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THE HOUSEHOLD WEALTH ACCUMULATION: SOME NEW EVIDENCE

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I. INTRODUCTION

An understanding of consumption-saving behavior of households is critical in understanding both the long run path and short term fluctuations of the economy. In recent years, a great amount of research—both empirical and theoretical—has been done in this area as many countries began to face a number of policy questions the answers to which depend on a detailed understanding of household savings behaviour. These questions include the response of saving to changes in the population structure, the tax structure, Social Security and other income transfer programs, and changes in other institutional structures.

In the aggregate level using macroeconomic time series data, the analysis of consumption and saving has been done quite fruitfully. However, it is known that, when micro parameters vary in a systematic way across the population, estimates of parameters from aggregate data bear only a distant and complicated relationship to the underlying structural parameters. Moreover, there is absolutely no way of knowing from the aggregate data just how closely the relevant conditions for aggregations are met and therefore in what direction biases may run. For example, the effect on consumption of an increase in income will be of one kind if the extra income goes mainly to entrepreneurs, and of another kind of it goes mainly to old age pensioneers: or again the effect of an increase in wages may be different from that of an increase in dividends. So it becomes necessary to go beyond the macro phenomena to examine the micro organisms; the households who make up the society. In other words, the study of microdata is particularly important because it is the process of household wealth accumulation that is presumed to explain the aggregate savings behaviour of the economy.

However, no consensus has been reached among the previous studies of microdata. Some early research suffered from the lack of sufficient data at the household tightly parameterized models often applied to fairly specifized data.

The main theme of this paper is a better understanding of the household savings behaviour over the life cycle through age-wealth profiles. We are going to use the Life Cycle model as the basis of this analysis.

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The Life Cycle model was first introduced by Modigliani and Brumberg in 1954 as an economic theory explaining aggregate consumption-savings behaviour. In a very stylized form, it suppose that, first of all, young agents have some body of human capital which they trade for current consumption and other capital which is itself traded for consumption in old age when human capital is exhausted. And second, the consumption and/or saving pattern is smooth and stable. The emphasis of this model on the influence of various demographic characteristics, especially age, makes it a logical beginning for disentangling the structure of age-wealth relationship.

Unlike many previous research, we will concentrate our efforts on the degree of wealth accumulation of households until retirement rather than on the hump shape of the age-wealth relationship. By incorporating the number of adult equivalents in the household into the family utility function, we will explore the degree and/or path of household wealth accumlation before the retirement age. Then using various model specifications in various predetermind sub groups we will explore the empirical implication of our model with 1983 Survey of Consumer Finances data. The main hypothesis of this study is that middle aged households which financially support their children for higher education (more precisely households are investing to their children's human capital — this is another type of intergenerational transfer) may experience a sudden increase in the consumption profile. Therefore they might face a slowdown of their wealth accumulation, since they cannot smooth their consumption profile in an expectation of this educational expense because of imperfect capital markets.

The data which will be used is 1983 Survey of Consumer Finances, a cross-section household survey. It contains various demographic, income, and balance sheet information for 3824 households.

Analysis begins with the presentation and discussion of the model to be estimated. Then, we will describe a stylized picture of cross section behaviour of household using various tabulations and proceed to exhibit the results of estimations of variations on our basic regression model.

II. THE BASIC MODEL SPECIFICATION

1. A General Model

A. Theoretical Mode

We assume that the most important motive for saving and wealth accumulation is to provide sufficient resources for consumption in retirement years. If an individual receives no labor earnings after his retirement, he should not consume all his labor earnings during his working periods. This simple principle makes each consumer allocate his total life time resources optimally. Based upon this fact, the Life Cycle model begins with the consumer's optimal life cycle choices in terms of the intertemporal allocation problem

$$(1)\ \max_{X^i} U^i(X^i, A^i)$$
$$\text{s.t. } (X^i, A^i) \in \Omega^i$$

where $X^i = \{X^i_{j\tau}\}^{t=0,\ \dots,\ T}_{j=1,\ \dots,\ C}$ is the vector of consumption bundles of in dividual i and A^i is the terminal wealth or the planned bequest of individual i. And Ω^i is a constraining set containing budget constraints of individual i. We suppose that the utility function is concave in (X^i, A^i). The implication of this formulation is that the individual receives utility only from present and prospective consumption and from assets bequeathed. Also that the price level of consumption bundles is not expected to change appreciably over the balance of the life span is the implicit assumption.

In reality, we feel that a rational consumer would continuously make new decision rules according to the changing environments. However, if for some time interval we could claim that persistence of decisions is insignificant, then we might think of preferences as a series of at least weakly summable subtutilities over time. This leads us to assume that the utility function is intertemporally separable in the form:

$$(2)\ \sum_{t=0}^{T} \theta^i(t)\ U^i(X^i_t) + b^i\theta^i(T)\ U^i(A^i)$$

where $\theta^i(t)$ is the subjective discounting factor with the discount rate.
(i.e. $\theta^i\,(t) = (1+\rho^i)^{-t}$).

This separability assumption is a strong one which implies that the utility derived from the current consumption is absolutely independent of all past and expected future consumption. In other words, the life time allocation of consumption is independent of the timing of income realization. However, this is not an implausible assumption which has troubled many economists in the consumer's intertemporal behaviour analysis.

It is a natural extension that we assume that each consumer's preference in the society can be represented by a representative individual's preference. Further, we can suppose without loss of generality that the consumption bundle is represented by a single aggregate commodity, C. Then the consumer faces the following maximization problem:

$$(3)\ \max \sum_{t=0}^{T} (1+\rho)^{1-t}U(C_t)\ +\ bU(A_T)$$

where C_t is a consumption path.[1] If we do not consider any kind of uncertainty and assume that we have a perfect capital market, the only constraint in the above life time utility maximization problem is the life time budget constraint:

$$(4)\quad \sum_{t=0}^{T} C_t \prod_{i=0}^{t} (1+r_i)^{-1} + A_T \prod_{i=0}^{T} (1+r_i)^{-1} = A_0 + \sum_{t=0}^{T} E_t \prod_{i=0}^{t} (1+r_i)^{-1}$$

where r_i is interest rate at time i and E_t is current earnings at time t which will be defined in detail later.

For operational simplicity, the utility function is assumed to be isoelastic.[2] Specifically,

$$(5)\quad U(C_t) = \begin{cases} \dfrac{1}{1-\Gamma} C_t^{1-\Gamma} & \Gamma \neq 1 \\ \ln C_t & \Gamma = 1 \end{cases}$$

$$U(A_T) = \begin{cases} \dfrac{1}{1-\Gamma} A_T^{1-\Gamma} & \Gamma \neq 1 \\ \ln A_T & \Gamma = 1 \end{cases}$$

In this type of utility function, labor supply decisions are separable or exogenous. We include all kinds of incomes in defining E_t. In other word, E_t is the sum of wage income, interest income, dividend income, and incomes from private pension and Social Security. Further, we assume that initial wealth, A_0, is zero. Then, maximizing (5) subject to the budget constraint (4) under the specific conditions we mentioned above leads the following first order condition:

$$(6)\quad \frac{U'(Ct)}{U'(C_{t+1})} = \frac{1 + r_{t+1}}{1+\rho}$$

This marginal condition tells us that the individual expands his consumption to the point at which the ratio of one plus the rate of interest equals one puls the time preference rate. Using our specific CARA (Constant Relative Risk Aversion) class utility function, it becomes:

[1] Throughout the paper, t can be interpreted in two ways. On the one hand, t is the age of head and is assumed to run from O to T. On the other hand, t can be thought simply as time index.

[2] We note that under the assumed certainty, any monotonic increasing transformation of the utility function (5) will represent the same preference.

(7) $$\frac{C_{t+1}}{C_t} = \left(\frac{1+r_{t+1}}{1+\rho}\right)^{1/r}$$

Consequently, as expected, the consumption profile would rise, remain unchanged, or decline accordingly as $((1+r_{t+1}/(1+\ ))$ is greater than, equal to, or less than unity, respectively.[3] By plugging equation (7) into the lifetime budget constraint, we can get the final explicit solution for C_t's and A_T:

$$C_t = a\hat{E}_0 \left(\frac{\prod_{i=0}^{t} (1+r_i)}{(1+\rho)^t}\right)^{1/r}$$

(8) $$A_T = a\hat{E}_0 \{b \prod_{i=0}^{T} (1+r_i)\}^{1/r}$$

$$a = \{b^{1/r} (\prod_{i=0}^{T} (1+r_i)^{1/r-1} + \sum_{t=0}^{T} (1+\rho)^{-t/r} \prod_{i=0}^{t} (1+r_i)^{1/r-1}\}$$

Here a is a teste parameter and E_0 is the present discounted value of life time earnings at the beginning of his life time. In the following section we will develop this basic model further to incorporate the case of a household consisting of N_t adult equivalents

B. The Extended Model

Following Blinder et al (1981), we adapt this model to the case of a family consisting of N_t adult equivalents when the age of head is t. We assume that the family consumption utility function is:

(9) $N_tU\ (C_t/N_t)$

, and $U(A_T)$ is same as before. In other words, family utility is the utility of the family's consumption per adult equivalent multiplied by the number of adult equivalents. Then, the corresponding consumption path and the final wealth are given by:

$$C_t = \alpha_1\hat{E}_0 \left(\frac{\prod_{i=0}^{t} (1+r_i)}{(1+\rho)^t}\right)^{1/r} * (N_t)^{1/r}$$

[3]This is true for any class of utility functions with U'>O and U"<O.

$$(10)\ A_T = \alpha_1 \hat{E}_0 \{b \prod_{i=0}^{T} (1+r_i)\}^{1/\Gamma}$$

, where

$$(11)\ \alpha_1 = \{b^{1/\Gamma} \prod_{i=0}^{T} (1+r_i)^{1/\Gamma-1} + \sum_{t=0}^{T} (N_t)^{1/\Gamma} (1+\rho)^{-t/\Gamma} \prod_{i=0}^{t} (1+r_i)^{1/\Gamma-1}\}^{-1}$$

We expect that the number of adult equivalents, N_t, jumps considerably when households begin to support their children's higher education. Thus, when their children go for a higher education, households experience a big increase in their consumption profile.

Since our data set is a single cross section data and we do not have good data on consumption by age, we should figure out the implications of the model for the path of current holdings of assets A_t, which is our main concern.[4] Let $\hat{E}_t$ be the present discounted value of earnings from age t forward:

$$(12)\ \hat{E}_t = \sum_{t=0}^{T} E_s \prod_{i=t}^{s} (1+r_i)^{-1}$$

, where T, the length of life, is assumed to be perfectly known. The budget constraint from time t forward implies that the sum of A_t and E_t should be equal to the present discounted value of future consumption plus the planned bequest.

$$(13)\ A_t + \hat{E}_t = \sum_{s=t}^{T} C_s \prod_{i=t}^{s} (1+r_i)^{-1} + A_T \prod_{i=t}^{T} (1+r_i)^{-1}$$

For simplicity, we assume the interest rates are constant over time.[5] Then using (8), the above equation can be rewritten:

$$(14)\ A_t + \hat{E}_t = \alpha_1 (1+r)^t \{\sum_{s=t}^{T} (1+\mu)^s (N_s)^{1/\Gamma} + \delta\} \hat{E}_0$$

, where

[4]Since the Life Cycle model is also a theory of household wealth accumulation, any failure of the Life Cycle model to account for the household distribution of wealth would cast doubts on the model's validity as an explanation of household savings behaviour.

[5]In a world of certainty, the time dependent rate of interest only makes the problem complicate to handle without changing any implication of the model.

$$\mu = \left(\frac{1+r}{1+} \right)^{1/\Gamma}$$

and

$$(15)\ \delta = b^{1/\Gamma}\ (1+r)^{T/\Gamma - T}.$$

Equation (14) tells us that the ratio of current fungible wealths plus discounted value of future earnings to the total life time earnings—this can be regarded as one variation of the permanent income concept—is nothing but a linear function of adult equivalent years of consumption still remaining when the age of head is t.

Three main features of this specification can be discussed. First, the terms in the bracket {•} of equation (14) behave like a fixed effect containing as it does all the unit-specific expectations of future adult equivalent years of consumption and interest rates. Second, estimated value of δ for different groups would imply that the average household of each group leaves a bequest equivalent to those years of consumption. The third, the most important, is that in equation (14) the dependence of asset holdings on age follows the highly nonlinear functional form derived from the strict form of the Life Cycle theory. So, the path of household wealth accumulation cannot be approximated simply by a linear regression of household wealth on age and age squared terms. Moreover, N_t, the number of adult equivalents at time t (or when the age of head is t), has a strong influence upon the path of household wealth accumulation. We expect that N_t rises sharply whenever children go for a higher education, say college. This results in an increase in comsumption and brings a negative impact on household wealth accumulation (in a nonlinear way of course), i.e., it slows down the speed of household wealth accumulation. Later, we will make use of this property intensively.

2. A Model Specification

Above we have presented the formal model of Life Cycle wealth accumulation. As we know, a very strict version of that model is able to be hardly applied to the data, since the model is highly nonlinear. For this reason we find it at least heuristically convenient to begin modelling again at a somewhat less formal model.

The central idea of Life Cycle theory is that individuals are forward looking in the sense that decisions within a period are not affected by past decisions except insofar as they are embodied in the current state variables. In other words, consumers enter each period with a perception of the current state of the world. Of particular relevance to current decisions are the state variables which measure ordinary financial and real wealth, stocks of durables, and the expectation of future income streams from labor, pensions, Social Security and other transfer programs, inheritance, extraordinary capital gains and potential losses from uninsured stocks.

Within the period, these components of wealth are shocked by unanticipated events (unemployment, unexpected taxes, unanticipated inflation, and etc.). Consumption decisions are made within the period constrained by the revised resource constraints and any shocks to the lower bound of consumption. Usually, we can assume that consumption rises sharply when children go for higher educations or a marriage. This consumption shock slows down the accumulation of wealth in the highest earning years in one's life time. Actually, we found out that a slow down of household wealth accumulation around the family head's age 50 was apparent (especialy, in the subsamples of families who support their children over age 15).

In terms of the usual analysis of consumer decisions, the notion of the proper budget constraint is fairly complicated. First, the relevant quantities are as perceived by the decision unit. Secondly, even if such perceptions are well defined, imperfect access to capital markets may imply that future constraints cannot be collapsed into a single summary constraint in the present period. In the general case then, a proper substitute would be required for the whole sequence of budget constraints over life time.

We introduce the concept of the permanent income as a substitute for one's life time earnings. This permanent income is constructed not to vary much with age unlike measured income.

The model we have in mind is of the following sort:

(16) $NW = f\ (AGE, CHLD, EXRT, X) \times PI$

Equation (16) indicates that the ratio of family net worth, NW,[6] to the permanent income, PI, is a function of the family head's age, AGE, and the vector of demographic characteristics which includes the presence of children over age 15 supported by the family not only living together but also not living with them[7], CHLD, the age of expected retirement of the family head and/or spouse, EXRT, and other socio-economic variables such as race, marital status, educations and occupations of the family head and/or spouse. Later we will also include the presence or absence of private pensions in the form of a dummy variable into this specification. We think of some unmeasured variables as being determined along with the wealth profile in a larger system of equations and so have estimated a reduced form for wealth. These predetermined variables influence wealth in a highly nonlinear way through the number of adult equivalents and some parameters. Intuitively, this is because variables that shift the consumption profile up or down

[6]Net worth here can be defined in various ways. In the broadest sense, it includes future rights to private pensions and Social Security as well as all kinds of fungible wealths. In the narrowest sense, it just means the financial net worth.

[7]We include only the number of children who are still legally the member of the family.

for a short period would change the slope of the agewealth profile.

Given the above conditions, it is possible to estimate the nonlinear function by the following modified cubic spline function:

$$(17)\quad \frac{NW}{PI} = \alpha + \sum_{i=1}^{n}\beta_i X_i + \sum_{k=1}^{3}\tau_k \; AGE^k + \sum_{i=1}^{n}\sum_{k=1}^{3}\delta_{ik}X_i \; AGE^k$$
$$+ \theta_0\,(AGE - K_0)^2 \times DM + \theta_1\,(AGE - K_0)^3 \times DM$$
$$+ \theta_2\,(AGE - K_1)^2 \times DM + \beta_3\,(AGE\ 1\ K_1)^3 \times DM + \varepsilon$$

, where K_0 and K_1 are "knots" in the spline. DM is the dummy variable whose value is one if the family have even one child over age 15 who is financially supported by them. Burbidge and Robb (1984) employed similar specification in their wealth-age profile analysis of the Canadian family. The major differences are the inclusion of the permanent income and a dummy to the cubic spline function. This specification permits very considerable flexibility in the age-wealth profile, particularly near the age of "knots". Now, it will be instructive to proceed to the complete specification of our model through an examination of our data.

III. THE DATA

The data we are going to use is the 1983 Survey of Consumer Finance. The 1983 Survey of Consumer Finances is the latest publicly available data which was jointly sponsored by the Board of Governors of the Federal Reserve System, the United States Department of Health and Human Services, the Federal Deposit Insurance Corporation, the Comptroller of the Currency, the Federal Trade Commission, the United States Department of Labor, and the United States Department of the Treasury, Office of Tax Analysis. Interviewing for the 1983 survey was carried out by the Survey Research Center of the University of Michigan from February through July, 1983.

The unit of observations for the survey is the family, which is defined to include all persons residing together in the same dwelling unit who are related by blood, marriage, of adoption. Families include one person units as well as units of two or more persons. A total of 3,824 families was interviewed voluntarily. But, due to serious missing value problems, only 3,665 families (95.8% of the original sample) in which the majority of dollar figures were present are used in this analysis[8].

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[8]A series of statistical procedures was employed to impute missing values in instances in which respondents failed to provide complete responses on dollar values of either assets or liabilities. Much

Very extensive informations were gathered on assets and liabilities for each household. We are going to include the following items in our balance sheet:

ASSET

Checking Account
Savings Account
Money Market Account
IRA and Keogh Account
Certificates of Deposits
Savings Bonds
Bonds
Stocks and Mutual Funds
Trust Account
House
Other Properties
Vehicles
Private Business
Present Discounted Value of Private Pension
and Social Security

LIABILITIES

All Kinds of Mortgages
Land Contract and Notes
Credit Card Debts
Other Consumer Debts

The value of future rights to private pension and Social Security should be included in our broad definition of wealth. However, these rights are not generally fungible. Instead they represent a claim to a future income stream. In practice we attempt to measure the effects of these claims through constructed proxies which we describe later. Vastly more complicated is the general problem of insurance and the subsidiary issue of state contingent social transfer programs. Such transfers are as legitimately interpreted as a form of wealth as is Social Security, representing simply a claim on as income stream in particular states of nature. Unfortunately, the severely limited information available to us makes even construction of a crude proxy dubious. One more to note here is that, even though we have the values of jewels, paintings, antiques, and precious metals, we exclude those items from asset side. This is done because, first, people tend to report the value of these things at the purchsing price not at the market value. Secondly, even though they

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of this tedious works has been done by Dr. Gregory E. Ellinhausen of the Federal Reserve Board's Division of Research and Statistics. We are very much thankful to Dr. Gregory E. Ellihausen for his generous provision of the 3,665 cleaned sample tape of the 1983 Survey of Consumer Finances.

report the market value, their valuation are very doubtful in most cases, since only experts can make a precise valuation of these kinds of consumption goods in most cases. In addition, quite a small portion (2.3%) of 3,665 sample households reported that they possess these kinds of estates and they are rich families for which these assets are small parts of their total wealth. Thus dropping out these estates does not affect the robustness of our analysis.

In terms of total family income, we include the followings:

1. Wages and salaries (including payments in kind)
2. Business, rental, interests and other capital income including unrealized capital gains
3. Contributions, inheritance, cash gifts and lump sum settlements.
4. Veteran's benefits, unemployment insurances, workmen's compensations
5. Social Security and private pension benefits

We do not include the proceeds from the sale of estates, stocks, cars, and any properties, because we can not identify how much of these proceeds are the real capital gains which may be thought of as the part of household income.

IV. CONSTRUCTION OF VARIABLES

In this section we deal with the empirical construction of variables for use in equation (17). First, we characterize the arry of wealth variables we will employ and then examine the construction of permanent income.

1. Construction of Wealth Variables

Our narrowest definition of net worth is the financial net worth which is most highly liquid. Next we include less liquid assets such as equities in home and other properties, vehicles and boats. These are all "fungible" wealth which were the major concern of Life Cycle theory of asset accumulations before Martin Feldstein (1974) proposed the Social Security wealth issue in his pioneering article. The construction of this "fungible" asset is very stylized and straitforward. We will look at these "fungible" asset more closely in the next section.

For the majority of American families today, future benefits of private pensions and Social Security become a very important form of household wealth, especially as their ages approach the age of retirement. Pension benefits are calculated based upon informations on the receipt of pension, employee contributions to those plans, starting year of benefits, employer contributions and the degree to which benefits are fixed in nominal terms or indexed to a certain measure of inflation. However the calculation of current net present value of Social Security benefits is not well defined if we admit the possibility of both borrowing constrains and uncertainty, both of which may vary across the population. The method we choose to calculate the Social Security wealth is, in some sense, an extension of the established tradition of Feldstein and Pellechio (1977). Through a procedure outlined below and discussed in detail in Appendix 4A. 2, we estimate the stream of future labor earnings for the head and spouse of each household in our sample. To that stream we apply the Social Security Administration regulations to calculate the level of future taxes and benefits. Explicit allowance is made for the fact that benefits to survivors are conditioned on the number of years o worker survives. For partially or fully retired persons, the calculation of the benefit stream is based upon the level of current benefits received ajusted for any labor earnings received. Benefits are then summed within periods over all the partitions of the benefit space using standard survival probabilities as weights, and then discounted across periods to the present and finally summed.

The most difficult decision is what to do about the human capital component of wealth. After exploring a number of such measure, we decided to estimate a permanent income and use the permanent income as a proxy for the human capital component of wealth. The construction of permanent income will be discussed in detail in next section:

2. Constructon of Permanent Income

What we observe in the type of cross section data is simply instantaneous characteristics of a population which may differ from the ususl characteristics in some ways. This issue of measurement error is nothing but the generalization of the notion of permanent income, which is a very widely accepted concept by many economists studying consumption-saving behaviour in the context of the Life-Cycle theory.

Our concern here is that with an appropriate measure of human capital, we want to disentangle the earnings behaviour of the observed cohorts in a way we can interpret as having longitudinal implications. A simple plot of average family income over age of family head for various groups usually presents a "hump" shape with a substantial drop at the age of retirement. In a steady state with no growth in the economy, that profile would represent the expected labor income stream for that particular cell. In a growing economy, this "hump" shape of age-income profile in a cross section data in any particular year does not necessarily imply a similar relationship for an individual's income stream over one's life time.

Thus, we need an estimate of permanent income for each individual in the sample in order to estimate the model of household asset holdings over the life cycle free from any biases caused by using current income.

To construct a permanent income, we assume that an individual's permanent income is a function of some observable variables, some unobservable variables and a cohort effect.

$$(18)\ \ln PI_{it} = \sum_k \beta_k X_{it}^k + K_i + C\ (AGE_{it})$$

, where PI_{it} is a permanent income of individual i in year t. X_{it}^k's are various observable characteristics for individual i including region, place of residence, occupation, employment status, race, and education of family head and spouse β_k's are the associated parameters. K_i measures individual fixed effects such as skill or good fortune which is unobservable. K_i is constructed such that its mean over the population is zero and has variance σ_K^2. The final term, $C\ (AGE_{it})$, represents a cohort effect which implies that, other things being equal, younger generations are better off than their precedenters because of technical progress and capital accumulations.

But, one's permanent income is unobservable. What we observe in the cross section data is current earnings which is different from permanent income mainly for two reasons. One is the existence of age-earnings profile over the life cycle and the other is due to random shocks to income, which is usually called a "transitory" component of income.

$$(19)\ \ln E_{it} = \ln PI_{it} + f(AGE_{it}) + \varepsilon_{it}$$

, where E_{it} is the earnings of individual i at year t, and the function f measures the age-earnings profile which is assumed to be constant across the population. The transitory component of income, denoted by ε_{it}, is assumed to be a white noise (i.e. i.i.d.) whose variance is σ_ε^2.

By combining the above two equations, we have the following estimable earnings equation:

$$(20)\ \ln E_{it} = \sum_k \beta_k X_{it}^k + g(AGE_{it}) + K_i + \varepsilon_{it}$$

, where

$$g(AGE_{it}) = f\ (AGE_{it}) + C\ (AGE_{it})$$

The error term in equation (17), $K_i + \varepsilon_{it}$, has zero mean and variance $\sigma_K^2 + \sigma_\varepsilon^2$. Clearly, estimation of earnings equation (20) gives us consistent estimates of β_k's and the function g. The function g is approximated by the age polynomial equation.[9] But the age earnings profile and the cohort effect cannot be separated through estimation of the function g. We must use outside data to impose the cohort effect. We assume that this cohort effect may be different for various identifiable population and industry subgroups (e.g. by race, education, etc.). Hence, the part

[9]We used a cubic function of AGE. The AGE coefficients are significant and imply that earnings (unadjusted for the cohort effect) reach a maximum at age 45.29 for men and 40.38 for wemen.

of cohort effect can be said to be already captured in the first term of earnings equation (20). What we want to estimate here as a cohort effect is the effect of pure changes in productivity, market conditions of the economy, etc., which are not explicitly entered as exogenous variables in our model. This implies that part of the growth of real earnings is accounted for by individual characteristics such as education and race. The rest of the growth is accounted for by overall productivity and market condition changes. We used the average weekly earnings of U.S. non-agricultural employees as the basis for the calculation of the growth rate of real earnings.[10] As an approximation, only one half is assumed to be accounted for by a pure cohort effect.

Then, C (AGE_{it}) function is estimated by:[11]

(21)

$$C^i(AGE_{it}) = \begin{cases} \sum_{k=1}^{z^i} RE_{1961-k} & \text{for } AGE_{it} > 47 \\ -\sum_{k=1}^{z^i} RE_{1961+k} & \text{for } AGE_{it} \leqslant 47 \end{cases}$$

, where

$$z^i = \begin{cases} AGE_{it} - 47 & \text{for } AGE_{it} > 47 \\ 47 - AGE_{it} & \text{for } AGE_{it} \leqslant 47 \end{cases}$$

RE is an annual real growth rate of average weekly earnings of non-agricultural workers attributable to the cohort effect. With the estimates of β_k's and the C function, we can construct an estimate of permanent income of each individual in the sample, provided that we have a value for the unobservable individual specific effect, K_i. The information available to us is the estimate of the combined term, $K_i + \varepsilon_{it}$ given by regression residuals from the estimation of earnings equation (20). It is a well-known proposition that the minimum variance estimator of K_i given $K_i + \varepsilon_{it}$ is:

[10] There was a comment that a separate growth rate should be used for each separate industrial category of occupation. At first we divided the whole sample into 3 industrial categories—agricultural, manufacturing and service sectors. However, since this division did little change our results, we decided to keep on using a single growth rate for all households—the average weekly earnings of U.S. non-agricultural employees—as the basis for the calculation of the growth rate of real earnings.

[11] A standard age, 47, is defined as the age at which the income is equal to the average income of all household heads.

$$(22)\ K_i = \frac{\delta_k^2}{\delta_k^2 + \delta_\varepsilon^2}(K_i + \varepsilon_{it}) \qquad (22)$$

In other words, K_i is the variance-weighted residuals from earnings equation. Lillard and Willis (1978), Lillard and Weiss (1979), and Lillard (1977), using different sources of data, found that the individual specific component seemed to be about one half of the residuals from earnings equation. We think, for present purpose, that it is sufficient to note that in several of our predictions of individual's permanent income we used an estimate of K_i as one half of the residuals from the estimation of equation (20). Hence our estimate of permanent income is:

$$(23)\ \ln PI_{it} = \sum_k \beta_k X^k_{t\,t} + C\ (AGE_{it}) + K_i$$

It is worth noting that the error in the estimate of permanent income is uncorrelated with the information used to construct the estimate, and hence with the estimate itself.[12] This means that since lnPI appears linearly in the equation for asset hodings we still can obtain consistent estimates of the parameters of the wealth equation (17) even though we are using an estimate of permanent income.

Up to now, we implicitly assumed that all individuals were in "full-time" employment. We didn't consider either temporary layoffs, or part-time work by. Hence the earnings equation (20) was estimated for all household heads who were in "full-time" employment. For those who temporarilly unemployed or part-time employed, we estimated the permanent income based upon previous employment information. For the spouse the same earnings equation was estimated. But we made an explicit adjustment for non-participation in the labor force.[13]

V. EMPIRICAL RESULTS

Beginning in this section, we examine the results of our formal model of household wealth accumulation. In most empirical work, one explores a great

[12]To see this, denote the error in the estimate by

$$\mu_{it} = \ln PI_{it} - \ln PI_{it}$$

$$= \frac{\sigma_k^2}{\sigma_k^2 + \sigma_\varepsilon^2}\varepsilon_{it} - \frac{\sigma_\varepsilon^2}{\sigma_k^2 + \sigma_\varepsilon^2} K_i$$

Then,

$$E(\mu_{it} \ln PI_{it}) = E(\mu_{it}(K_i + \varepsilon_{it})) = 0$$

[13]The probabilities of being in labor force for spouse were estimated from the probit procedure.

number of variations on a given model in hopes of determining the stability of an estimated structure under various perturbations. We have been no exception in this way. After a careful review we decide two more model are worth reporting here in addition to our basic model.

1. The Basic Model

We first began by regressing the ratio of net worth to permanent income on the full set of variables over the whole sample of 3,665 households using the following model:

$$(24)\ \frac{NW}{PI} = \alpha + \sum_{i=1}^{n} \beta_i Xi + \sum_{k=1}^{3} \tau_k AGE^k + \sum_{i=1}^{n} \sum_{k=1}^{3} \delta_i X_i AGE^k + \theta^0 (AGE - K_0)^2 \times DM + \theta_1 (AGE - K_0)^3 \times DM + \theta_2 (AGE - K_1)^2 \times DM + \theta_3 (AGE - K_1)^3 \times DM + \varepsilon$$

Initially we set K_0, the first knot, equal to 50 which we think is the age around which the consumption may start to rise sharply due to their support of their children's higher education, marriages, and so on. Actually we saw in the preceding section that the accumulation of family net worth or financial net worth slowed down around this age. The second knot, K_1, is set equal to 65, the age of retirement beyond which wage income becomes negligible.

At first we employed the ordinary least square method over the whole sample. After a careful examination of the result and the residual plot we found that the residuals are not normally distributed. And we found that we had a serious problem of outliers. There were 6 households (only 0.16% of the whole sample) with net worth of more than 2 million dollars. These outliers induced a very poor fit for the wealth equation. The best way to deal with these outlier problems is to attach smaller weights to these outliers.[14] King and Dicks-Mireaux (1982) adopted the log transformation to reduce the importance of outliers. In order to apply the log transformation they truncated their sample, i.e., they eliminated all low and/or negative wealth holding households. However this truncation of the sample is undesirable since the cut-off criterion may be arbitrary and it can weaken the robustness of the model. Instead we adopted the following modified version of Box-Cox transformation[15] as originally suggested in Burbidge and Robb (1985):

[14]Dropping outliers completely from the sample can be another way of dealing with outliers. But this is undesirable since the cut off criterion may be quite arbitrary and it reduces the robustness of the model.

[15]Originally, Box-Cox transformation was developed in order to use in such a case that dependent variable can have a value of "zero".

$$(25)\ NW_{(r)} = \frac{\text{sign (NW)} \times |NW|^{r-1}}{r} \quad 0<r\leqslant 1$$

The maximum likelihood procedures were used to find an optimal value of r. The estimates of r were 0.42, 0.48 and 0.51 for the ratio of net worth to permanent income, the ratio of financial net worth to permanent income, and permanent income, respectively. Though separate estimates of r should be used in separate subsamples or for separate regressions, we used the same estimates of r for the entire analysis. This was done because the estimates of r across the subsamples did not vary much and using a separate estimates of r for each separate subsamples did not make a big difference in terms of goodness of fit and harm the robustness of our model. Adopting this transformation resulted in a much improved fir to the equation with an R-bar squared of 0.3562 compared with 0.2292 before the transformation.

From the net worth regressions, we can see that the dummy for having children aged between 15 and 21 implies the possible slowdown or decline in the household wealth accumulation around age 50 for the families which have these children (see Tables 1 and 2). This suggests to us that middle aged people with children aged

[**Table 1**] Net Worth Regressions after r-Transformation without Age Interaction Terms

Independent Variables	Model (1)	Model (2)	Model (3)
INTERCEPT	−4.132**	−3.802**	−3.792**
	−5.978	−5.410	−5.398
HAGE	0.092**	0.01860	0.01645
	2.002	0.39539	0.34924
HAGE2	0.00048	0.00192**	0.00195**
	0.51644	1.99189	2.02148
HAGE3	−0.00001	−0.00002**	−0.00002**
	−1.58313	−2.87688	−2.91784
HAGSQ1DM	−0.00539**	−0.00524**	−0.00508**
	−2.06295	−2.06362	−2.00199
HAGCB1DM	0.00019	0.00023*	0.00022*
	1.34521	1.68029	1.61019
HAGSQ2DM	−0.00122	−0.00207	−0.00192
	−0.66503	−1.14840	−1.06542
HAGCB2DM	−0.00011	−0.00015	−0.00014
	−1.09365	−1.57629	−1.49541
DREGION1	—	−0.047	−0.051
		−0.544	−0.606
DREGION2	—	0.108	0.105
		1.416	1.372
DREGION4	—	−0.202	−0.013
		−0.318	−0.148

Independent Variables	Model (1)	Model (2)	Model (3)
DPLACE2	—	0.237**	0.230**
		2.995	2.910
DPLACE3	—	0.318**	0.323**
		4.046	4.103
NOSPOUSE	—	-0.056	-0.052
		-0.443	-0.410
HJOB1	—	-0.213*	-0.239**
		-1.773	-1.982
HJOB2	—	-0.352**	-0.376**
		-3.474	-3.690
HJOB3	—	0.560**	0.597**
		3.263	3.464
SJOB1	—	-0.300**	-0.336**
		-2.333	-2.591
SJOB2	—	-0.199**	-0.219**
		-2.334	-2.553
SJOB3	—	0.161	0.184
		0.567	0.646
HSCH1	—	0.486**	0.473**
		6.152	5.979
HSCH2	—	0.109	0.103
		1.202	1.131
SSCH1	—	0.379**	0.375**
		3.782	3.741
SSCH2	—	0.259**	0.262**
		2.178	2.203
KID1	—	0.006	0.009
		0.062	0.092
KID2	—	0.033	0.039
		0.361	0.433
RACE1	—	0.409**	0.395**
		3.156	3.049
RACE2	—	-0.337**	-0.343**
		-2.236	-2.279
HSEX	—	-0.069	-0.069
		-0.653	-0.652
PENSION	—	—	0.155**
			2.156
R-SQUARE	0.2739	0.3421	0.3430
ADJ R-SQ	0.2725	0.3370	0.3377
F VALUE	196.87	67.474	65.373
PROB>F	0.0001	0.0001	0.0001

Note: * significant at 10% level
** significant at 5% level
numbers under coefficients are t-statistics.

[**Table 2**] Net Worth Regressions after r-Transformation with Age Interaction Terms

Independent Variables	Model (4)	Model (5)	Model (6)
INTERCEPT	1.259	0.494	0.390
	0.322	0.129	0.102
HAGE	−0.47891*	−0.49326*	−0.48480*
	−1.77825	−1.86765	−1.83425
HAGE2	0.01537**	0.01548**	0.01538**
	2.70541	2.77829	2.76019
HAGE3	−0.00012**	−0.00012**	−0.00012**
	−3.27084	−3.33677	−3.33006
HAGSQ1DM	−0.00578**	−0.00545**	−0.00540**
	−2.25941	−2.17189	−2.15099
HAGCB1DM	0.00026**	0.00023*	0.00022*
	1.94785	1.71040	1.69019
HAGSQ2DM	−0.00270	−0.00248	−0.00249
	−1.46629	−1.37722	−1.38111
HAGCB2DM	−0.00018*	−0.00016*	−0.00016*
	−1.87342	−1.70239	−1.69625
DREGION1	−0.076	−0.172**	−0.171**
	−0.903	−2.072	−2.060
DREGION2	0.102	0.025	0.025
	1.346	0.340	0.339
DREGION4	0.009	−0.039	−0.040
	0.098	−0.438	−0.446
DPLACE2	0.228**	0.145*	0.145*
	2.906	1.877	1.873
DPLACE3	0.309*	0.409*	0.407**
	3.955	5.311	5.290
NOSPOUSE	1.446	1.595	1.607
	0.803	0.904	0.910
HJOB1	3.089	3.465	3.533
	1.290	1.476	1.504
HJOB2	3.311*	3.039*	3.161*
	1.760	1.647	1.707
HJOB3	−1.529	−1.978	−1.903
	−0.378	−0.499	−0.480
SJOB1	−0.290**	−0.553**	−0.546**
	−2.241	−4.293	−4.228
SJOB2	−0.208**	−0.371**	−0.372**
	−2.398	−4.324	−4.322
SJOB3	0.199	−0.190	−0.182
	0.706	−0.684	−0.656
HSCH1	−2.557*	−2.361	−2.230
	−1.674	−1.576	−1.533
HSCH2	−4.631**	−4.142**	−4.190**
	−2.253	−2.054	−2.077
SSCH1	0.383**	0.262**	0.270**
	3.787	2.631	2.694

Independent Variables	Model (4)	Model (5)	Model (6)
SSCH2	0.253**	0.112	0.117
	2.145	0.962	1.006
KID1	0.016	0.062	0.058
	0.167	0.659	0.627
KID2	0.020	0.069	0.068
	0.211	0.749	0.736
RACE1	−4.678*	−5.997**	−6.061**
	−1.641	−2.144	−2.166
RACE2	1.435	−0.196	−0.239
	0.432	−0.060	−0.073
HSEX	−0.885	−0.446	−0.423
	−0.474	−0.243	−0.231
PENSION	−0.739	−0.781	−0.839
	−0.508	0.548	−0.588
HJOB1AGE	−0.183	−0.229	−0.233
	−1.130	−1.443	−1.470
HJOB1AG2	0.003	0.004	0.004
	1.009	1.261	1.289
HJOB1AG3	−0.0002	−0.00003	−0.00003
	−1.01689	−1.18924	−1.21521
HJOB2AGE	−0.202	−0.193	−0.208*
	−1.564	−1.574	−1.635
HJOB2AC2	0.004	0.004	0.004
	1.375	1.415	1.475
HJOB2AG3	−0.00002	0.00002	0.00002
	−1.33333	−1.36745	−1.42592
HJOB3AGE	0.182	0.187	0.183
	0.710	0.747	0.728
HJOB3AG2	−0.004	−0.005	−0.005
	−0.867	−0.924	−0.906
HJOB3AG3	0.00003	0.00003	0.00003
	0.96178	1.04489	1.02912
HSCH1AGE	0.174*	0.150	0.145
	1.710	1.500	1.450
HSCHIAG2	−0.003	−0.003	−0.003
	−1.602	−1.458	−1.408
HSCH1AG3	0.00002	0.00002	0.00002
	1.60947	1.51332	1.46231
HSCH2AGE	0.311**	0.275**	0.278**
	2.273	2.050	2.073
HSCH2AG2	−0.006**	−0.006**	−0.006**
	−2.271	−2.112	−2.134
HSCH2AG3	0.00004**	0.00004**	0.00004**
	2.31112	2.19628	2.21699
RACE1AGE	0.364*	0.443**	0.449**
	1.829	2.278	2.300

Independent Variables	Model (4)	Model (5)	Model (6)
RACE1AG2	-0.008*	-0.101**	-0.010**
	-1.9125	-2.347	-2.370
RACE1AG3	0.00006**	0.00007**	0.00007**
	2.01769	2.43579	2.45711
RACE2AGE	-0.069	0.042	0.045
	-0.300	0.185	0.199
RACE2AG2	0.00046	-0.002	-0.002
	0.09329	-0.368	-0.382
RACE2AG3	0.000	0.00002	0.00002
	0.078	0.51439	0.52691
HSEXAGE	0.124	0.076	0.077
	0.972	0.630	0.618
HSEXAG2	-0.004	-0.003	-0.003
	-1.456	-1.108	-1.093
HSEXAG3	0.00003*	0.00002	0.00002
	1.82433	1.47844	1.46078
NOSPAGE	-0.038	-0.043	-0.044
	-0.312	-0.351	-0.366
NOSPAGE2	-0.00027	0.00001	0.00005
	-0.10576	0.00667	0.02001
NOSPAGE3	0.00001	0.00000	0.00000
	0.37761	0.21601	1.20619
PENAGE	0.117	0.108	0.112
	1.175	1.098	1.141
PENAGE2	-0.004*	-0.003*	-0.004*
	-1.707	-1.632	-1.675
PENAGE3	0.00003**	0.00003**	0.00003**
	2.14681	2.10234	2.14121
LPI	—	0.00631**	0.00604**
		12.0332	9.63522
LSSW	—	—	-0.05448
			-0.77598
R-SQUARE	0.3666	0.3911	0.3912
ADJ R-SQ	0.3562	0.3809	0.3809
F VALUE	35.333	38.545	37.918
PROB>F	0.0001	0.0001	0.0001

Note: * significant at 10% lvel
** significant at 5% level
numbers under coeficients are t-statistics.

15 or over would be investing relatively more in the form of their children's human capital and less in financial assets. (see Table 3 and 4). This becomes much more apparent if we look at the financial net worth equation. If we consider this type of intergenarational transfer as a saving, then that could offset more or less the

[**Table 3**] Financial Net Worth Regressions without Age Interaction Terms using r-Transformation

Independent Variables	Model (1)	Model (2)	Model (3)
INTERCEPT	−1.504**	−1.599**	−1.594**
	−2.765	−2.908	−2.900
HAGE	−0.06354**	−0.09835**	−0.09924**
	−1.75432	−2.66792	−2.69124
HAGE2	0.00212**	0.00277**	0.00278**
	2.87644	3.67331	3.68747
HAGE3	−0.00001**	−0.00002**	−0.00002**
	−2.88895	−3.56719	−3.58884
HAGSQ1DM	−0.00770**	−0.00697**	−0.00690**
	−3.74644	−3.51062	−3.47699
HAGCB1DM	0.00030**	0.00031**	0.00031**
	2.76334	2.97829	2.94019
HAGSQ2DM	−0.00542**	−0.00523**	−0.00517**
	−3.75703	−3.70340	−3.65742
HAGCB2DM	−0.00028**	−0.00028**	−0.00028**
	−3.66271	−3.79629	−3.75141
DREGION1	—	0.132**	0.130**
		1.988	1.960
DREGION2	—	0.154**	0.153**
		2.584	2.561
DREGION4	—	−0.081	−0.079
		−1.141	−1.104
DPLACE2	—	0.042	0.039
		0.675	0.630
DPLACE3	—	−0.044	−0.042
		−0.708	−0.679
NOSPOUSE	—	0.176*	0.178*
		1.771	1.789
HJOB1	—	−0.024	−0.035
		−0.256	−0.369
HJOB2	—	−0.224**	−0.233**
		−2.820	−2.927
HJOB3	—	0.508**	0.523**
		3.783	3.878
SJOB1	—	−0.357**	−0.372**
		−3.545	−3.662
SJOB2	—	−0.171**	−0.179**
		−2.562	−2.669
SJOB3	—	−0.146	−0.136
		−0.654	−0.612
HSCH1	—	0.412**	0.407**
		6.674	6.571
HSCH2	—	0.143**	0.140**
		2.011	1.973

Independent Variables	Model (1)	Model (2)	Model (3)
SSCH1	—	0.334**	0.333**
		4.260	4.237
SSCH2	—	0.167*	0.168*
		1.792	1.805
KID1	—	-0.169**	-0.167**
		-2.284	-2.268
KID2	—	-0.197**	-0.195**
		-2.781	-2.742
RACE1	—	0.299**	0.293**
		2.950	2.892
RACE2	—	-0.339**	-0.341**
		-2.875	-2.897
HSEX	—	0.052	0.052
		0.637	0.638
PENSION	—	—	0.064
			1.137
R-SQUARE	0.1717	0.2582	0.2584
ADJ R-SQ	0.1701	0.2524	0.2525
F VALUE	108.21	45.154	43.645
PROB>F	0.0001	0.0001	0.0001

Note: * significant at 10% level
** significant at 5% level
numbers under coefficients are t-statistics.

[**Table 4**] Financial Net Worth Regressions with Age Interaction Term using r-Transformation

Independent Variables	Model (4)	Model (5)	Model (6)
INTERCEPT	0.527	-0.173	-0.275
	0.173	-0.059	-0.093
HAGE	-0.27280	-0.28592	-0.27759
	1.30425	-1.40565	-1.36325
HAGE2	0.00747**	0.00757*	0.00747*
	2.69241	1.76329	1.74119
HAGE3	-0.00005*	-0.00005**	-0.00005*
	-1.89484	-1.94977	-1.94006
HAGSQ1DM	-0.00722**	-0.00692**	-0.00687**
	-3.63841	-3.58289	-3.55509
HAGCB1DM	0.00035**	0.00032**	0.00032**
	3.31785	3.08040	3.05449
HAGSQ2DM	-0.00565**	-0.00545**	-0.00546**
	-3.95429	-3.92322	-3.92811
HAGCB2DM	-0.00030**	-0.00028**	-0.00028**
	-4.02142	-3.88539	-3.87725

Independent Variables	Model (4)	Model (5)	Model (6)
DREGION1	0.117*	0.029	0.030
	1.792	0.460	0.476
DREGION2	0.156**	0.086	0.086
	2.654	1.497	1.496
DREGION4	−0.063	−0.106	−0.107
	−0.892	−1.555	−1.565
DPLACE2	0.048	−0.028	−0.028
	0.793	−0.464	−0.469
DPLACE3	−0.037	0.055	0.054
	−0.604	0.929	0.905
NOSPOUSE	0.156	0.293	0.305
	0.112	0.216	0.224
HJOB1	2.201	2.546	2.613
	1.185	1.408	1.444
HJOB2	3.672**	3.423**	3.543**
	2.515	2.409	2.485
HJOB3	−2.968	−3.378	−3.304
	−0.946	−1.106	−1.082
SJOB1	−0.314**	−0.554**	−0.547**
	−3.122	−5.586	−5.503
SJOB2	−0.159**	−0.309**	−0.309**
	−2.370	−4.673	−4.670
SJOB3	0.102	−0.457**	−0.450**
	0.465	−2.1365	−2.099
HSCH1	−1.478	−1.296	−1.239
	−1.247	−1.126	−1.072
HSCH2	−3.910**	−3.462**	−3.510**
	−2.450	−2.229	−2.259
SSCH1	0.344**	0.234**	0.241**
	4.384	3.044	3.126
SSCH2	0.164*	0.035	0.041
	1.797	0.395	0.454
KID1	−0.185**	−0.143**	−0.146**
	−2.512	−2.000	−2.038
KID2	−0.225**	−0.180**	−0.181**
	−3.090	−2.538	−2.554
RACE1	−1.069	−2.275	−2.338
	−0.483	−1.056	−1.085
RACE2	−0.730	−2.222	−2.264
	−0.283	−0.886	−0.902
HSEX	−2.083	−1.682	−1.658
	−1.436	−1.191	−1.175
PENSION	−0.799	−0.839	−0.895
	−0.709	−0.764	−0.814
HJOB1AGE	−0.151	−0.193	−0.197*
	−1.200	−1.578	−1.613

Independent Variables	Model (4)	Model (5)	Model (6)
HJOB1AG2	0.003	0.004	0.004
	1.203	1.512	1.548
HJOB1AG3	−0.00002	−0.00002	−0.00002
	−1.26389	−1.48004	−1.51421
HJOB2AGE	−0.227**	−0.225**	−0.233**
	−2.264	−2.303	−2.380
HJOB2AG2	0.004*	0.004**	0.004**
	1.932	2.000	2.077
HJOB2AG3	−0.00002*	−0.00002*	−0.00002*
	−1.70033	−1.75745	−1.83102
HJOB3AGE	0.224	0.230	0.224
	1.128	1.187	1.161
HJOB3AG2	−0.005	−0.005	−0.005
	−1.233	−1.314	−1.291
HJOB3AG3	0.00003	0.00004	0.00003
	1.36278	1.47489	1.455
HSCH1AGE	0.085	0.062	0.058
	1.070	0.813	0.752
HSCH1AG2	−0.002	−0.001	−0.001
	−0.926	−0.743	−0.681
HSCH1AG3	0.00001	0.00001	0.00001
	1.00007	0.87532	0.81331
HSCH2AGE	0.266**	0.233**	0.236**
	2.503	2.255	2.285
HSCH2AG2	−0.006**	−0.005**	−0.005**
	−2.569	−2.399	−2.427
HSCH2AG3	0.00004**	0.00004**	0.00004**
	2.75512	2.64228	2.66599
RACE1AGE	0.086	0.160	0.164
	0.556	1.063	1.093
RACE1AG2	−0.002	−0.003	−0.004
	−0.528	−1.016	−1.046
RACE1AG3	0.00001	0.00002*	0.00002
	0.538	1.87329	1.03111
RACE2AGE	0.057	0.158	0.161
	0.320	0.912	0.930
RACE2AG2	−0.00141	−0.003	−0.004
	−0.37129	−0.930	−0.948
RACE2AG3	0.00001	0.00002	0.00002
	0.33514	0.86039	0.87791
HSEXAGE	0.170*	0.129	0.128
	1.714	1.343	1.328
HSEXAG2	−0.004**	−0.003*	−0.003
	−2.002	−1.611	−1.592
HSEXAG3	0.00003**	0.00002*	0.00002*
	2.26433	1.87344	1.85178

Independent Variables	Model (4)	Model (5)	Model (6)
NOSPAGE	0.034	0.030	0.028
	0.353	0.323	0.304
NOSPAGE2	−0.001	−0.001	−0.001
	−0.585	−0.465	−0.448
NOSPAGE3	0.00001	0.00001	0.00001
	0.72802	0.54901	0.53619
PENAGE	0.083	0.074	0.078
	1.071	0.982	1.037
PENAGE2	−0.002	−0.002	−0.002
	−1.313	−1.220	−1.277
PENAGE3	0.00002	0.00002	0.00002
	1.48719	1.42534	1.47721
LPI	—	0.00577**	0.00551**
		14.2912	11.4052
LSSW	—	—	−0.05369
			−0.99398
R-SQUARE	0.2965	0.3343	0.3345
ADJ R-SQ	0.2850	0.3232	0.3232
F VALUE	25.733	30.136	29.658
PROB>F	0.0001	0.0001	0.0001

Note: * significant at 10% level
** significant at 5% level
numbers under coefficients are t-statistics.

dissaving caused by Social Security.

One might be puzzled by the fact that the coefficients of the head's education dummies have negative values, and are significant. However, if we look at more closely, then we can find that by combining the cross effect with age we can get some explanations. In other words, if people are more educated, they may have very low (or sometimes negative) ratio of net worth to permanent income in younger ages due to both high borrowing and high permanent income. In our model the coefficient of the head's college education dummy was negative until he reached the age of around 35. The same argument can be applied to race dummies. In Table 1 we displayed the results of same regressions without all age cross terms. We now see the right signs of education and race dummies have changed to what we orriginally expected except the college education dummy.[16]

The pension coverage reflects a consistently positive, though insignificant, effect on the ratio of net worth of permanent income. But, if we look at the effect

[16]In our data, most families with this highest education dummy are young households which, again, have low ratio of net worth to permanent income. Thus, we can say there may be a smaple selection bias.

of pension coverage by age through age cross effect, we can find that for younger households the pension coverage has negative effect on NW/PI. This can be a result of the fact that younger families do rarely care for their future. And when they are covered by a pension after retirement, this tendency (reluctance to save) deepens causing negative effects on NW/PI. In other words, it reveals that those younger households do have relatively less need to save.

The Social Security wealth variable has, as we expect, a negative, though insignificant, sign implying that the coverage of Social Security may reduce household saving. To estimate the displacement effect of Social Security wealth, we applied the log transformation to the model (24) in hoping for the coefficient of the Social Security variable to be intepreted as a proxy for the elasticity, The implied offset to wealth accumulation (or saving) resulting from an additional dollar of Social Security wealth is 0.352 dollar for net worth and 0.527 dollar for financial net worth.

To see the complexity of the relationships between age and other variables more clearly, let's examine graphs of the predicted values of the ratio of net worth to permanent income. We chose to focus our attention on two typical groups of households. The first group consists of households having no children aged 15 and over supported by them (let's call this group NOCHLD). The second group is a group of households with one or more children aged 15 and over who are still (financially) supported by the family (let's call this group CHLD).

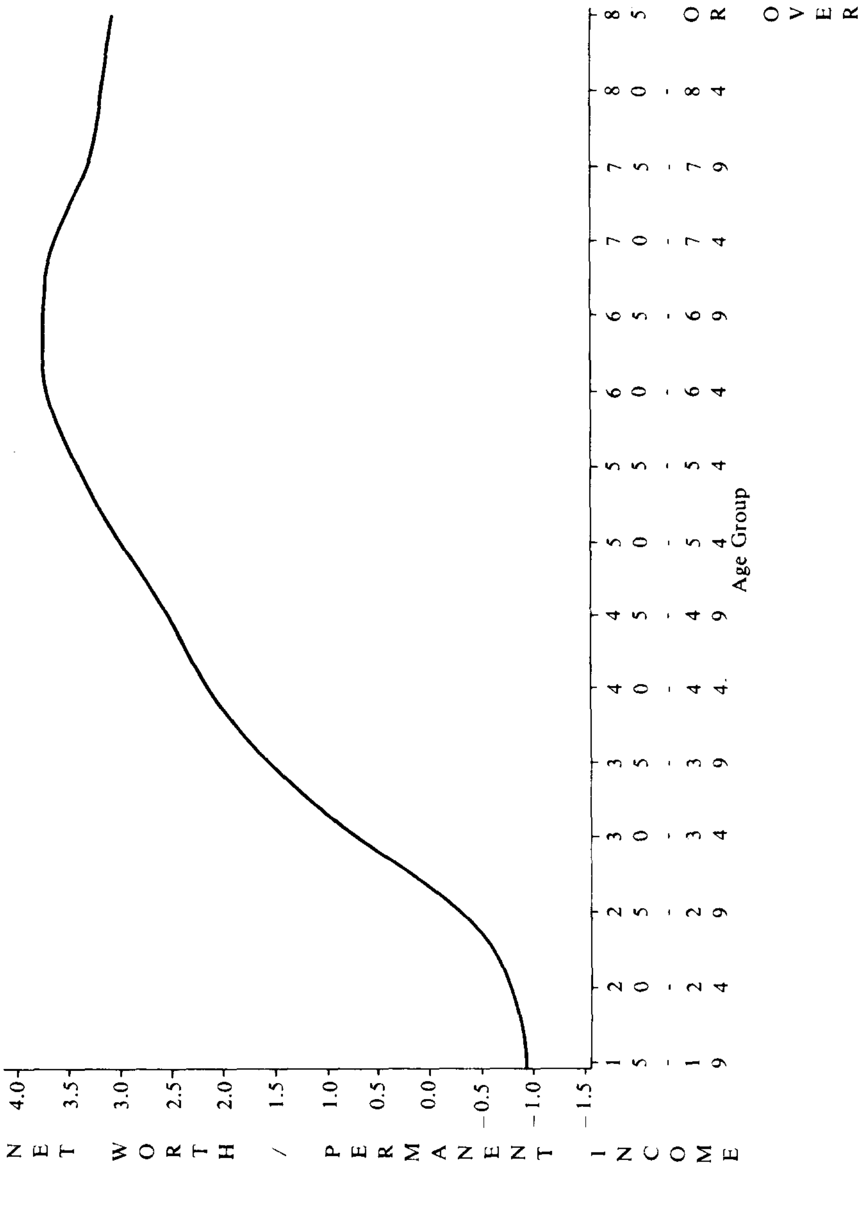
The age-NW/PI profiles for both groups have an approximately inverted U-shape with a little decline after the peak. That profile for NOCHLD households steadily rise until it reaches the peak around age sixty to sixty-four, and then it declines. While the same profile for CHLD households, after attaining a "plateau" around age forty to fifty-four, shows further increases from age sixty-five on. It shows a decline from age seventy, from which we have a very small number of observations (only 38 households compared with 421 households in NOCHLD group).

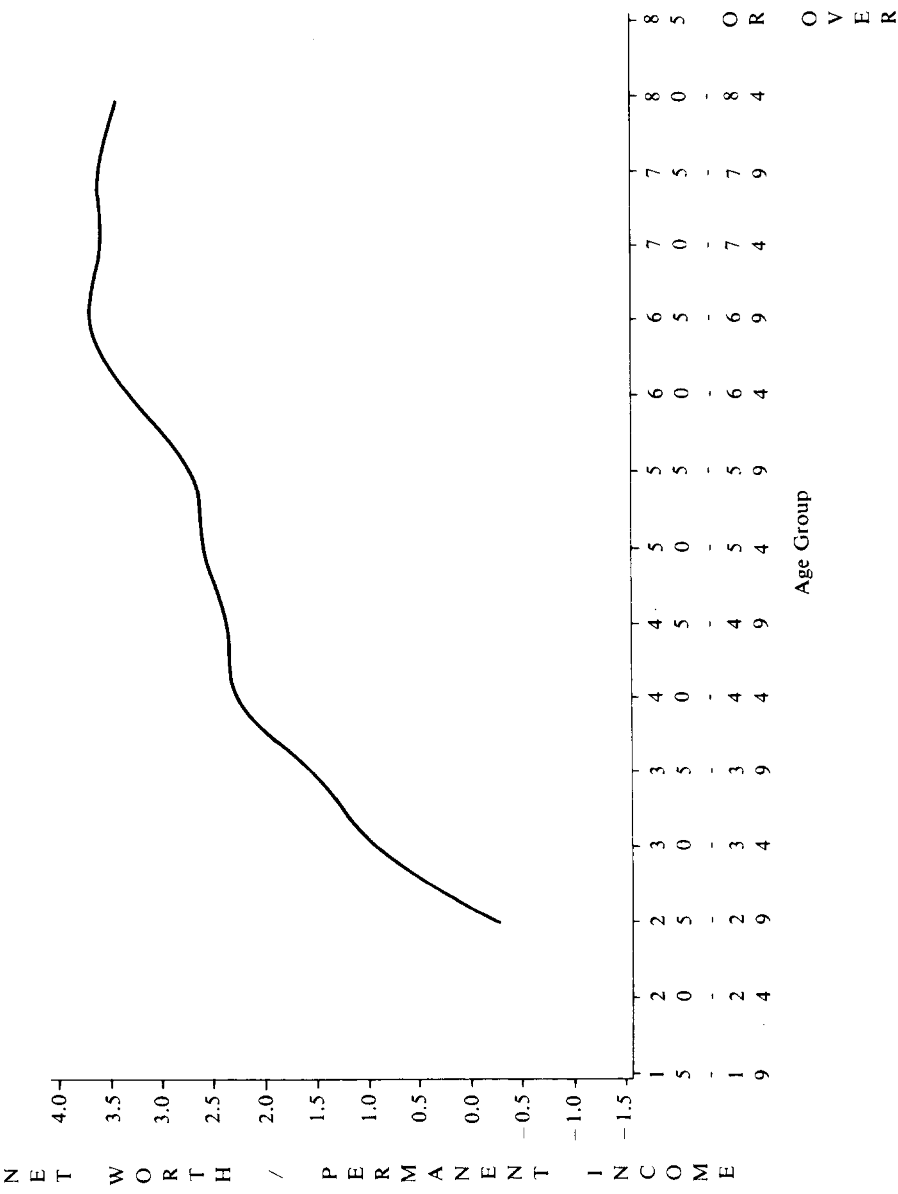
The difference between the NOCHLD and CHLD profiles in Figure 1 and 2 seems to stem from differences between these two groups in their consumption patterns due to the existence of children and 15 or over, their consequent attitudes towards saving, and the imperfection of the capital market. These graphs reveal that the consumption shock due to higher education of their children leads to the slow down of wealth accumulation around age fifth and makes the profile of CHLD reach its peak around age 65-69.[17]

Then we conducted F-tests on each of the groups of variables using model (4)

[17]To John Weicher's suggestion, we truncated our sample to households with head age 35 or over and ran the same regressions in hoping for more clear supports of the hypothesis. The results are turned out to be more convincing our hypothesis.

[Figure 1] Ratio of net worth to permanent income Households without children Aged 15 and over





[Figure 3]Ratio of net worhth to Permantet income Households was Children Aged 15 And OVER

[**Table 5**] F-Test of the Hypothesis that the Listed Variable and Their Interactions with Age Spline Are Zero

Variables	F-statistic	PROB>F
Education of Head	7.8965	0.0001
Job of Head	5.9317	0.0001
Sex of Head	3.6559	0.0056
Education of Spouse[1]	10.6497	0.0001
Job of Spouse[1]	1.5296	0.2031
Marital Status	3.5816	0.0064
Race	10.8380	0.0001
Pension	4.9930	0.0005
Age Spline Terms[1]	12.2537	0.0001

Note: [1] F test was done without interactions with age spline terms.
PROB>F is the critical level which is the significance level at which the null hypothesis is rejected.

in Table 2 (e.g. on the set of dummy variables representing different occupations of the family head and the interactions of these variables with age spline terms). The results of these F-tests are reported in Table 5. All these groups are proven to be statistically different from zero except the spouse occupation which has a critical level of 0.2031. Also we conducted F-tests on age spline terms for all our regression models, and these variables tested as always significantly different from zero.

Finally, as a simple test of the estimations represented in this section, we have ranked the r-transformed values of the ratio of net worth to permanent income, discarded the top and bottom 3% outliers and restimated the basic set of models. The results are only modestly affected. In general, coefficients move a little toward a range more supportive of the conclusion we derived in this section.

2. A Modified Model

As we noted before, a typical pattern of the asset accumulation of a household according to the Life Cycle Hypothesis of Saving will display a very nice hump shape. But, when their children go for a higher education, we expect that the consumption profile jumps markedly. Consequently the speed of wealth accumulation slows down or in extreme cases they even shows the sign of decumulation of household wealth.

This suggests us that a potentially useful intuitive analysis would be the regression of the following form:

$$\frac{NW}{PI} = a_0 + a_1 \, AGE + a_2 \, AGE^2 + a_3 \, AGE^3$$

(26)

$$+ \sum_{i=1}^{3} b_i DM_i + \sum_{j=1}^{3} c_j G_j + \varepsilon$$

Here NW and PI are net worth and permanent income, respectively, as before. AGE is the age of family head. DM_i's and G_j's are all one-zero dummies indicating the presence of children and older person supported by the family in a certain age group. The index i ranges from 1 to 3, and they represent children's age classes 15-17, 18-21, and 22 and over, respectively. The index j also range from 1 to 3, and they indicate older person's age classes 50-64, 65-74, and 75 and over, respectively.

The polynomial terms in age trace the pattern of wealth accumulation relative to the permanent income by a household in the absence of children aged 15 and over and/or older persons aged 50 and over. Coefficients b_i's would then measure net contribution of the presence of children of a particular age class to the net worth of the household, expressed as the ratio of the permanent income. Note that by construction permanents income is not likely to the affected much by the presence of children aged 15 and over and older persons in the household, except that it is affected slightly by the family size. Ther estaimation of model (26) was made over two subsamples. First, we ran the OLS for the whole sample, and then we leave out the all self-employed households from the sample. The final results are reported in Table 6 for the whole sampel and Table 7 for the sample excluding self-employed households.[18]

Estimated values of coefficients of age polynomials imply that the ratio of net worth to permanent income increase with age at a decreasing rate in both cases, ending at slightly more than 4 at age 63.29 for the whole sample and at slightly less than 4 at age 59.54 for the subsample excluding all self-employed households. And the same ratio for financial net worth shows similar patterns but reaches its maximum of about 3 around age 70 for the whole sample and a maximum of about 2.5 around age 67. Coefficients for DM_i's are mostly negatives with one exception of DM1 in net worth equation. Also the size of these coefficients are decreasing functions of age of children. Since college education is more expensive than high school education, this decreasing pattern is no surprise at all. If we look at the financial net worth regressions, this pattern is much more apparent. Notice that the absolute values of coefficient b_i's in financial net worth regressions is much greater than in net worth regressions. For instance, while the presence of children aged 18-21 reduces the ratio of net worth to permanent income by 0.2, it reduces the ratio of financial net worth to permanent income by 0.32. All these

[18]Here, r-transformation is used again.

facts mean there is substantial dissavings by middle aged children who are still supported by the family.

The coefficient c_j's are mostly positive and not significant except c_3. We might think that the presence of older persons in the household means that they merged their children with positive net worth. But since these older persons are the main dissavers in the households, the coefficients should decrease over the age classes. We are not quite sure why the net contribution to the net worth of households by the presence of older persons increases with the age of older persons.

When we add the PENSION variable only the coefficient is positive and significant. The positive sign of the pension coverage is a somewhat puzzling results to

[**Table 6**] New Worth Regressions (All Observations)

Independent Variables	Dependent Variabable					
	Net Worth			Financial Net Worth		
INTERCEPT	-4.607**	-4.590**	-4.786**	-1.793**	-1.782**	-1.950**
	-6.884	-0.6864	-7.453	-3.400	-3.389	-3.890
HAGE	0.125**	0.118**	0.023	-0.044	-0.048	-0.130**
	2.826	2.669	8.533	-1.260	-1.386	-3.875
HAGE2	-0.0002	-0.0001	0.0015*	0.002**	0.002**	0.003**
	-0.2341	-0.996	1.7302	2.466	2.564	4.697
HAGE3	-0.000001	-0.00001	-0.00001**	-0.00001**	-0.00001**	-0.00002*
	-0.00020	-0.99596	-2.27742	-2.52489	-2.62019	-4.102
DM1	0.060	0.071	0.046	-0.178**	-0.171**	-0.192**
	0.592	0.702	0.476	-2.232	-2.141	-2.525
DM2	0.012	0.010	-0.010	-0.201**	-0.202**	-0.219**
	0.115	0.097	-0.099	-2.470	-2.487	-2.828
DM3	-0.084	-0.073	-0.135	-0.321**	-0.313**	-0.367**
	-0.677	-0.590	-1.135	-3.290	-3.218	-3.945
G1	0.438	0.437	0.457*	-0.273	-0.273	-0.256
	1.489	1.489	1.622	-1.181	-1.183	-1.164
G2	0.240	0.214	0.510	0.259	0.242	0.494
	0.548	0.489	1.210	0.751	0.702	1.503
	1.160**	1.166**	1.476**	0.394	0.398	0.663**
	2.641	2.657	3.499	1.142	1.154	2.013
PENSION	—	0.190**	-0.138**	—	0.123**	-0.156**
	—	2.702	-1.975	—	2.236	-2.866
LPI	—	—	0.099**	—	—	0.008**
	—	—	17.58	—	—	19.24
R-SQUARE	0.2738	0.2752	0.3318	0.1727	0.1738	0.2499
RDJ R-SQ	0.2720	0.2732	0.3298	0.1706	0.1715	0.2476
F VALUE	152.95	138.63	164.77	84.692	76.806	110.52
PROB>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Note: * significant at 10% level

** significant at 5% level

numbers under coefficients are t-statistics us even though the inclusion of the pension coverage variable to the basic model didnot improve the R-SQUARE a lot. However if we include the permanent income variable as a explanatory variable, then this puzzle dissapears. As you see in Table 6 and 7, the sign of PENSION coefficient becomes negative in all cases, which implies that the coverage of pension tempts people to dissave (precisely not to save) causing negative effects on the ratio of net worth to the permanent income. This principle can be applied to the case of Social Security.

[**Table** 7] Net Worth Regressions (without self-employed households)

Independent Variables	Dependent Variabable					
	Net Woth			Financial Net Worth		
INTERCEPT	-4.259**	-4.187**	-4.398**	-1.579**	-1.531**	-1.710**
	-6.298	-6.205	-6.762	-3.011	-2.925	-3.415
HAGE	0.101**	0.086**	-0.004	-0.058*	-0.068*	-0.144**
	2.244	1.924	-0.085	-1.676	-1.947	-4.297
HAGE2	0.0003	0.0005	0.002**	0.002**	0.002**	0.003**
	0.2884	0.5403	2.299	2.853	3.067	5.110
HAGE3	-0.00001	-0.00001*	-0.00002*	-0.00001**	-0.00001**	-0.00002*
	-1.37121	-1.60741	-2.84671	-2.913	-3.11414	-4.553
DM1	0.035	0.053	0.035	-0.209**	-0.198**	-0.213**
	0.340	0.512	0.354	-2.613	-2.469	-2.778
DM2	-0.055	-0.051	-0.025	-0.167**	-0.170**	-0.192**
	-0.526	-0.484	-0.099	-2.051	-2.092	-2.470
DM3	-0.096	-0.078	-0.140	-0.311**	-0.299**	-0.352**
	-0.764	-0.619	-1.161	-3.190	-3.069	-3.780
G1	0.320	0.322	0.345	-0.283	-0.281	-0.262
	1.057	1.066	1.184	-1.203	-1.200	-1.169
G2	0.295	0.258	0.528	0.297	0.272	0.501
	0.678	0.594	1.260	0.880	0.808	1.555
G3	1.217**	1.233**	1.505**	0.437	0.448	0.678**
	2.792	2.836	3.688	1.294	1.328	2.102
PENSION	—	0.313**	-0.045	—	0.207**	-0.098*
	—	4.328	-0.622	—	3.685	-1.734
LPI	—	—	0.009**	—	—	0.008**
	—	—	16.39	—	—	18.07
R-SQUARE	0.2731	0.2770	0.3288	0.1707	0.1739	0.2447
RDJ R-SQ	0.2712	0.2749	0.3266	0.1686	0.1716	0.2423
F VALUE	145.58	133.56	155.17	79.767	73.407	102.66
PROB>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Note: * siginficant at 10% level
** significant at 5% level
numbers under coefficients are t-statistics

VI. CONCLUSION

In this study we examined the wealth accumulation behavior of households mainly before the retirement ages. The purpose of this study was to establish a set of empirical facts upon which we can construct more realistic life cycle models.

Most previous studies tried to test the hump shape of wealth profile—whether dissaving actually occurs after retirement—suggested by the Life Cycle Hypothesis of Saving. Few researchers paid their attentions to what should the shape of wealth accumulation before retirement. The principal result of this study is that the wealth accumulation behavior of households before retirement ages can differ depending on whether households support financially children for their higher education such as colleges.

We have found there is evidence that welath accumulation slows down when middle aged households support their children financially. This slowdown of wealth accumulation is a result of combined reasons of a consumption shock in the form of higher educational expense and imperfect capital market structure preventing them from borrowing against their fungible assets.

Once we control for differences in permanent income, net worth shows a plateau before it reaches its maximum. This phenomenon is much more apparent when we take the narrowest definition of new worth—financial net worth. Although there is clearly a good deal of noise in the measurement of permanent income and some wealth variables, our findings are more or less consistent with what the extended Life Cycle Model predicts.

Another point is that there is a tendency in the literature to identify the behavior of all households with a single model. Our evidence here suggests that different motives are likely to exist case by case, i.e. there may be significant differences in wealth accumualtion behavior across household types. In these cases it would be helpful to include a proxy for a distribution of motives to save in the estimation of the Life Cycle Model.

More work is needed to clarify what can be an appropriate measure for permanent income, pension wealth, Social Security wealth and other types of wealth components. In addition we can be greatly benefited if we have at least a much larger number of cross section data with more careful definitinal and sampling alignment or more substantial panel data. Under such circumstances we can extract in finer way the longitudinal effects of changes in intererst rates and various taxes and transfers. We also might be able formulate more appropriate collections of hypotheses to improve our understanding of household behavior and further macroeconomic activities.

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