consumption behavior. In particular, Blinder [1976], Felstein [1974], Katlikoff et. al. [1982], and Shefrin and Thaler [1988], working with survey data, find that for most families the resources available to provide for retired consumption appear to be quite adequate to support retired consumption at a rate consistent with life resources.

3.6.4.6. The Impact of Social Security and Bequests in the Life-Cycle Consumption Function

The bequests motive in the LCH is not different from the model presented in Chp.II. At this point, the effect of social security will be considered.

In the specification of the life-cycle consumption function, consumption is a function of private wealth and disposable income. Proponents of the hypothesis that social security reduces personal saving argue that social security represents a form of wealth that displaces private wealth. To test the validity of this hypothesis, both its proponents and critics employ an alternative specification of the consumption function in which consumption depends upon private wealth, disposable income, and social security wealth, which is defined in the literature as either gross or net (Williamson and Jones, 1981, p.1036).

A pay-as-you-go social security system does not directly change current aggregate disposable income, since for every lira of tax there is a lira of benefits. The only way social security reduces saving (increases consumption) is by inducing society to consume what would otherwise have been saved. According to the life-cycle theory, consumption is determined by time preference and lifetime income, but is independent of when the income is received. Therefore, social security only increases consumption if it increases lifetime income when the present value of benefits received during retirement exceeds the present value of taxes paid during the working years (Wilcox, 1989, p.290). In this case, if the retirement period is unchanged, individuals will increase their consumption and the system will reduce saving. If social security decreases lifetime income, consumption will decrease.

During the introduction or expansion of a pay-as-you-go social security program, the lifetime income of older individuals in the economy is increased. This is because they are not paying the new or increased taxes during their entire working years. Since current social security taxes are transferred directly to retirees as current benefits, social security generates intergenerational transfers from workforce participants to retriees. In an ongoing social security system, new or increased taxes do not imply equivalent reductions in the lifetime incomes of current younger and future labor force participants, since they will receive compensating transfers from following generations. Therefore, only the intergenerational transfers during the introduction or expansion of social security increase aggregate consumption. This increase in consumption results from a substitution of social security wealth for private assets (Felstein, 1974, p.905-6; Williamson and Jones, 1981, p.1038).

3.6.4.7. Policy Implications of the Life-Cycle Hypothesis

The question to be considered in this section is whether, or how far, the acceptance of the LCH consumption function effects our understanding of the working of an economy, and in particular of stabilization policies.

Let us consider first, fiscal policy. It can be readily shown that a consumption function of the type (3.200) implies that the multiplier effect of an autonomous increase in expenditure in indefinitely large if the marginal tax rate is zero (The income response increases linearly in time at the rate $S(1-\alpha)$); if the marginal tax rate is t_m the multiplier approaches $1/t_m$, which is independent of the parameter of the consumption function. At a more abstract level, the LCH has widespread implications for the family of issues revolving around the burden of the national debt (Modigliani, 1961, pp.733-34; 1970, p.198). For the short-run stabilization policy, the implication of the transitory income taxes as follows: Attempts at restraining (or stimulating) demand through transitory income taxes (or rebates) can be expected to have small effects on consumption and to lower (raise) saving because consumption depends on life resources which are little affected by a transitory tax change. In the long-run, a progressive tax on consumption is more equitable than one on current (quite apart from its incentive effects on saving) (Modigliani, 1986, p.310).

But the implications for monetary policy are even more significant, as the LCH implies a direct and rather speed link between interest rate and consumption. This is because a change in (real) interest rate affects the rate at which the market capitalizes the earnings from assets and thus the market value of assets and finally consumption. In the FMP (Federal Reserve-MIT-Penn Model) model Modigliani [1971] allow explicitly for the effect of long-run interest rates on the market value of corporate equities. He estimated that the elasticity of corporate stock with respect to the (real) long-term interest rate (r) for given profit expectations is roughly one. Since the market value of stock (K) is roughly one-third of A and A is roughly five times C, the elasticity of consumption with respect to r comes to

$$\frac{dC}{dr}\,\frac{r}{C} = \left(\frac{\delta C}{\delta A}\,\frac{A}{C}\right)\left(\frac{\delta A}{\delta K}\,\frac{K}{A}\right)\left(\frac{\delta K}{\delta r}\,\frac{r}{K}\right)$$

$$= 0.05 \times 5 \times 0.3 \times 1 = 0.08$$

At first sight this looks like a relatively modest response as compared with that of other components of demand whose dependence on interest rates has been traditionally recognized (Modigliani, 1971, pp.19-20).

For short-run stabilization policy, the monetary mechanism works in the LCH as follows: The fact that wealth enters importantly in the short-run consumption function means that monetary policy can affect aggregate demand not only through the traditional channel of investment but also through the market value of assets and consumption (Modigliani, 1959, pp.505-6; 1986, p.310).

Expenditures financed by deficit tends to be paid by future generations; those financed by taxes are paid by the current generation. The conclusion rests on the proposition that private saving, being controlled by life-cycle considerations, should be (nearly) independent of the government budget stance, and therefore private wealth should be independent of the national debt. It fallows that the national debt tends to crowd out an equal amount of private capital at a social cost equal to the return on the lost capital (which is also approximately equal to the government interest bill). This conclusion stands in sharp contrast to that advocated by the so-called Ricardian Equivalence Proposition (Barro, 1974, pp.1096-110), which holds that whenever the government runs a deficit, the private sector will save more in order to offset the unfavorable effects of the deficit on future generations.

Of course, to the extent that the government deficit is used to finance productive investment, then future generations also receive the benefit of the expenditure, and letting them pay for it through deficit financing may be consistent with intergenerational equity. In an open economy, the investment crowding-out effect may be attenuated through the inflow of foreign capital, attracted by the higher interest that results from the smaller availability of investible funds. However, the burden on future generations is roughly unchanged because of the interest to be paid on the foreign debt. Finally, if there is slack in the economy, debt-financed government expenditures may not crowd out investment, at least if accompanied by an accommodating monetary policy, but may instead, raise income and saving (Modigliani, 1986, p.311). In this case, the deficit is beneficial, as was held by the early Keynesians; however, the debt will have a crowding-out effect once the economy returns to full employment. The LCH suggests that to avoid this outcome, a good case can be made for a so-called cyclically balanced budget.

CHAPTER IV
AN EMPIRICAL TEST OF THE ABSOLUTE INCOME, THE RELATIVE INCOME, THE PERMANENT INCOME, AND THE LIFE-CYCLE HYPOTHESES *

A substantial part of the effort spent on studying aggregate consumption function during the postwar years has been directed toward the analysis and verification of essentially four hypotheses-the Absolute Income Hypothesis (AIH) of Keynes, the Relative Income Hypothesis (RIH) of Duesenberry, the Permanent Income Hypothesis (PIH) of Friedman and the Life-Cycle Hypothesis (LCH) of Modigliani, Brumberg, and Ando. Apart from AIH, other three hypotheses, though different in scope and formulation, these hypotheses are known to have strong family connections. The answers they provide to some of the basic questions in the theory of consumption function are complementary rather than competitive. However, the fact remains that different specification implied by these hypotheses may not fit equally well in a given country nor may any single specification across countries. Each specification emphasizes different aspects of consumer behavior, and not all countries can be presumed to be similar in this respect. In order to find out which of the specifications suits a particular country most, a comparative study of the different theories is required. While substantial efforts have been made to test the above theories for the rest of the world, our knowledge about their empirical validity in the case of Turkey to be lacking. This gap in the empirical research may be attributed either to the lack of adequate analytical tools, as in the case of the estimation of permanent income and consumption in Friedman's hypothesis, or to the paucity of suitable data, as in the case of LCH.

The present chapter represent a step to fill the gap, in the case of Turkey, partially by attempting a comparison of the four hypotheses mentioned above.

4.1. The Data

To test the hypotheses mentioned above cross-sectional data were collected from urban Adana with household consumption and income survey. Sample size was 600 households. With this survey, data have been collected on the socioeconomic conditions of households, like household size, labor force and employment conditions of household members, income of household, sources and distribution of

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income, expenditures, demand of household for goods and services.

METHODOLOGY AND THE SAMPLE PLAN

Sampling Unit : The ultimate sampling unit is the household.

Sampling Method : Multistage systematic sampling method was used depending on the size of the urban Adana.

Stratification : The whole sample region was stratified into three strata as developed, medium-developed and less-developed places.

Sample Selection : First, each sample strata was divided into three substratas as poor, medium, and rich according to their socioeconomic conditions. For sample districts, maps which show natural blocks weighted by the number of resident households, were used. On the maps, artificial blocks of about 300 households, based on the boundaries of natural blocks, were formed. Using these maps, artificial blocks were selected as two independent subsamples for each stratum. Second, for the selection of sample households a pre-survey performed and an enumeration list was for each stratum using the results of the households were chosen in every stratum and every subsample by a circular systematic method, with the constraint of being a multiple of three and being separable into three secondary subsamples. To have sufficient number of sample households in every category of income class, sample selection was performed after households in the enumeration list were stratified according to the type of income, like wages and salaries, entrepeneurial income and others. From the enumeration lists, households of foreign nationals and households composed of only 1 and more than 8 members were eliminated. In the enumeration list, the first household preceding the sample household was designated as the first substitute, the first household following the sample household as the second substitute, the second preceding household as the third substitute, the second following household as the fourth substitute.

In the survey a household is defined as follows : A household is a community of common management, composed of one or more persons with or without family ties, who live in the same dwelling and share their income, meals and other expenditures. Persons with family ties who live in separate dwellings or persons with separate income and expenditure who live in the same dwelling are not members of the household.

4.2. Consumption Functions to be Tested

Before going on further we will introduce the theoretical consumption functions which are to be tested in the subsequent section under the name of different hypotheses.

4.2.1. Functions Related to the Absolute Income Hypothesis

In order to test the Keynesian hypothesis (AIH) on the basis of a cross-sectional sample of individual households, divided in a finite number of income groups, one needs to assume that : (a) consumption is determined by household income, (b) when the income of household increases (so that it shifts from a lower to a higher income class), this household will adopt the MPC of the new class, and (c) the macroeconomic income does not change at the occasion of a redistribution of income among income groups.

Assumption (c) is necessary to preclude the effects of a growing or declining aggregate income on the value of the MPCs. Thus, according to Keynes, a general increase of national disposable income in the understanding of unchanged relative income distribution will lead to smaller MPCs for all households.

To test the AIH the parameters of the following specification will be estimated, that is,

$$C_j = a + b\, Y_j + e_j \qquad (4.1)$$

C_j = consumption of household in class j
Y_j = disposable income of households in class j
e_j = error term with zero mean unknown variance

Considering the sample of household as a whole and make the MPC itself dependent on disposable income :

$$b = c - d\, Y_j + e_j$$

Substitution of the above function into (4.1) for all classes taken together leads to

$$C_j = a + c\, Y_j - d\, Y^2_j + e_j \qquad (4.2)$$

This is the second function to be tested for the AIH. A third specification for the AIH is

$$C_j = a + b\, \ln Y_j + e_j \qquad (4.3)$$

These three functions will be estimated to test the AIH in the following section.

4.2.2. Functions Related to the Relative Income Hypothesis

According to Duesenberry, although all past incomes, from peak to the current year, influence current consumption the past peak income makes the most significant contribution. In the case of our cross-sectional data we are unable to know past peak income, but a good proxy for the past peak income is a common use in the econometrics of the consumption function, that is, average income overall the income groups. Thus, the consumption function proposed by Duesenberry may be stated as

$$C_j/Y_j = a + b\ (Y_j/YA) + e_j \qquad (4.4)$$

YA = average income overall the income groups.

A variant of (4.4) was proposed by Davis, who replaced the past peak income by the past peak consumption on the ground that the standard of living and the consumer habits are not so much reflected in earned income as in actual consumption. Thus, the consumption function proposed by Davis may be written as

$$C_j/Y_j = a + b\ (Y_j/CA) + e_j \qquad (4.5)$$

CA = average consumption overall the income groups.

If (C_j/Y_j) in (4.4) and (4.5) is determined by the Nerlovian "partial adjustment" model, that is,

$$[(C_j/Y_j)-(C_j/Y_j)_{-1}] = \phi\ [(C_j/Y_j)^* - (C_j/Y_j)_{-1}]$$

where $(C_j/Y_j)^*$ denotes the optimal value in the partial adjustment model and ϕ denotes the coefficient of adjustment. Therefore, (4.4) and (4.5) can be written as

$$C_j/Y_j = a + b\ (Y_j/Y_A) + c\ (C_j/Y_j)_{-1} + e_j \qquad (4.6)$$

$$C_j/Y_j = a + b\ (Y_j/C_A) + c\ (C_j/Y_j)_{-1} + e_j \qquad (4.7)$$

Another variant of the RIH is habit persistence model. This variant can be written as

$$C_j = a + b\ Y_j + c\ (C_j)_{-1} + e_j \qquad (4.8)$$

In addition to the above functions we have estimated the following specifications to test the RIH. These are

$$C_j = a + b\ Y_j + c\ (C_j)_{-1} + e_j \qquad (4.9)$$

$$C_j/Y_j = a + b\ (C_j/C_A) + e_j \qquad (4.10)$$

$$C_j/Y_j = a + b\ (\Delta Y_j/Y_j) + c\ (C_j/Y_j\ )_{-1} + e_j \qquad (4.11)$$

4.2.3. Functions Related to the Permanent Income Hypothesis

The basic contention in the permanent income hypothesis is that consumption is proportional to what the consumer considers is permanent income not just to whatever happens to be his measured income during the observation period. Thus

$$CP_j = k\ YP_j + e_j \qquad (4.12)$$

CP_j = permanent consumption of household in class j
YP_j = permanent income of household in class j

To test the permanent income hypothesis with the estimation of (4.12) the appropriate data for permanent consumption and permanent income are needed. We have calculated these data by eliminating transitory elements from the measured consumption and income. These transitory components were obtained by including additional questions which helps to drive transitory consumption and income in the household consumption and income survey questionnaire.

The second equation estimated to test the permanent income hypothesis is the general distributed lag model which is rather complex in the interpretation of the parameters and the error term, that is,

$$C_j = b\ (C_j)_{-1} + k\ (1-b)\ Y_j + \epsilon_j \qquad (4.13)$$

where

$$\epsilon_j = e_j - \beta\ (e_j)_{-1}$$

In this model k=(k(1-b)/(1-b), and k is interpreted as the long-run MPC while k(1-b) is interpreted as the short-run MPC. In addition, a different variant of this model will be estimated in the subsequent sections.

4.2.4. Functions Related to the Life-Cycle Hypothesis

In the life-cycle hypothesis the household decides on its consumption on a lifetime basis not just on a single period basis. Thus, if household consumes over the periods 1 to T his lifetime utility is a function of consumption in each of those periods. The resulting consumption function is of the form

$$C_j = a\ (A_j)_{-1} + b\ Y_j + c\ Y_j^{*} + e_j$$

A_j = assets of household in class j
Y_j^* = the present value of expected income over the rest of the households' lifetime of households in class j

Because of the aggregation problems Y_j^* is expressed in terms of Y_j so that the estimated form is

$$C_j = a\,(A_j)_{-1} + b\,Y_j + e_j$$

Because of the data are not available at the lagged value of assets, following Ando and Modigliani [1963] I have modified the above functions as

$$C_j = a\,A_j + b\,Y_j + e_j$$

To test this function, five different variants of it were specified since the wealth data provided by the survey have different types. These five specification are

$$C_j = a\,AS_j + b\,Y_j + e_j \qquad (4.14)$$

$$C_j = a\,L_j + b\,Y_j + e_j \qquad (4.15)$$

$$C_j = a\,AP_j + b\,Y_j + e_j \qquad (4.16)$$

$$C_j = a\,AC_j + b\,Y_j + e_j \qquad (4.17)$$

$$C_j = a\,AP_j + b\,Y_j + c\,L_j + e_j \qquad (4.18)$$

AS_j = total assets of households in class j, stated by the households as they have

L_j = total liquid assets of households in class j, stated by the households as they have

AP_j = money value of the households' property in class j, calculated using market prices

AC_j = calculated value of households' total assets in class j, using information collected from the households

The LCH consumption function further simplified to avoid measuring assets since the assets data may be incorrectly obtained due to households' hiding of their property. If we assume that

$$A_j = (A_j)_{-1} + Y_j - C_j$$

hence

$$C_j - (C_j)_{-1} = a\,[(Y_j)_{-1}] + b\,[Y_j - (Y_j)_{-1}] + \epsilon_j$$

and

$$C_j = b\,Y_j + (a-b)\,(Y_j)_{-1} + (1-a)\,(C_j)_{-1} + \epsilon_j \quad (4.19)$$

when $\epsilon_j = e_j - (e_j)_{-1}$, thus giving yet a second form the lag distributions of L_j and Y_j

In addition to these function we specify equations (4.14) to (4.18) in a different forms, these are

$$C_j/Y_j = b + a\,(AS_j/Y_j) + e_j \quad (4.20)$$

$$C_j/Y_j = b + a\,(L_j/Y_j) + e_j \quad (4.21)$$

$$C_j/Y_j = b + a\,(AP_j/Y_j) + e_j \quad (4.22)$$

$$C_j/Y_j = b + a\,(AC_j/Y_j) + e_j \quad (4.23)$$

$$C_j/Y_j = b + a\,(AP_j/Y_j) + c\,(L_j/Y_j) + e_j \quad (4.24)$$

3.2.5. Miscellaneous Functions

Apart from the above consumption functions related to the four theories mentioned above we have estimated some different specifications. Two of them are known to be Friedman-Mincher specification and can be written as follows:

$$C_j/Y_j = a + b\,(L_j/E_j) + e_j \quad (4.25)$$

$$C_j/Y_j = a + b\,(L_j/E_j) + c\,(C_j/Y_j)_{-1} + e_j \quad (4.26)$$

E_j = number of employed persons in class j

An important variable that affects the consumption is the household size. To see the relation between the household size and the consumption following two specification were tested, these are

$$C_j = a + b\,H_j + e_j \quad (4.27)$$

$$C_j = a + b\,H_j + c\,Y_j + e_j \quad (4.28)$$

Expectations are important factors in the household's decision about consumption. Consumption will largely be influenced by whether the expectations are pessimistic or optimistic. To test how expectations are affect the consumption; an expectation index was calculated on the basis of households' expectations about the future economic conditions. To determine whether expectations are pessimistic or optimistic each household was asked to state its expectations about the general economic conditions in

Turkey, the level of the inflation rate, its own consumption, and its own income in the next year. Each question has five alternative and each alternative has a numerical value such as

1 = very bad
2 = bad
3 = no change
4 = good
5 = very good

or in the case of the consumption or income levels

1 = will decrease much
2 = will decrease
3 = will be same
4 = will increase
5 = will increase much

The numerical value of the each question was summed for each household and is interpreted as the household expectation index. Regression estimations were obtained between the household expectation index and the consumption. The regression equations are specified as follows:

$$C_j = a + b\ EX_j + e_j \qquad (4.29)$$

$$C_j = a + b\ EX_j + c\ Y_j + e_j \qquad (4.30)$$

EX_j = value of the expectation index in class j

4.3. Empirical Results

4.3.1. Some General Remarks on the Estimation Procedure

It is well known that when the data is cross-sectional OLS estimation is biased if the disturbances are heteroscedastic (Pindyck and Rubinfeld, 1981, pp.140-141). To see whether heteroscedasticity does occur or not the scatter-plot of the estimated equations are examined. Another problem of the estimation procedure is that the estimated parameters are biased if the data are highly grouped. This bias exists because of the grouped data is not a linear transformation of the ungrouped data.

When heteroscedasticity occurs Generalized Least Squares (GLS) or Weighted Least Squares (WLS) estimation may be superior to the other methods of estimation. To test heteroscedasticity all equations were estimated with techniques of OLS, GLS, and WLS the results of these three methods are compared, it is seen that there is no difference among the results.

To solve the grouping problem the Seemingly Unrelated Regression (SUR) estimation method is tried at the first stage. But I have seen that SUR is not an efficient method in the case of my data. This conclusion is based on the result that the OLS estimation of a simple consumption function resulted in a very low MPC, and also when SUR was utilized the MPC was still very low. The OLS result with the grouped data is

$$C_j = 0.254E{+}08 + 0.038\ Y_j + \epsilon_j$$
$$(6.11) \qquad (3.82)$$

$$R^2 = 0.45 \quad F^* = 14.56 \quad DW = 0.849$$

and the SUR result is

$$C_j = 0.245E{+}08 + 0.040\ Y_j + \epsilon_j$$
$$(6.24) \qquad (2.97)$$

$$R^2 = 0.45 \quad F = 16.48 \quad DW = 0.946$$

Since OLS regressions implicitly weight each pair of observations equally, the grouping of the APCs around 1.0 with extreme values at each end of the income distribution hints that the regression of consumption on income might be strongly influenced by extreme cases of savings and dissavings. Further, the distribution of households clearly shows some intervals represent far more households than others. Considering the first fact in the above, the data has been divided into 20 groups and the lowest and the highest income groups have been excluded from the data. To solve the second problem, unequal group size, each group was formed as to include 30 households. When this modified data was used to estimate a simple consumption function, the OLS estimation gave the following result:

$$C_j = 0.763E{+}07 + 0.649\ Y_j + \epsilon_j$$
$$(4.29) \qquad (15.06)$$

$$R^2 = 0.93 \quad F = 226.72 \quad DW = 1.72$$

This is a rather reasonable result for the cross-sectional data.

In some cases, autocorrelation problem has been observed. This may be either the equal sizing of groups or the exclusion of the intercept in some models. DW statistics are used to test for "spatial" autocorrelations. Since the models do not contain an intercept term, autocorrelations may occur. Additionally, when the observations have a natural ordering the possible omitted regressors and functional specification suggest that the neighbouring distrubances may be correleted. Here, the observations are for households classified into income groups and hence may be ordered. Since, in most cases, we are concerned mainly with the consuption path and functional forms alterations in the data, ordering may be deterrent (Tansel, 1986, p.251). When autocorrelation has been detected, both Hildreth-Lu and Cohrane-Orcutt iteration methods used. Cohrane-Orcutt method has given more significant result in all cases.

4.3.2. Test of the Absolute Income Hypothesis

The OLS results of the three consumption function proposed for the AIH is as follows;

Equation (4.1) :

$$C_i = 0.763E{+}07 + 0.65\, Y_i + \epsilon_i$$
$$(4.29) \qquad (15.06)$$

$$R^2 = 0.98 \qquad F = 226.72 \qquad DW = 1.72$$

Equation (4.2) :

$$C_i = 0.678E{+}07 + 0.70\, Y_i - 0.47E{-}09\, Y_i^2 + \epsilon_i$$
$$(2.20) \qquad (4.37) \qquad (-0.35)$$

$$R^2 = 0.94 \qquad F = 107.18 \qquad DW = 1.75$$

Equation (4.3) :

$$C_i = -0.374E{+}09 + 0.237E{+}108 \ln Y_i + \epsilon_i$$
$$(-9.70) \qquad (10.43)$$

$$R^2 = 0.87 \qquad F = 108.80 \qquad DW = 1.30$$

In all the three equations related to the AIH, the MPCs rather low from the expected level. In addition to low MPC equation (4.3) has an incorrect sign for the intercept term. The value of the intercept in this equation is $e^{(-a/b)}$ and does not provide the condition that a consumption function has a positive intercept. The MPC, of equation (4.3) is

$$\frac{b}{Y} = 0.75$$

MPC out of this model is rather high relative to (4.1) and

(4.2) but not as much as expected value.

Another point that we must care out of it is that if the condition;

$$Y_i > \frac{-c}{2d}$$

hold for the most of the income groups, this equation is not meaningful since the above condition implies that the MPC is negative. The above condition holds for the most of the groups and therefore, equation (4.2) is not a good fit. Also t-statistic-shown in the parentheses (hereafter all t-statistics will be shown in the parentheses below the coefficients) is not significant even at 70 percent significance level.

4.3.3. Test of the Relative Income Hypothesis

The OLS estimation results of the consumption functions fitted to test RIH listed in the below.

Equation (4.4) :

$$C_i/Y_i = \underset{(10.9)}{1.168} - \underset{(-1.94)}{0.61}\,(Y_i/Y_A) + \epsilon_i$$

$R^2 = 0.19$ F = 3.77 DW = 2.06

Equation (4.5) :

$$C_i/Y_i = \underset{(10.9)}{1.168} - \underset{(-1.94)}{0.15}\,(Y_i/C_A) + \epsilon_i$$

$R^2 = 0.19$ F = 3.77 DW = 2.06

Equation (4.6) :

$$C_i/Y_i = \underset{(10.9)}{1.065} - \underset{(-1.94)}{0.57}\,(Y_i/Y_A) + \underset{(0.64)}{0.12}\,(C_i/Y_i)_{-1} + \epsilon_i$$

$R^2 = 0.21$ F = 2.03 DW = 1.86

Equation (4.7) :

$$C_i/Y_i = \underset{(5.50)}{1.065} - \underset{(-1.75)}{0.14}\,(Y_i/Y_A) + \underset{(0.64)}{0.12}\,(C_i/Y_i)_{-1} + \epsilon_i$$

$R^2 = 0.21$ F = 2.03 DW = 1.86

Equation (4.8) :

$$C_j = 0.770E+07 + 0.65\ Y_j - 0.01\ (C_j)_{-1} + \epsilon_j$$
$$(4.06) \qquad (11.07) \qquad (-0.14)$$

$R^2 = 0.93 \quad F = 106.43 \quad DW = 1.78$

Equation (4.9) :

$$C_j = 0.750E+07 + 0.70\ Y_j - 0.05\ (Y_j)_{-1} + \epsilon_j$$
$$(4.28) \qquad (11.06) \qquad (-1.25)$$

$R^2 = 0.94 \quad F = 118 \quad DW = 1.54$

Equation (4.10) :

$$C_j/Y_j = 1.120 - 0.11\ (C_j/C_A) + \epsilon_j$$
$$(8.04) \qquad (-0.93)$$

$R^2 = 0.05 \quad F = 0.87 \quad DW = 1.93$

Equation (4.11) :

$$C_j/Y_j = 0.896 + 0.02\ (\Delta Y_j/Y_j) + 0.16\ (C_j/Y_j)_{-1} + \epsilon_j$$
$$(4.77) \qquad (0.36) \qquad (0.73)$$

$R^2 = 0.06 \quad F = 0.47 \quad DW = 1.38$

Equations, (4.4), (4.5), (4.6), (4.7), (4.10), and (4.11) are not acceptable as it clear from the values of the coefficient of determination and F-statistics. Furthermore, in most cases t-statistics are not significant even at the 20 percent confidence interval. In addition to these weaknesses, some of the parameters have incorrect signs. Equations (4.8) and (4.9) seems to be acceptable. The long-run MPC out of these equations can be calculated as

$$MPC = \frac{b}{1-c}$$

The long-run MPC for equation (4.8) is 0.64 and for equation (4.9) is 0.67. These values are rather low as compared to the expected value of the long-run MPC. As it readily can be seen, lagged values of consumption and income have negative parameters in these equations. This is a contradictory result and the reason for the low long-run MPC out of these equations are these incorrect signs. Furthermore, the parameters that have incorrect signs are not significant at 80 percent confidence interval for the parameter of lagged consumption, and at 20 percent confidence interval for the lagged income.

4.3.4. Test of the Permanent Income Hypothesis

OLS estimations of the consumption functions implied by the PIH were autocorreleted. When OLS used, the Durbin-Watson statistic for equation (4.12) was 0.84, and it was 0.74 for equation (4.13). Therefore, Cohrane-Orcutt iteration method was utilized to eliminate autocorrelation and following results were obtained.

Equation (4.12) :

$$CP_j = 0.75\ YP_j + \epsilon_j$$
$$(11.96)$$

$R^2 = 0.97$ $F = 556.42$ $DW = 2.52$ $RHO = 0.62$

RHO is autocorrelation coefficient.

Equation (4.13) :

$$CP_j = 0.15\ (C_j)_{-1} + 0.68\ Y_j + \epsilon_j$$
$$(8.40) \qquad (1.65)$$

$R^2 = 0.97$ $F = 305.85$ $DW = 2.21$ $RHO = 0.70$

Both equations are acceptable due to all statistics. The long run MPC in equation (4.12) is 0.75 and remains rather low relative to the expected level. The long run MPC for equation (4.13) can be calculated as follows:

$$MPC = k = \frac{k(1-b)}{1-b}$$

The result of the above calculation is 0.80 and this value quietly approaches to the expected long-run MPC.

4.3.5. Test of the Life - Cycle Hypothesis

When the OLS was utilized to estimate regression equations for the LCH consumption function, all estimations resulted in autocorreleted disturbances. As before, Cohrane-Orcutt iteration method was used for each equation. Estimated regression equations are listed in the below.

Equation (4.14) :

$$C_j = 0.001\ (AS_j) + 0.72\ Y_j + \epsilon_j$$
$$(0.55) \qquad (9.86)$$

$R^2 = 0.97$ $F = 266.88$ $DW = 2.45$ $RHO = 0.62$

Equation (4.15) :

$$C_j = -0.008\,L_j + 0.78\,Y_j + \epsilon_j$$
$$\quad\;\; (-0.52) \qquad\quad (10.18)$$

$R^2 = 0.97$ $F = 264.16$ $DW = 2.39$ $RHO = 0.55$

Equation (4.16) :

$$C_j = 0.002\,AP_j + 0.71\,Y_j + \epsilon_j$$
$$\quad\;\; (1.00) \qquad\quad (9.68)$$

$R^2 = 0.97$ $F = 276.45$ $DW = 2.20$ $RHO = 0.54$

Equation (4.17) :

$$C_j = 0.001\,AC_j + 0.72\,Y_j + \epsilon_j$$
$$\quad\;\; (0.70) \qquad\quad (9.69)$$

$R^2 = 0.97$ $F = 268.60$ $DW = 2.41$ $RHO = 0.60$

Equation (4.18) :

$$C_j = 0.006\,AP_j + 0.72\,Y_j - 0.028\,L_j + \epsilon_j$$
$$\quad\;\; (0.52) \qquad\quad (8.30 \qquad (-2.02)$$

$R^2 = 0.97$ $F = 221.14$ $DW = 1.95$ $RHO = 0.33$

Equation (4.19) :

$$C_j = 0.83\,Y_j + 0.02\,(Y_j)_{-1} + 0.13\,(C_j)_{-1} + \epsilon_j$$
$$\quad\;\; (7.90) \qquad (2.19) \qquad\quad (1.93)$$

$R^2 = 0.98$ $F = 256.36$ $DW = 1.75$ $RHO = 0.72$

Equation (4.20) :

$$C_j/Y_j = 0.959 + 0.003\,(AS_j/Y_j) + \epsilon_j$$
$$\qquad\quad (9.48) \qquad (1.61)$$

$R^2 = 0.16$ $F = 2.92$ $DW = 1.93$ $RHO = 0.20$

Equation (4.21) :

$$C_j/Y_j = 1.011 + 0.015\,(L_j/Y_j) + \epsilon_j$$
$$\qquad\quad (9.59) \qquad (1.10)$$

$R^2 = 0.09$ $F = 1.40$ $DW = 2.11$ $RHO = 0.25$

Equation (4.22) :

$$C_j/Y_j = \underset{(3.49)}{0.650} + \underset{(2.16)}{0.009}\,(AP_j/Y_j) + \epsilon_j$$

$R^2 = 0.25$ $F = 4.95$ $DW = 1.90$ $RHO = 0.68$

Equation (4.23) :

$$C_j/Y_j = \underset{(6.92)}{0.862} + \underset{(1.70)}{0.005}\,(AC_j/Y_j) + \epsilon_j$$

$R^2 = 0.18$ $F = 3.26$ $DW = 1.93$ $RHO = 0.13$

Equation (4.24) :

$$C_j/Y_j = \underset{(7.18)}{0.900} + \underset{(1.95)}{0.007}\,(AP_j/Y_j) - \underset{(-2.80)}{0.081}\,(L_j/Y_j) + \epsilon_j$$

$R^2 = 0.31$ $F = 3.11$ $DW = 1.74$ $RHO = -0.25$

Examination of the coefficients of determination shows that equations (4.20), (4.21), (4.22), (4.23), and (4.24) are not acceptable at all. While R^2s are sufficiently high asset effect on consumption is rather low in equations (4.14) through (4.18). This may be due to inadequacy of the data. Inadequacy of the data might be a result of the hiding of assets by the households. In equations (4.15) and (4.18) the parameters of the liquid assets has a negative sign, a conflicting result to the expected sign. But, this may be interpreted as a correct situation since liquid assets mainly include bank deposits, and to expect consumption to fall-while savings are increasing vis-a-vis bank deposits-is not unreasonable.

Equation (4.19), the distributed lag form of the LCH, is the prophonet among the others. The MPC is 0.98 with the calculation method of the simple summation of the parameters. If we use the method which is similar to the one employed for the equation (4.12) we obtain the value 0.976 for the long-run MPC. 0.976 is the value that we expect for the long-run MPC.

4.3.6. Test of the Miscellaneous Functions

For the Friedman-Mincher specification we have obtained the following OLS estimations.

Equation (4.25) :

$$C_j/Y_j = 1.064 - 0.52E{-}07 + \epsilon_j$$
$$(12.47) \quad (-1.26)$$

$R^2 = 0.09 \quad F = 1.59 \quad DW = 2.07$

Equation (4.26) :

$$C_j/Y_j = 0.961 - 0.44E{-}07 + 0.12\,(C_j/Y_j)_{-1} + \epsilon_j$$
$$(5.04) \quad (-1.01) \quad (0.60)$$

$R^2 = 0.11 \quad F = 0.94 \quad DW = 1.87$

None of the Friedman-Mincher specifications can be acceptable either in terms of F-test or t-test.

Testing of the household size resulted in the following OLS estimations.

Equation (4.27) :

$$C_j = 0.467E{+}08 + 669985\ H_j + \epsilon_j$$
$$(0.90) \quad (1.45)$$

$R^2 = 0.12 \quad F = 2.09 \quad DW = 0.53$

Equation (4.28) :

$$C_j = 0.546E{+}07 + 20227\ H_j + 0.64\ Y_j + \epsilon_j$$
$$(0.36) \quad (0.15) \quad (13.66)$$

$R^2 = 0.93 \quad F = 106.44 \quad DW = 1.71$

Equation (4.27) is not a good fit at all. In equation (4.28), adding of the income variable increases R^2 but still parameter of the household size is not significant at 5 percent confidence interval. However, the effect of the household size is very clear from the high value of the parameters.

Testing of the expectations effect by utilizing OLS gave the following regression equations.

Equations (4.29) :

$$C_j = -200E{+}09 + 508888\ EX_j + \epsilon_j$$
$$(-3.54) \quad (4.04)$$

$R^2 = 0.51 \quad F = 16.29 \quad DW = 1.21$

Equations (4.30) :

$$C_i = 0.624E+08 - 128825\ EX_i + 0.75\ Y_i + \epsilon_i$$
$$\quad (2.03) \qquad (-1.78) \qquad (11.03)$$

$$R^2 = 0.95 \quad F = 130.48 \quad DW = 2.02$$

The equation (4.30) must be considered with confidence. It may not be reasonable to add the income variable if the concern is mainly to see the effect of expectations. While the coefficient of expectations has a negative sign in the equation (4.30), it has a positive sign with a reasonable high value in the equation (4.29). The coefficient of the expectation index is not significant at 10 percent confidence interval in the equation (4.30), but it is significant at 0.001 percent confidence interval in the equation (4.29). While R^2 is 0.51, the significance level of F-statistic is 0.0009 for the equation (4.29). Therefore, it seems reasonable to conclude that the optimistic expectations increase the consumption for the current time while pessimistic expectations increases the consumption for the future.

4.4. Conclusion

The consumption function is a mathematical formula expressing the relationship between consumption and the factors affecting it. Explanatory variables can be classified as economic variables, socioeconomic variables, demographic variables, and behavioral variables.

Among the economic variables, the income variable has been studied most extensively. There are four hypotheses about the relationship between consumption and income; the Absolute Income Hypothesis, the Relative Income Hypothesis, the Permanent Income Hypothesis, and the Life-Cyle Hypothesis.

The consumption function can be estimated by using either time-series or cross-section data. In Turkey, reliable time series data on consumption and on some related variables are not available. In this study, an attempt was made to test the hypotheses mentioned above by using the cross-section data. Experiments were conducted using thirty consumption function specification. The functions that fulfill four requirements were identified as successful. These requirements are used as the evaluation criteria.

1. Coefficient of determination is greater than 90 %

2. Variances of the coefficients are small.

3. The algebraic signs of the coefficients meet the expectations implied by the related theories.

4. The marginal propensity to consume is greater than 0.80.

It was seen that the successful functions were obtained by these two models:

$$\underline{C = \beta C_{-1} + k(1-\beta)Y}$$

$$\underline{C = \beta Y + (\alpha-\beta) Y_{-1} + (1-\alpha) C_{-1}}$$

The first one of these models is the distributed lag form of the Permanent Income Hypothesis. The second one is the distributed lag form of the Life-Cycle Hypothesis. Comparison of the marginal propensity to consume out of these models show that the distributed lag form of the Life-Cycle Hypothesis predicts the long-run marginal propensity to consume correctly. However, the long-run marginal propensity to consume out of the distributed lag form of the Permanent Income Hypothesis does approach to the expected level.

My final conclusion is that taking into account the vast quantity of empirical research, concerning the consumption function implied by the Permanent Income or Life-Cycle Hypotheses, that accumulated since late 1950, the majority of economists would probably come down in favor of one of these two hypotheses. However, these two competing hypotheses are to varying extents intuitively appealing and as we have seen it is no easy task to discriminate between them on empirical grounds.

As Friedman [1957, p.231] argued that "The consumption analyst, as it were, has been priding himself on his success in adding yet more epicycles. The possibility of dispensing with the [existing theory] does not, of course, mean that [existing] empirical findings are in error, that the variables [found] related to consumer behavior are not related to it, any more than acceptance of the Copernican view rendered nonexistent the astronomical movements that it was necessary to introduce additional epicycles to explain. What it does mean is that these empirical relations can all be inferred from a much simpler structure, that they can all be regarded as manifestations in different guise of a single and simpler set of forces rather than as the result of largely irreducible ultimate forces."

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