A STUDY OF LIQUIDITY CONSTRAINTS AND PRECAUTIONARY SAVINGS: MICRO EVIDENCE FOR THE YOUNG

DISSERTATION

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

by

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1995

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Advisor
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To my parents
wife
and daughter
ACKNOWLEDGMENTS

My most sincere gratitude goes to my advisor, Dr. Paul Evans, for his invaluable guidance, insight, and encouragement throughout this work. I also thank my dissertation committee members, Dr. Nelson Mark and Dr. Pok-sang Lam for their comments and suggestions. Thanks also go to my colleagues and church members for their assistance and prayers.

And I owe special thanks to my parents, parents-in-law, wife, Junghee, and daughter, Brittany, for their endless love, support, and patience throughout my graduate work.
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CHAPTER I
INTRODUCTION

There has been a lot of discussion on the relevance of the life-cycle/permanent-income hypothesis (LPH).\(^1\) According to the LPH’s representative agent paradigm, a rational, forward-looking consumer can maximize lifetime utility subject to a lifetime budget constraint through the intertemporal allocation of consumption. A consumer can freely borrow against future earnings in a perfect capital market to smooth the path of consumption over time and to finance consumption in the earlier years by dissaving and paying off the debt later in the life cycle. One important point drawn from the LPH is that there is no correlation between the change in current

\(^1\)The life cycle theory and the permanent income hypothesis are originally two distinctive theories. See Modigliani and Brumberg (1954), Modigliani and Ando (1960), and Ando and Modigliani (1963) for the life cycle theory and Friedman (1957) for the permanent income hypothesis. However, they share many important things in common (e.g. the separation of the consumption and income profiles) and can be treated as a combined theory. In particular, the permanent income hypothesis does not specify the length of the horizon and also suggests that younger households may have difficulty borrowing against the future earnings. The contribution of Modigliani et al. and Friedman was that they transformed the notion of optimal consumption profile into a formal model that makes econometric estimation feasible. Furthermore, the LPH showed the empirical relevance of the separation of consumption and income profiles.
income and the change in consumption from the current period to the next.

One trend of the literature tests the time-series restrictions on the data implied by the LPH and rational expectations. Hall's random walk theory of consumption is a pioneering approach incorporating the notion of rational expectations with the LPH. Hall (1978) derives a testable implication of the LPH and argues that consumption is a martingale so that the only information useful in predicting its future values is its current value. He tests this implication using the postwar U.S. quarterly aggregate time-series data, finding little evidence against it.

The issue of the excess sensitivity of consumption to current income for the rejection of the LPH argues that consumption appears too sensitive to information about income, responding not only to the changes in permanent income signaled by innovations in the current income process but also to the changes in current income itself.

Another notable literature derives testable implications for the behavior of consumption in the presence of liquidity constraints. It is concerned with the consumption behavior of consumers who are restricted in their ability to borrow to

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2 See Hall (1978), Hansen and Singleton (1983), and Mankiw, Rotemberg and Summers (1985) along this line.

3 See Flavin (1981) for detail.
finance consumption and argues that the empirical rejection of the LPH may be due to the fact that some households are liquidity-constrained.4

In most prior analyses, questions have been raised about the extent to which the LPH is consistent with the evidence. There is evidence that changes in consumption are positively related to predictable changes in income.5 Many argue that simple representative agent models of the LPH are not likely to explain reality well without substantial modification.6 The empirical status of the LPH of consumers' behavior is thus seriously attacked.

The apparent empirical failure of the LPH partly lies in the fact that it cannot explain the behavior of the entire population. However, there is evidence that the LPH may be consistent with the observed behavior of households with only some exceptions. In particular, the aggregate time series data do not appear to have enough information to explain the complex individual behavior and the distribution of economic agents with respect to relevant characteristics. Micro data on the individual households may have an advantage over the aggregate time-series data in this regard.

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6 For example, Deaton argues that the LPH does not predict the sort of aggregate relationships that are implied by representative agent models.
The possibility of liquidity constraints is mentioned as one of the reasons for the failure of the LPH.\textsuperscript{7} Most of the time-series evidence does not necessarily reflect the importance of liquidity constraints but the cross-section evidence does. And many suggest that some of households in the population are at least influenced by either current or future liquidity constraints.\textsuperscript{8}

If consumers are liquidity constrained, the limited borrowing opportunities restrict their options regarding consumption. When their income declines, they have to reduce their consumption. For these consumers, consumption depends heavily on current income. The degree of liquidity constraints is likely to differ systematically by groups with different characteristics. It leads to differential effects on the young and the old, those with high and low wealth, etc. A temporary decline in current income is likely to reduce the consumption of the young and those with low wealth more appreciably than that of the old and those with high wealth.

In the first part of this dissertation, we assess the empirical relevance of the LPH for the consumption behavior of

\textsuperscript{7} Liquidity constraints usually refer either quantity constraints on the amount of borrowing or the differential interest rates between the loan rates and the borrowing rates, though it would be hard to find an empirical study that investigates the possibility of the latter.

\textsuperscript{8} For example, the $\lambda$-model assumes that a fraction $\lambda$ of aggregate income is received by households subject to liquidity constraints. See Campbell and Mankiw(1989, 1991) for detail.
young households by testing an individual consumption model with cross-sectional micro data adopted from panel data. We examine the effect of liquidity constraints on consumption in order to evaluate the quantitative importance of liquidity constraints and estimate the proportion of the population for which liquidity constraints appear relevant. We investigate whether consumption patterns vary among young households with different financial ability and demographic features.

For this work, we use the 1987-1988 National Longitudinal Survey of Youth (NLSY) data that include the detailed individual histories of earnings, assets and other information for young age cohorts for several years. This panel data set enables us to conduct an appropriate empirical test for our purpose as it is regarded as good micro data but not yet extensively used for this kind of research.

We find no evidence of liquidity constraints for young households even after selectivity bias is eliminated from our data. This result is contrary to the findings of Hayashi(1985a) that liquidity constraints are most evident for young households. So our finding provides micro evidence against the effect of liquidity constraints on consumption for young households.
When individuals are confronted with uncertain incomes, the precautionary saving motive leads them to consume less and save more to guard against bad luck. So an individual's optimal consumption is presumed to be a function not only of levels of current and expected future incomes and the previous period's assets but also of the uncertainty of the agents' environment.

There is a considerable literature on the implications of precautionary savings against future uncertainty, but it mostly centers on income uncertainty. Precautionary savings arise when individuals foresee income risk and thus consume less and save more to guard against possible income downturns in the future. In this context, many analyses of precautionary savings start with how uncertain income affects consumption and eventually conclude that precautionary savings may play a substantial role in consumer behavior and thus have important macroeconomic implications.

Along this line, Barsky, Mankiw, and Zeldes (1986) show that precautionary saving may result in a violation of Ricardian equivalence. Skinner (1988) argues that precautionary savings against uncertain income could comprise

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9 For example, see Leland (1968) as an introductory paper to this issue.

10 They argue that when taxes are levied on risky labor income, the marginal propensity to consume out of tax cut, coupled with a future tax increase, can be substantial because tax cut provides certain wealth while future tax increase is contingent upon future income.
up to 56 percent of aggregate life cycle savings. Kimball and Mankiw(1989) study the response of consumption to the timing of taxes and show that the impact of announced future tax cut causes an immediate increase in the level of consumption by reducing the variability of future income. Carroll(1994) tests an implication of the basic life cycle model of consumption and argues that the effect of future income uncertainty is important because it leads consumers facing greater income uncertainty to consume less.

The importance of precautionary savings has many policy implications with respect to capital accumulation. For example, the prevalence of government entitlement programs like social welfare and unemployment compensation may lower precautionary savings by reducing future income risk and thus may cause aggregate savings to decline.

Although there is plenty of research on the qualitative importance of precautionary savings, only a few attempt to directly test and measure the presence of precautionary savings. Kuehlwein(1991) tests for precautionary saving by deriving an explicit measure of consumer uncertainty, the expectational errors from a consumption Euler equation and finds no evidence of precautionary saving. Dynan(1993) focuses on consumption variability and provides an explicit measure that reflects the strength of the precautionary savings motive using data from the 1985 Consumer Expenditure Survey(CEX).
She finds a small estimate of relative prudence suggesting that precautionary saving is an unimportant determinant of consumer behavior.

The second part of this dissertation deals with precautionary savings revealed in consumption variability of the young households. This is motivated by Dynan (1993) and attempts to directly confirm the presence of precautionary savings on a micro foundation by testing consumption growth on variables that measure the variance of the agents' risky environment. It also provides a quantitative estimate of the importance of precautionary savings by deriving an explicit measure of precautionary motives, the coefficient of relative prudence.

We use data from the 1985-1988 NLSY for this empirical work. The fact that the NLSY covers a span of several years enables us to calculate a potentially better measure of risk than Dynan can from the 1985 CEX. The NLSY also allows us to get a broad measure of total consumption unlike the Panel Study of Income Dynamics in which only food consumption is available. Our test yields a significantly positive, but small, estimate of relative prudence for young households. This finding is not consistent with the widely accepted view that relative prudence should be large. However, it fairly confirms the finding of Dynan's (1993) that precautionary saving is an unimportant determinant of consumer behavior. But the
significance of estimated coefficient which is different from zero indicates that it can explain at least a small fraction of consumer behavior of young households.

We also perform the same test for our samples of high-wealth liquidity-unconstrained households and low-wealth liquidity-constrained households to check possible downward bias. The unconstrained sample produces similar results to those of the whole sample, but the constrained sample produces mixed results. Hence, allowing for liquidity constraints does not much alter our results.

The organization of this dissertation is as follows. In Chapters II and III, respectively, we present models, explain data and the variables used for empirical investigation, and discuss the empirical methods and their implications. Chapter II investigates the effects of liquidity constraints. It discusses a theoretical framework that is an extension of the analysis of Hayashi (1985a) and then tests the implication of the LPH and the existence of liquidity constraints based on this model. Chapter III is concerned with precautionary savings and consumption variability. It discusses a model, tests for precautionary savings, and provides an explicit measure of the precautionary motive. Finally, Chapter IV wraps up this dissertation, providing a brief summary and concluding remarks.
CHAPTER II
CONSUMPTION AND LIQUIDITY CONSTRAINTS

II. 1. MODEL SPECIFICATION

II. 1. 1. Theoretical Postulates

Let's assume that a household's consumption at any period is represented by a linear relationship of independent variables affecting consumer's decision.

\[ C_t = f( X ) + e_t \]  \hspace{1cm} [1]

where \( C_t \) = current consumption
\( f( X ) \) = the part of consumption explained by a vector of variables \( X \)
\( e \) = error term

Also given the existence of liquidity constraints, a household has constraints \( L \) such that consumption cannot exceed some upper limit exogenously given to it. A sufficiently large \( L \) implies the LPH, since consumption can be made large despite the liquidity constraint.
\[ C_{t+i} \leq L_{t+i} \quad (i = 0, 1, 2, \ldots) \]  

where \( L \) means upper bound of consumption 
the subscript \( t \) represents the current period 
and the subscript \( i \) means subsequent periods.

The optimal consumption in the current period \( C_t \) can be represented by:

\[ C_t = \min( C_t^*, L_t ) \]  

in which \( C_t^* \) is intertemporally optimal consumption where the future liquidity constraints may be present but the current liquidity constraint is not. \( C_t^* \) is referred to as desired consumption. Desired consumption may not be the level of consumption given by the LPH because future liquidity constraints may exist. Hence, the current optimal consumption \( C_t \) is:

\[ C_t = C_t^* \quad \text{if} \quad C_t^* \leq L_t \]  

\[ C_t = L_t \quad \text{if} \quad C_t^* > L_t \]  

(A) If \( C_t = C_t^* \), then households are not currently liquidity constrained, and we can neither reject nor accept the LPH.
(B) If \( C_t < C_t^* \), then households are currently liquidity constrained, which is sufficient to reject the LPH that
assumes that liquidity constraints are not present for all periods.

Let's assume that \( n \) households exist in the sample set \( N \).

\[
N = \{1, 2, \ldots, n\} \tag{6}
\]

In this entire sample \( N \), which is comprised of two subgroups, there are \( n_1 \) liquidity-unconstrained households in subsample \( N_1 \) and \( n_2 \) liquidity-constrained households in subsample \( N_2 \).

\[
N = N_1 + N_2 \tag{7}
\]
\[
N = \{1, 2, \ldots, n_1, n_1+1, \ldots, n\} \quad (n_2 = n - n_1) \tag{8}
\]

The first unconstrained group follows the consumption rule \( C_1 = f_1(X) \). The second constrained group is governed by \( C_2 = f_2(X) \).

Now, let \( G \) be an upper limit on consumption for a household that is not liquidity constrained. For this household, consumption does not exceed the threshold value. Let an individual household's consumption and a threshold value be \( g(X_n) \) and \( G \), respectively. Then,
(A) If a household consumption is less than the threshold value, it is presumed not to be liquidity constrained.

\[ g(X_n) < G : n \leq n_1 \text{ with probability one} \quad [9] \]

(B) If a household consumption is greater than or equal to the threshold value, it may be liquidity constrained.

\[ g(X_n) \geq G : \text{prob}(n \leq n_1) < 1 \quad [10] \]

Because the probability that a household is not liquidity constrained given that its consumption is less than \( G \) is one, \( g(X_n) = f_1(X_n) \). As a result, \( f_1(X) \) can be estimated using least squares for the sample of households satisfying \( g(X_n) < G \).

The probability that a household is liquidity-constrained given that its consumption is greater than or equal to \( G \) is positive if \( n_1 > 0 \). Therefore, for some of the households in this sample, \( g(X_n) = f_2(X_n) \neq f_1(X_n) \). As a result, estimating the relationship between \( C \) and \( X \) for this sample using least squares produces some function intermediate between \( f_2(X_n) \) and \( f_1(X_n) \). The function is closer to \( f_2(X_n) \), the lower \( \text{prob}(n \leq n_1 \mid g(X_n) \geq G) \) is for the sample. In the limit that this probability is zero, the function becomes \( f_2(X) \).
There is a trade-off in selecting $G$. On the one hand, if $G$ is too high, $\Pr( n \leq n_1 \mid g(X_n) < G ) = 1$ may not hold so that $f_1(C)$ is estimated with bias. On the other hand, if $G$ is too low, the estimate from the second sample may not differ much from $f_1(C)$. Statistical tests of the nonzero differences may thus have little power. Thus, care should be taken in selecting $G$. 
II. 1. 2. Hypothesis and Discussion

Assumption # 1.

This assumption sets the specific upper bound $L$ for current consumption.

$$L \geq YD^* + 0.2 \text{ LIQ} \quad [11]$$

where $YD^*$ is disposable income and LIQ is the amount of liquid assets.

The R.H.S is the amount at households' disposal for consumption without borrowing. It implies that households can spend at least $YD^* + 0.2 \text{ LIQ}$ in the current period if they want to without any need to borrow. Households are assumed to be willing to spend down only a fraction of liquid assets in any period. The reason is that they may expect to face future liquidity constraints or may want to take precautions against unexpected future liquidity constraints. Alternatively, proportional transaction costs may make gradual spending of liquid assets optimal. The figure 0.2 is a plausible lower bound for the correct figure.$^{11}$

$^{11}$Because recent financial innovation has made assets more liquid, it may be reasonable to consider a larger figure. The figure 0.2 is adopted to make the results here comparable to those of Hayashi(1985a).
Assumption # 2.

This assumption is about how to derive desired consumption $C^*$. Let $X$ be a vector of variables that are available from the data set. It includes all the available information such as disposable income and assets. The expectation of desired consumption conditional on $X$ is a linear function of $X$.

$$E (C^*| X) = X' a$$  \[12\]
$$C^* = X' a + e, \quad E (e| X) = 0$$ \[13\]

where $E$ is expectational operator.

The error term $e$ includes anything that is not explained by $X$ and the expected value of $e$ conditional on $X$ is zero. This equation is the reduced-form equation for desired consumption $C^*$ since it is a regression of $C^*$ on $X$. (In terms of the theory, $f_1(X)$ and $f_2(X)$ are assumed to be linear.)

Assumption # 3.

This is the assumption pertaining to the correlation between measurement error $u$ and independent variable $X$. It allows measurement error to have a nonzero conditional mean. The expectation of $u$ conditional on $X$ is nonzero.
\[ E(ul X) = X'd \] \[ u = X'd + v, \quad E(vl X) = 0 \]

where \( v \) is the error term for measurement error.

**Assumption # 4.**

This assumption is about the error term of the reduced-form equation that will be estimated. From the previous assumptions (Assumption # 2 and # 3), the reduced-form equation for desired consumption \( C^* \) is the following equation.

\[ C^* + u = X'b + (e + v) \quad E((e + v) l X, u) = 0 \] \[ b = a + d \]

The error term \( (e + v) \) of the reduced-form equation for \( C^* \) has a zero mean and is normal and homoscedastic. This is to make sure that the estimators obtained by the OLS are not only unbiased and consistent but also are minimum variance unbiased estimators. Desired consumption \( C^* \) is expressed as a function of \( X \) which is the reduced-form determinants under the LPH. The R.H.S. of the above first equation includes essentially all the information about budget constraints. This
consumption equation is estimated by the ordinary least squares estimation based on the previous assumptions.

Now, let's set the threshold consumption (G) as a fraction of consumption upper bound L. The reason for this is to reduce the possibility that measured consumption by liquidity constrained households satisfies the sample separation rule \( \text{CON} < G \).\(^{12}\)

\[
G = 0.85 \times (\text{YD} + 0.2 \text{LIQ})
\]  \[17\]

Define the limited dependent variable \( Y \) as:

\[
Y = \begin{cases} 
\text{CON} & \text{if } \text{CON} < G \\
G & \text{otherwise (e.g. } \text{CON} \geq G) 
\end{cases}
\]  \[18\]

or

\[
Y = X'b + (e + v) \text{ if } X'b + (e + v) < G \\
Y = G \text{ otherwise}
\]  \[19\]

According to the model above, dependent variable values are not observed beyond the threshold value \( G \), but the corresponding explanatory variable observations are available and form part of data set used for estimation. If the dependent variable value is observed and takes a value below the

\(^{12}\) See Hayashi (1985a) for more detail.
threshold level, it is classified as non-limit observation. If the dependent variable value is not observed and takes a fixed value since it is above the threshold value, it is classified as limit observation. In this case, an explanatory variable may influence both the probability of limit observations and the size of non-limit observations.

We cannot directly use the OLS on the equation above, since the OLS method generates biased estimates. The disturbances do not have zero mean. It is possible to have values of the explanatory variables for which the expected value of the dependent variable is its limiting value and from this expected value, as from other expected values, we may have negative deviations as well as positive ones. Some values of \((e + v)\) greater than \((G - X'b)\) are not allowed. This leads to bias and inconsistency in the OLS estimators of the parameters. Then, this equation can be estimated by the Tobit procedure.\(^{13}\)

Thus, two different estimates of the reduced-form equation for desired consumption can be obtained. One is from the OLS estimation and the other is from the Tobit estimation. We make the following hypotheses.

\(^{13}\) Tobin analyzed the similar censored model problem on the demand for durable goods. See Tobin(1958), Amemiya(1973), and Maddala(1983) for more about Tobit model.
(A) The null hypothesis \(H_0\) is that no households are currently liquidity constrained. True consumption \((C)\) is equal to desired consumption \((C^*)\). In this case, the OLS can estimate an efficient and asymptotically normal coefficient \(b\).

\[ C = C^* \quad \text{and} \quad \text{CON} = X'b + (e+v) \quad [22] \]

(where \(\text{CON}\) is measured consumption and

\[ \text{CON} = C + u \quad \text{and} \quad C^* + u = X'b + (e+v) \]

(B) The alternative hypothesis \(H_1\) is that some of the households are currently liquidity constrained. But the Tobit procedure can generate a consistent and asymptotically normal estimate of \(b\) even if the alternative hypothesis is true.

If the null hypothesis \(H_0\) that no households are currently liquidity constrained is true, then the OLS and the Tobit procedure should yield the estimates that should not be statistically different. A significant difference implies that some households in the population are currently liquidity constrained. This is sufficient to reject the LPH which assumes that the current and future liquidity constraints do not exist.

If the alternative hypothesis \(H_1\) that some households are currently liquidity constrained is true, then the OLS and
the Tobit procedure should yield statistically different estimates. Moreover, the consumption forecasted from the Tobit coefficients should be larger than those from the OLS for the limit observation group.

Since the expectation of e is zero and $b_{Tobit}$ is the Tobit estimate of $b$ that is consistent for $b$, the difference between desired consumption $C^*$ and true consumption $C$ (e.g. $C^* - C$) can be consistently estimated as the difference between the sample mean of $X'b_{Tobit}$ and the sample mean of CON. If the measurement error($u$) has a zero mean, then the sample mean of $X'b_{Tobit}$ is a consistent estimate of $C^*$.

Wrapping up our discussion so far, we set the strategy for our empirical work in two ways:
(A) By comparing the two sets of estimates from the OLS and from the Tobit, we can assess the significance of liquidity constraints.
(B) By comparing the sample mean of predicted desired consumption ($X'b_{Tobit}$) with the sample mean of measured consumption (CON) and the sample mean of predicted consumption with the OLS estimate ($X'b_{OLS}$) on the entire sample, we can evaluate the quantitative importance of liquidity constraints.
II. 2. EMPIRICAL ANALYSIS

II. 2. 1. Data Description

The data for this empirical work came from the 1987-1988 National Longitudinal Survey of Youth (NLSY)\textsuperscript{14}. The NLSY is a longitudinal study that follows the same age cohort of youths over an extended period of time. It is micro panel data with observations on the same households for several periods, providing various detailed information such as the financial and demographic characteristics of young households in the U.S. Thus, it contains financial data including income, various selective assets, debt and other data such as education, marital status, age, employment and family size over the years.

In case of income, the NLSY supplies the information about the sources and amounts of income for each respondent, spouse, and the family over several years on the fields of military income, wage and salary, farm and business income, food stamps, educational benefit, assisted income from other

\textsuperscript{14} The National Longitudinal Survey (NLS) contains histories of earnings, assets and other information for some specific age groups over a span of several years. It originally aimed at conducting longitudinal study of the labor market experience of the United States population. In the late 1970s, consideration was given to a replication of the analysis of the earlier cohorts of youth as an extension of the study. This survey is called the National Longitudinal Survey of Youth (NLSY) and it covers young men and women between the ages of 14 and 21 as of January 1, 1979 when the initial survey started and personal interviews have been conducted each year with the respondents.
person, miscellaneous income and net family income. Asset information is available for the market values of residential property, liquid asset, farm and business, vehicle and other assets for respondents and spouses alike for the same periods. Debt information is classified in terms of mortgage and back taxes, other debt on residential property, debt on farm and business, debt on vehicle and other debt for the corresponding periods.

What is relevant for our analysis is the income, asset, debt and other demographic data that cover the years of 1987 through 1988. During this period, the respondents were between 22 and 30 in age. As a result, they were in a relatively earlier stage of their life cycle with respect to income-earning and asset-accumulation.
II. 2. 2. Constructed Variables

The variables created for this analysis are as follows;

NFI = total net family income during a year from various sources before taxes or other deductions. This also includes some transfer payments such as unemployment compensation benefits, AFDC(Assistance to Families with Dependent Children), food stamps, educational benefits.

MAS = amount of liquid assets such as money assets like savings account.

VRP = market value of houses and other real estate.

MBT = amount of mortgages and back taxes owed on residential property.

DRP = amount of other debts owed on residential property.

MFB = total market value of farm, business, and other property.

DFB = total amount of debts on farm, business, and other property.

MVH = total market value of all vehicles including automobiles.

DVH = total amount of money owed on vehicles including automobiles.

MOA = total market value of all other assets.

ODB = total amount of other debts.
\( \text{EMP} = \) employment status of the household head. (currently employed: 1, otherwise: 0)

\( \text{HGR} = \) highest grade completed of the household head representing education level. (from no education: 0, 1-11 grade, high school graduate: 12, 4th-year college graduate: 16, through to post-graduate level up to maximum 20.)

\( \text{MRS} = \) marital status of the household head. (currently married: 1, otherwise: 0)

\( \text{AGE} = \) age of the household head.

\( \text{FSZ} = \) family size. (number of family members living together)

\( \text{SCH} = \) currently attending or enrolled in school? (yes: 1, otherwise: 0)

\( \text{ERN} = \) the number of earners in each household.

\( \text{EMP}, \text{SCH} \) and \( \text{MRS} \) are independent dummy variables that either take 1 or zero because they are qualitative and categorical in nature.

Based on the above variables, we also define and calculate the following variables for each year.

\( \text{AST} = \) net market value of financial and physical assets.

\( \text{SAV} = \) household saving during a year defined as net changes in assets \((\text{AST}_{t} - \text{AST}_{t-1})\), since saving equals the
difference between asset holding in one period and that in a subsequent period.

\[ \text{CON} = \text{measured household consumption during a year derived as (NFI - SAV)} \]

\[ \text{DEB} = \text{total household debt} \]

\[
\begin{align*}
\text{AST8} &= \text{MAS8} + (\text{VRP8} - \text{MBT8} - \text{DRP8}) + (\text{MFB8} - \text{DFB8}) + (\text{MVH8} - \text{DVH8}) + (\text{MOA8} - \text{ODB8}) \quad [23] \\
\text{AST7} &= \text{MAS7} + (\text{VRP7} - \text{MBT7} - \text{DRP7}) + (\text{MFB7} - \text{DFB7}) + (\text{MVH7} - \text{DVH7}) + (\text{MOA7} - \text{ODB7}) \quad [24] \\
\text{SAV8} &= \text{AST8} - \text{AST7} \quad [25] \\
\text{CON8} &= \text{NFI8} - \text{SAV8} \quad [26] \\
\text{DEB7} &= \text{MBT7} + \text{DRP7} + \text{DFB7} + \text{DVH7} + \text{ODB7} \quad [27] \\
\text{(note: CON8 = consumption of 1988)} \\
\text{SAV8} &= \text{saving of 1988,} \]

\begin{align*}
\text{AST8} &= \text{net asset of 1988,} \\
\text{AST7} &= \text{net asset of 1987 etc)}
\end{align*}

---

\[ \text{For each household, consumption expenditure includes expenditure on services, non-durables, and some durables excluding house, farm, business and vehicles. Saving is a change in asset value during two subsequent periods. Current expenditures on house, farm, business and vehicles can add to an increase in their market values and hence in current saving. Hence, savings capture most of expenditures on durables.} \]
II. 2. 3. The Ordinary Least Squares Estimation

Our initial sample of young households in the panel data consists of 633 households. After we exclude non-interviews and incomplete responses (305 cases), too low and even negative consumption (38 cases), and outliers and truncated variables (38 cases), the sample is reduced to 252 cases. The sample mean, standard deviation of the key variables listed above are shown in Table 1.

In order to check the fitness of data, preliminary consumption regression was performed using only disposable income and net asset as independent variables.

\[
\begin{align*}
\text{CON8} &= a + b \text{ NFI8} + \epsilon \\
\text{CON8} &= a + b \text{ NFI8} + c \text{ AST7} + \epsilon
\end{align*}
\]

[28] [29]

Our criterion for acceptable coefficients of disposable income and net asset in the consumption equations are \(0.3 < b < 0.9\) and \(0.04 < c < 0.06\). The estimated regression result in detail is shown in Table 2. Result shows that both estimated coefficients fall within the acceptable range and are reasonable considering young household's consumption behavior.

The goal is to test the LPH against the more general case of liquidity constraints without generating an optimal
consumption rule. In order to test the LPH and evaluate the quantitative importance of liquidity constraints, we first regress consumption on variables available in the data and then basically separate the sample into two groups. The first group consists of households whose consumption is below the threshold value of consumption (non-limit observations). The second group consists of households whose consumption is above or equal to the threshold level of consumption (limit observations).

In the first place, in our regression equation, \( \text{CON} = X'b + (e+v) \), we assume that the vector \( X \) as independent variables consists of the following variables, virtually including all the variables available in the data; the constant, the value of residential property(\( \text{VRP7} \)), liquid assets(\( \text{MAS7} \)), net assets(\( \text{AST7} \)), disposable income(\( \text{NFI8} \)), employment(\( \text{EMP8} \)), education(\( \text{HGR8} \)), marriage(\( \text{MRS8} \)), age(\( \text{AGE8} \)), family size(\( \text{FSZ8} \)), total debt(\( \text{DEB7} \)), current enrollment in school(\( \text{SCH8} \)), the number of earners in a household(\( \text{ERN8} \)), and squared age(\( (\text{AGE8})^2 \)).\(^{16}\) The squared term in \( \text{AGE8} \) is included to explain possible differences in the consumption behavior by younger and older households. Because relatively high saving(or low consumption considering disposable income) households

\(^{16}\) Because age varies little in this sample, squared age may be excluded in the regression.
are not likely to be liquidity constrained, the estimated consumption equation is an appropriate description of how desired consumption is linked to the variables available in the data.

The regression result in detail is reported in Table 3. As is expected a priori, disposable income(NFI8) and net asset(AST7) have positive coefficients and are significant. Both debt(DEB7) and the value of residential property(VRP7) have negative coefficients, though only the former is significant. It indicates that most of the debts of a young household is closely associated with the payment for housing purchase and thus money available for consumption is sharply reduced.

Marital status(MRS8) has a negative coefficient and is significant. It appears that married couple tends to prudently curb consumption and save more. This probably suggests a housing effect. Surprisingly, the liquid asset(MAS7)'s coefficient is positive but small and insignificant. Age coefficients(AGE8, (AGE8)^2) are not significant. We note that our sample includes only young households that do not show a lot of variation in their ages. Employment status(EMP8) and family size(FSZ8) have positive coefficients but they are not significant. The number of earners in each family(ERN8) shows a negative coefficient but it is not significant.
Education is presumed to have additional explanatory power in determining whether or not a household holds adequate assets. Households in which the head received a high level of education are more likely to hold larger amounts of assets. In our estimation, education variables (HGR8 and SCH8) have negative coefficients but they are not significant.

In summary, the coefficients of NFI8 and AST7 are positive and significant and those of MAS7, FSZ8, EMP8 and (AGE8)² are positive but not significant. The coefficients of DEB7 and MRS8 are negative and significant and those of VRP7, HGR8, AGE8, SCH8, and ERN8 are negative but not significant.

In order to get significant coefficients only in our estimation, we use backward stepwise regression. It begins with all the candidate variables, removes the least significant predictor in order of t-ratios at the first step, and continues until every variable gets significant. The result is reported in Table 4. It shows that NFI8 and AST7 have significant positive coefficients but MRS8 and DEB7 have significant negative ones.
II. 2. 4. The Tobit Estimation

Now, we turn to sample separation procedure and employ a different estimation method on that sample. Our analysis deals with a case of limited dependent variable, which is referred to as the Tobit estimation solving censored regression problems.

Following Hayashi (1985a), we estimate a general reduced form equation for consumption for households by the Tobit procedure and compare this with the result by the ordinary least squares estimation (OLS). If the two estimates of the same equation for consumption are significantly different, a fraction of the households in the sample are presumed to be liquidity constrained. Also, the existence of liquidity constraints is apparent when we find a significant discrepancy between the desired consumption estimated by the Tobit procedure and the actual consumption.

Firstly, sample separation procedure is carried out on the whole sample. It is based on the threshold value that is set arbitrarily. The threshold value G depends on the size of disposable income (NFI8) and liquid asset (MAS7). Of the sample of 252 households, 77 households satisfied the

17 We adopt the same coefficients as those of Hayashi (1985a) in order to make the comparison possible.
criterion that \( \text{CON} < G = 0.85 * ( YD + 0.2 \text{ LIQ} ) \) (non-limit observation) and 175 households didn't with \( \text{CON} \geq G = 0.85 * ( YD + 0.2 \text{ LIQ} ) \) (limit observation). The threshold value \( G \) that splits the whole sample is represented by a fraction of disposable income and liquid asset. It differs from one household to another depending on the size of disposable income and liquid asset. In our case, disposable income(\( YD \)) is net family income(\( \text{NFI8} \)) and liquid asset(\( \text{LIQ} \)) is money asset(\( \text{MAS7} \)). Table 5 reports the sample mean and standard deviation of the variables for the non-limit observations and for the limit observations.

The mean of disposable income of the non-limit observation group is higher than that of the limit observation group. Moreover, the mean of asset of the non-limit observations is higher than that of the limit observations. So relatively rich young households are selected in the non-limit observation group. On average, non-limit observation households save a substantial amount(\$12,099) while limit observation households show negative saving(\(-\$3,234\)). And we also note that non-limit observation households have more number of earners on average in their households than their counterparts(1.42 vs. 1.18).
Secondly, we carry out the Tobit estimation by maximum likelihood estimation considering the threshold value affecting the value of dependent variable. The general Tobit model is

\[ Y = X'b + e \quad \text{if RHS} > 0 \]  \hspace{1cm} [30]

\[ Y = 0 \quad \text{if RHS} \leq 0 \]  \hspace{1cm} [31]

\( Y \) = dependent variable  \\
\( X \) = independent variable  \\
\( b \) = coefficient  \\
\( e \) = error term  \\
\( \text{RHS} \) = right hand side

Our model is

\[ \text{CON} = X'b + (e+v) \quad \text{if } X'b + (e+v) < G \]  \hspace{1cm} [32]

\[ \text{CON} = G \quad \text{otherwise} \]  \hspace{1cm} [33]

\( G \) = threshold value

In order to apply the general model, our model is transformed into

\[ G - \text{CON} = G - (X'b + (e+v)) \quad \text{if RHS} > 0 \]  \hspace{1cm} [34]

\[ G - \text{CON} = 0 \quad \text{if RHS} \leq 0 \]  \hspace{1cm} [35]
And this is the model on which we carry out maximum likelihood estimation to get Tobit estimates \( b \).

The result of the Tobit model estimation is displayed in Table 6. The estimation was performed by the maximum likelihood estimation using Quasi-Newton method. Looking at the Tobit estimation result, we note that disposable income(NFI8) and net asset(AST7) have positive coefficients while the marital status(MRS8) and debt(DEB7) have negative coefficients. Comparing the Tobit estimates with the OLS estimates, they appear to be quite similar to each other. This similarity may shed light on the argument against the effect of liquidity constraints on the behavior of many young households.

Moreover, in order to evaluate the importance of liquidity constraints, we compare the sample mean of measured consumption on the entire sample with the sample mean of predicted desired consumption \( X' \hat{b}_{Tobit} \). If the Tobit estimate is consistent for \( b \) and expectation of the measurement error\((u)\) is zero, then the sample mean of \( X' \hat{b}_{Tobit} \) is a consistent estimate of desired consumption \( C^* \). The comparison result is in Table 7.

The mean of predicted desired consumption\((X' \hat{b}_{Tobit})\) is $24,890 and the mean of measured consumption\((CON)\) is $24,600. Therefore, on average, the predicted desired
consumption is just a little higher than the measured consumption with the measured consumption 1.2% below the desired consumption level. Also the predicted consumption by the OLS is 1.1% below the desired consumption. Quantitatively, the magnitude of liquidity constraints does not seem to play an important role in affecting consumption as is suggested by the difference between the measured consumption or the OLS consumption and the Tobit consumption. It seems that the reason why the predicted desired consumption slightly overstates the measured consumption is because of the credit availability to the young households more accessible than ever before. (for instance, the enhancement of asset liquidity and the proliferation of credit cards, etc.)

The average ratio of predicted desired consumption to disposable income is 0.95. Although about 69% (175 cases out of 252 cases) of young households are from limit observations, predicted desired consumption exceeds measured consumption for only about 23% (59 cases out of 252 cases) of the entire young households, who are presumed to be liquidity-constrained. So the effect of liquidity constraints is not so evident even for young households in our analysis as is expected ex ante. This result is contrasting to what Hayashi (1985a) found in his cross-sectional analysis that not only the discrepancy between predicted desired consumption
and measured consumption is the largest for the young but also their average ratio of predicted desired consumption to disposable income exceeds one and thus the effect of liquidity constraints is most evident for young households. We compare our results with Hayashi’s (1985a). This is shown in Table 8.
CHAPTER III
PRECAUTIONARY SAVINGS AND CONSUMPTION VARIABILITY

III. 1. MODEL SPECIFICATION

Suppose a finitely-lived representative agent in a life cycle setting. This agent has a time-separable, instantaneous utility function. Formally this agent's problem at time $t$ can be stated as;

$$\max_{C_{t+j}} E_t \left[ \sum_{j=0}^{T-t} (1+\delta)^{-j} U(C_{t+j}) \right]$$  \[36\]

subject to the budget constraint

$$C_{t+j} = Y_{t+j} + (1+r)A_{t+j} - A_{t+j+1}$$  \[37\]

$A_t$ is given and the terminal condition $A_{T+1}=0$

where

$E_t = \text{expectations operator conditional on all information available at time } t$

$T = \text{the time of death}$

$\delta = \text{the subjective rate of time preference which is assumed to be constant over time and across households}$
\( r \) = the real interest rate which is assumed to be constant across households 

\( U \) = one-period, instantaneous utility function, which is separable and additive over time and it is strictly concave \((U'' < 0)\)

\( C \) = consumption 

\( Y \) = uncertain labor income 

\( A \) = nonhuman wealth

The first order condition for \( j=1 \) for the intertemporal utility maximization problem above yields the following set of Euler equation.

\[
U'(C_t) = \frac{(1+r)}{(1+\delta)} E_t [U'(C_{t+1})]
\]

[38]

Apply the second order Taylor-expansion series to approximate \( U'(C_{t+1}) \) to the above Euler equation.

\[
U'(C_{t+1}) = U'(C_t) + U''(C_t)(C_{t+1}-C_t) + \frac{1}{2} U'''(C_t)(C_{t+1}-C_t)^2
\]

[39]

And substitute it for the first order condition and rearrange.

Then,

\[
E_t \left[ \frac{(C_{t+1}-C_t)}{C_t} \right] = \frac{(1/\mu)(r-\delta)}{(1+r)} + \frac{p}{2} E_t \left[ \left\{ \frac{(C_{t+1}-C_t)}{C_t} \right\}^2 \right]
\]

[40]
where \( \mu = -C_t(U''/U') \), which is the coefficient of relative risk aversion
\( \rho = -C_t(U'''/U'') \), which is the coefficient of relative prudence.

We have developed a closed-form life cycle model of consumption to explain precautionary savings. And we provide an explicit estimate of the parameter in the utility function that reflects the strength of the precautionary saving motive. Equation [40] implies that higher uncertainty represented by higher expected variance of consumption is positively related to higher expected consumption growth if the third derivative of utility is positive (\( U''' > 0 \)), and vice versa.

If \( \rho \) is positive with \( U''' > 0 \), then expected consumption growth, \( E_t[(C_{t+1} - C_t)/C_t] \), is positively associated with expected squared consumption growth, \( E_t[(C_{t+1} - C_t)/C_t]^2] \). Therefore, higher expected consumption growth reflecting higher saving is linked to higher expected squared consumption growth reflecting greater uncertainty.

Considering several periods with which individual's consumption stream is associated, expected consumption growth can be replaced by an average of realized consumption growth, ex post. In this way the model becomes tractable and
it paves a way to measure the strength of the precautionary saving motive using micro panel data on consumption.

Equation[39] can be transformed into,

\[
1/N \sum_{t=1}^{N} \{(C_{t+1}-C_t)/C_t\} = (1/\mu) \frac{(r-\delta)}{(1+r)} + (\rho/2) \left[1/N \sum_{t=1}^{N} \{(C_{t+1}-C_t)/C_t\}^2\right] + \epsilon \tag{41}
\]

or

\[
\text{avg}(GC)_{i} = \left(\frac{1}{\mu}\right) \frac{(r-\delta)}{(1+r)} + (\rho/2) \text{avg}(GC^2)_{i} + \epsilon \tag{42}
\]

where \((GC)_{i}\) represents individual's consumption growth

\(N\) represents the number of periods in the sample

\(\text{avg}(\ .\ )\) means the average of \((\ .\ )\)

\(\epsilon\) is error term arising when expected values are replaced by sample means.

Equation[42] is estimated to derive \(\rho\), the coefficient of relative prudence and the size of \(\rho\) determines the strength of the precautionary saving motive. The error term \(\epsilon\) is presumably correlated with \(\text{avg}(GC^2)_{i}\). The ordinary least squares(OLS) estimate of \(\rho/2\) in Equation[42] is biased and inconsistent. Hence we choose instrumental variables uncorrelated with the disturbance \(\epsilon\). The selected instrumental variable should be exogenous and the covariance between the error term and the instrumental variable should be zero but the covariance of the instrument with the regressed and with the regressor should be nonzero and finite. So we use two-stage
least squares (2SLS) regression to get consistent estimates of $\rho / 2$. The method of two-stage least squares yields consistent estimators of the coefficients of an equation if the equation is just identified or overidentified.
III. 2. EMPIRICAL ANALYSIS

III. 2.1. Data Description and Constructed Variables

The 1985-1988 National Longitudinal Survey of Youth (NLSY) is used for the empirical work. The NLSY is a longitudinal study that follows the same age cohort of youths over an extended period of time, tracking down observations on the same households. It contains information on the income, assets, and financial and demographic characteristics of young households in the U.S. on a yearly basis. In the data we choose, the respondents were in their twenties.

Some variables are directly selected from the data but others are constructed and calculated based on them. Asset (AST) is defined as net market value of financial and physical wealth. Saving (SAV) is defined as net changes in assets during two subsequent periods (AST_t - AST_{t-1}). Consumption (CON) is calculated from the net family income (NFI) and the level of assets for each household. So, CON = NFI - SAV. Durable expenditures like payment for houses, farm, business and vehicles are excluded from consumption, but other durable expenditures as well as services and non-durable expenditures are included. So we obtain a broad measure of consumption that covers a wide range of consumption expenditure. We calculate each year's
consumption and it is adjusted for household size by dividing consumption by the number of family members in each household. Consumption growth is obtained by dividing the change in individual consumption during the two subsequent periods by the previous period’s amount.

The NLSY contains variables that measure the variance of agent's environment and may predict uncertainty in the future. These variables may be good instruments for \( \text{avg}(GC^2) \), which is the average of squared consumption growth implying consumption variability. We select qualitative and categorical instruments in education (SCH, HGR), employment (EMP), family size (FSZ), marital status (MRS), age of household head (AGE), the number of earners in each household (ERN). And initial asset (AST5) is chosen as a quantitative instrument. Following is the description of the variables we choose in our analysis.

\[ \text{NI} = \text{total net family income during a year from various sources before taxes or other deductions. This also includes some transfer payments such as unemployment compensation benefits, AFDC (Assistance to Families with Dependent Children), food stamps, educational benefits.} \]

\[ ^{18} \text{It is theoretically more reasonable to divide consumption by the number of adult equivalents in each household than by the number of family members. But it is impossible to get appropriate adult equivalents based on our data. Moreover, children's consumption level seems to be as much as that of adults as far as nondurable consumption is concerned.} \]
MAS = amount of liquid assets such as money assets like savings account.

VRP = market value of houses and other real estate.

MBT = amount of mortgages and back taxes owed on residential property.

DRP = amount of other debts owed on residential property.

MFB = total market value of farm, business, and other property.

DFB = total amount of debts on farm, business, and other property.

MVH = total market value of all vehicles including automobiles.

DVH = total amount of money owed on vehicles including automobiles.

MOA = total market value of all other assets.

ODB = total amount of other debts.

EMP = employment status of the household head. (currently employed: 1, otherwise: 0)

SCH = Currently attending or enrolled in school? (yes: 1, otherwise: 0)

HGR = highest grade completed of the household head representing education level. (from no education: 0, 1-11 grade, high school graduate: 12, 4th-year college graduate: 16, through to post-graduate level up to maximum 20.)

MRS = marital status of the household head. (currently married: 1, otherwise: 0)
\( \text{AGE} = \text{age of the household head.} \)

\( \text{FSZ} = \text{family size. (number of family members living together)} \)

\( \text{ERN} = \text{the number of earners in each household.} \)

\( \text{EMP, SCH and MRS are independent dummy variables that either take 1 or zero because they are qualitative and categorical in nature.} \)

\( \text{AST} = \text{net market value of financial and physical assets.} \)

\( \text{SAV} = \text{household saving during a year defined as net changes in assets} (\text{AST}_t - \text{AST}_{t-1}), \text{ since saving equals the difference between asset holding in one period and that in a subsequent period.} \)

\( \text{CON} = \text{measured household consumption during a year derived as} (\text{NFI} - \text{SAV}). \)

The calculation of consumption in each year (1986, 1987, 1988) is as follows. (The number attached to each variable implies year.)

\[
\text{AST8} = \text{MA58} + (\text{VRP8} - \text{MBT8} - \text{DRP8}) + (\text{MFB8} - \text{DFB8}) + (\text{MVH8} - \text{DVH8}) + (\text{MOA8} - \text{ODB8}) \quad [43]
\]

\[
\text{AST7} = \text{MAS7} + (\text{VRP7} - \text{MBT7} - \text{DRP7}) + (\text{MFB7} - \text{DFB7}) + (\text{MVH7} - \text{DVH7}) + (\text{MOA7} - \text{ODB7}) \quad [44]
\]

\[
\text{AST6} = \text{MAS6} + (\text{VRP6} - \text{MBT6} - \text{DRP6}) + (\text{MFB6} - \text{DFB6}) + (\text{MVH6} - \text{DVH6}) + (\text{MOA6} - \text{ODB6}) \quad [45]
\]
\[ \text{AST5} = \text{MAS5} + (\text{VRP5} - \text{MBT5} - \text{DRP5}) + (\text{MFB5} - \text{DFB5}) + (\text{MVH5} - \text{DVH5}) + (\text{MOA5} - \text{OBD5}) \]  

\[ \text{SAV8} = \text{AST8} - \text{AST7} \]  
\[ \text{SAV7} = \text{AST7} - \text{AST6} \]  
\[ \text{SAV6} = \text{AST6} - \text{AST5} \]  

\[ \text{CON8} = \text{NFI8} - \text{SAV8} \]  
\[ \text{CON7} = \text{NFI7} - \text{SAV7} \]  
\[ \text{CON6} = \text{NFI6} - \text{SAV6} \]  

\( \text{ICN} \) = consumption in each household adjusted by the family size.  
\[ \text{ICN8} = \text{CON8}/\text{FSZ8} \]  
\[ \text{ICN7} = \text{CON7}/\text{FSZ7} \]  
\[ \text{ICN6} = \text{CON6}/\text{FSZ6} \]  

\( \text{GICN} = \text{avg}(GC)_i \) = average of annual consumption growth for each household for 1985-1988.  
\[ = \frac{1}{2} \left\{ (\text{ICN7} - \text{ICN6})/\text{ICN6} + (\text{ICN8} - \text{ICN7})/\text{ICN7} \right\} \]  

\( \text{SICN} = \text{avg}(GC^2)_i \) = average of squared annual consumption growth for each household for 1985-1988.  
\[ = \frac{1}{2} \left\{ ((\text{ICN7} - \text{ICN6})/\text{ICN6})^2 + ((\text{ICN8} - \text{ICN7})/\text{ICN7})^2 \right\} \]
III. 2. 2. The Two-stage Least Squares Estimation

Our initial sample of young households in the NLSY consists of 633 households. For the four year span (1985-1988), interviews fail to take place for 194 households, 16 households are dropped due to providing insufficient data, and 93 households are deleted because of negative or zero consumption. We end up with 330 young households. In order to make sure that the instruments are not correlated with the error term, realizations of these variables from the first year (1985) of data for a household are used. We also use the two-stage least squares method to get consistent estimates of the coefficient of relative prudence.

At the first stage, we check how the instruments explain the variability of consumption. Our hypothesis in this estimation is the following.

The null hypothesis ($H_0$): The coefficients of the instruments of the squared consumption growth, $\text{avg}(GC^2)$, equal zero.

The alternative hypothesis ($H_1$): The coefficients of the instruments of the squared consumption growth, $\text{avg}(GC^2)$, do not equal zero.
We estimate with four alternative sets of instruments. The first two sets are composed of the qualitative instruments available in our data and the last two sets contains the quantitative instrument (AST5) in addition to the qualitative instruments. Specifically, the first set includes instruments such as education, employment, family size, marital status, age, and the number of earners. The second set omits the education instruments (SCH5, HGR5) from the first set. The third set includes the initial asset (AST5) as a quantitative instrument in addition to the first set. The fourth set omits the education instruments from the third set. The reason for the above procedure is because we conjecture that education and initial asset are important instruments with a big impact. We restrict the term \((r-\delta)/(1+r)\) to be the same across households by assuming the same real interest rate and time preference rate.

In the second stage, we obtain the estimated coefficients on \(\text{avg}(GC^2)_i\) and thus the coefficient of relative prudence that reflects the strength of precautionary saving motive. Our hypothesis in this estimation is the following.

The null hypothesis \((H_0)\): The coefficient of relative prudence equals zero.

The alternative hypothesis \((H_1)\): The coefficient of relative prudence does not equal zero.
The results are summarized in Table 9 and Table 10. Table 9 refers to the results associated with only the qualitative instruments and Table 10 entails initial asset (AST5) as the quantitative instrument.

At the first stage of the two stage least squares regression, we do the F-test to check the effect of the instruments on the variability of consumption. The $R^2$ statistics for the first stage regression range from 0.074 to 0.131. It does not make any difference to the $R^2$ statistics to include initial asset (AST5) as an instrument. But education variable (SCH,HGR) appears to be somewhat important to explain the variation. Overall, the instruments chosen in this analysis explain only a small part of the consumption variability. Among the instruments only the number of earners (ERN5) is significant at the 5 percent level and only for it we cannot reject the hypothesis that the coefficients are not equal to zero.\(^{19}\)

In the second stage results, the estimated coefficients on $\text{avg}(GC^2)_i$ are positive but small (0.008-0.009) with very small standard errors. The positive coefficients imply that risk affects consumption growth positively and this is what the precautionary saving motive leads us to believe. Simply put it, households that are confronted with more risk save more

\(^{19}\) The number of earners seems to be the principal instrumental variable in our estimation.
and households that face less risk save less. Although the coefficients are small, the very small standard errors make them significant at the 5 percent level.

The implied $\rho$ (the coefficient of relative prudence) ranges from 0.016 to 0.018, which are small but significant with standard errors of 0.004. Hence, we cannot reject the hypothesis that the coefficient of relative prudence of young households is not zero, even though the size of the estimated coefficients are small. It appears that the precautionary saving motive for the young is not a big part of their consumer behavior but it has some potential to explain the young households' behavior.

We can check the significance of self-selection effect that may lead to downward biases in our estimates of $\rho$ by testing the overidentifying restrictions. We obtain the p-values from this test (ranging from 0.954 to 0.988) to see the correlation of instrumental variables with the second-stage residuals. We find that the overidentifying restrictions cannot be rejected and self-selection effect does not seem to be a problem in our estimation. Finally, we include the comparison of our results with Dynan's(1993) in Table 15.
III. 2. 3 Liquidity Constraints

We have obtained the small estimates of relative prudence on entire sample of young households. Next we consider the presence of liquidity constraints as a possible source of bias in our estimation. We conjecture that liquidity-constrained consumers may have faster consumption growth because liquidity constraints keep them from spending as much as they want at the current time. However, they might show less variable consumption than the liquidity-unconstrained consumers and this fact may yield downward biased estimates of relative prudence in our results for the entire sample.

We divide the entire sample into two subsamples, high-wealth households and low-wealth households to consider the effect of liquidity constraints on this estimation. High-wealth households are presumably liquidity-unconstrained and low-wealth households are presumably liquidity-constrained. The criterion is the amount of liquid assets (MAS) relative to net family income (NFI). If MAS exceeds one month's NFI, this household is referred to as high-wealth household. If not, it is referred to as low-wealth household. We get 68 unconstrained high-wealth households and 262 constrained low-wealth households following this criterion. We proceed in the same way on the two subsamples as we do on the entire sample to explore the role of liquidity constraints.
Table 11-14 present the results for the same four sets of instruments used previously. The first stage R² for the unconstrained households ranges from 0.373 to 0.499 compared to 0.076-0.115 for the constrained households. In all cases, the instruments explain more of the variability of consumption for the unconstrained high-wealth households than for the constrained low-wealth households. At the first stage, only for ERNS for the unconstrained households can we reject the hypothesis that the coefficients are equal to zero.

In the second stage, the estimated coefficients of \( \text{avg}(\text{GC}^2)_i \) for the unconstrained households are similar to those for the entire households. They are positive and significant. But the estimated coefficients of \( \text{avg}(\text{GC}^2)_i \) for the constrained households are larger than those for the unconstrained households, but with larger standard errors. So the implied \( \rho \) for constrained low-wealth households are larger than those for unconstrained high-wealth households, with larger standard errors. We have ambiguous results. It appears liquidity constraints do not lead to the estimates of relative prudence biased downward, shown by larger coefficients. On the contrary, liquidity constraints may interact with precautionary saving motives to force the young households more prudent in consumer behavior.

Hence the presence of liquidity constraints does not appear to explain the failure to get substantial precautionary
saving in the young households. And one cannot reject the hypothesis that the estimated coefficient of relative prudence is not zero for the unconstrained households.

Testing the overidentifying restrictions on the two subsamples, respectively, yield the similar results (p-values ranging from 0.869 to 0.999) to those on the entire sample.
CHAPTER IV
CONCLUSION

In Chapter II, we discussed consumption and liquidity constraints. We tested for the implication of the life-cycle/permanent-income hypothesis (LPH) and the quantitative importance of liquidity constraints for young households using micro panel data. We used the 1987 and 1988 National Longitudinal Survey of Youth (NLSY) data, which provides an array of financial statistics and demographic information for a panel of young households.

The ordinary least squares estimates of the reduced-form consumption equation do not show a substantial deviation from the implications of the LPH for young households. Assuming that some households in the sample are liquidity-constrained, we divided the sample into high saving households and low saving households in terms of threshold consumption, conjecturing that high saving households probably are not liquidity-constrained but low saving households probably are.

We found that a substantial proportion of the sample classified as limit observations report negative saving and have income and assets less than its counterpart, on average.
When the Tobit estimates of the reduced-form consumption equation were compared with the ordinary least squares estimates, the difference was not significant. And the gap between predicted desired consumption and measured consumption is not evident for young households, understating the significance of liquidity constraints. And when the Tobit estimates are used to predict desired consumption for the entire sample, it only slightly overpredicts actual consumption.

So unlike the Hayashi’s (1985) findings from the 1963-1964 Survey of Financial Characteristics of Consumers (SFSS) suggesting that liquidity constraints are most evident for young households, our findings from the 1987-1988 National Longitudinal Survey of Youth (NLSY) provide evidence against it.

In Chapter III, we discussed precautionary savings and consumption variability. We tested for precautionary saving motives associated with the variance of consumption growth, using the 1985-1988 NLSY for the empirical work.

We employed two-stage least squares to obtain a consistent estimate of relative prudence as a measure of the strength of precautionary saving motive. This study used a broad measure of consumption and a direct measure of
uncertainty (consumption variability rather than income variability).

Two stage least squares yielded a significantly positive, but small, estimate of relative prudence, indicating a small precautionary saving motive for young households. This small estimate is contrary to the widely accepted view that precautionary saving motive is strong. The presence of liquidity constraints does not appear to explain the failure to estimate a substantial precautionary saving effect for young households. And the self-selection effect can be ignored in our estimation according to the results of test of overidentifying restrictions.
Table 1.

Sample Statistics on the 1987-88 NLSY Data

Total Observations on young households: 252

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFI8</td>
<td>$26051</td>
<td>17029</td>
</tr>
<tr>
<td>AST7</td>
<td>$9825</td>
<td>16591</td>
</tr>
<tr>
<td>SAV8</td>
<td>$1451</td>
<td>10516</td>
</tr>
<tr>
<td>CON8</td>
<td>$24600</td>
<td>18266</td>
</tr>
<tr>
<td>DEB7</td>
<td>$11706</td>
<td>24889</td>
</tr>
<tr>
<td>MAS7</td>
<td>$2253</td>
<td>4863</td>
</tr>
<tr>
<td>VRP7</td>
<td>$11129</td>
<td>26151</td>
</tr>
<tr>
<td>AGE8</td>
<td>26.86</td>
<td>2.23</td>
</tr>
<tr>
<td>HGR8</td>
<td>12.89</td>
<td>2.31</td>
</tr>
<tr>
<td>MRS8</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>EMP8</td>
<td>0.85</td>
<td>0.36</td>
</tr>
<tr>
<td>FSZ8</td>
<td>2.02</td>
<td>1.24</td>
</tr>
<tr>
<td>SCH8</td>
<td>0.07</td>
<td>0.26</td>
</tr>
<tr>
<td>ERN8</td>
<td>1.25</td>
<td>0.60</td>
</tr>
</tbody>
</table>
Table 2.

Ordinary Least Squares Regression Result (1)
(Preliminary Consumption Regression)

1. \( \text{CON8} = a + b \text{NFI8} + \varepsilon \)
   
   Dependent Variable = CON8  Independent Variable = NFI8
   
   Number of observations = 252  Multiple R = 0.825  \( R^2 = 0.680 \)
   
   Adjusted \( R^2 = 0.679 \)  Standard Error of Estimate = 10351.121
   
   Durbin-Watson D statistic = 2.151
   
   First Order Autocorrelation = -0.075

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>Std Coef</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>1554.722</td>
<td>1193.408</td>
<td>0.000</td>
<td>1.303</td>
</tr>
<tr>
<td>NFI8</td>
<td>0.885***</td>
<td>0.038</td>
<td>0.825</td>
<td>23.056</td>
</tr>
</tbody>
</table>

2. \( \text{CON8} = a + b \text{NFI8} + c \text{AST7} + \varepsilon \)

   Dependent Variable = CON8  Independent Variable = NFI8, AST7

   Number of observations = 252  Multiple R = 0.826  \( R^2 = 0.681 \)

   Adjusted \( R^2 = 0.679 \)  Standard Error of Estimate = 10350.320

   Durbin-Watson D statistic = 2.157

   First Order Autocorrelation = -0.078

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>Std Coef</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>1632.415</td>
<td>1195.748</td>
<td>0.000</td>
<td>1.365</td>
</tr>
<tr>
<td>NFI8</td>
<td>0.865***</td>
<td>0.043</td>
<td>0.806</td>
<td>20.069</td>
</tr>
<tr>
<td>AST7</td>
<td>0.045</td>
<td>0.044</td>
<td>0.041</td>
<td>1.019</td>
</tr>
</tbody>
</table>

(note) *** means that it is significant at the 1 % level.
Table 3.

Ordinary Least Squares Regression Result (II)
(All Explanatory Variables)

Equation: \( \text{CON} = X'b + (e+v) \)

Dependent Variable = CON8    Independent Variables = X's

Number of Observations = 252    Multiple R = 0.843    \( R^2 = 0.710 \)

Adjusted \( R^2 = 0.694 \)    Standard Error of Estimate = 10102.981

Sum of Squared Residuals = 0.242927E+11

Durbin-Watson D Statistic = 2.203

First Order Autocorrelation = -0.102

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>Std Coeff</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>38370.439</td>
<td>94139.205</td>
<td>0.000</td>
<td>0.408</td>
</tr>
<tr>
<td>VRP7</td>
<td>-0.034</td>
<td>0.054</td>
<td>-0.048</td>
<td>-0.626</td>
</tr>
<tr>
<td>MAS7</td>
<td>0.056</td>
<td>0.179</td>
<td>0.015</td>
<td>0.309</td>
</tr>
<tr>
<td>NFI8</td>
<td>0.920***</td>
<td>0.048</td>
<td>0.857</td>
<td>19.221</td>
</tr>
<tr>
<td>EMP8</td>
<td>18.617</td>
<td>2188.683</td>
<td>0.000</td>
<td>0.009</td>
</tr>
<tr>
<td>HGR8</td>
<td>-117.579</td>
<td>320.031</td>
<td>-0.015</td>
<td>-0.367</td>
</tr>
<tr>
<td>MRS8</td>
<td>-3709.697*</td>
<td>1900.116</td>
<td>-0.102</td>
<td>-1.952</td>
</tr>
<tr>
<td>AGE8</td>
<td>-2716.692</td>
<td>6965.687</td>
<td>-0.332</td>
<td>-0.390</td>
</tr>
<tr>
<td>AST7</td>
<td>0.159**</td>
<td>0.073</td>
<td>0.144</td>
<td>2.183</td>
</tr>
<tr>
<td>FSZ8</td>
<td>686.652</td>
<td>629.730</td>
<td>0.046</td>
<td>1.126</td>
</tr>
<tr>
<td>DEB7</td>
<td>-0.087*</td>
<td>0.045</td>
<td>-0.118</td>
<td>-1.952</td>
</tr>
<tr>
<td>(AGE8)^2</td>
<td>51.587</td>
<td>128.922</td>
<td>0.341</td>
<td>0.400</td>
</tr>
<tr>
<td>SCH8</td>
<td>-632.387</td>
<td>2557.672</td>
<td>-0.009</td>
<td>-0.247</td>
</tr>
<tr>
<td>ERN8</td>
<td>-393.131</td>
<td>1712.449</td>
<td>-0.013</td>
<td>-0.230</td>
</tr>
</tbody>
</table>

(note) The point estimate of the coefficient that is significant is denoted by *'s.

* : significant at the 10% level.
** : significant at the 5% level.   *** : significant at the 1% level.
Table 4.

Ordinary Least Squares Regression Result (III)
(Significant Explanatory Variables Only)

Equation: \( CON = X'b + (e+v) \)
Dependent Variable = CON8
Independent Variables = X's
Number of Observations = 252
Multiple R = 0.841 \( R^2 = 0.706 \) \( \text{Adjusted } R^2 = 0.702 \)
Standard Error of Estimate = 9976.269
Sum of Squared Residuals = 0.245829E+11
Durbin-Watson D Statistic = 2.213
First Order Autocorrelation = -0.106

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>Std Coef</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>2602.235</td>
<td>1230.731</td>
<td>0.000</td>
<td>2.114</td>
</tr>
<tr>
<td>NFI8</td>
<td>0.905***</td>
<td>0.042</td>
<td>0.843</td>
<td>21.318</td>
</tr>
<tr>
<td>MRS8</td>
<td>-3523.367***</td>
<td>1347.134</td>
<td>-0.097</td>
<td>-2.615</td>
</tr>
<tr>
<td>AST7</td>
<td>0.145***</td>
<td>0.049</td>
<td>0.132</td>
<td>2.989</td>
</tr>
<tr>
<td>DEB7</td>
<td>-0.104***</td>
<td>0.031</td>
<td>-0.142</td>
<td>-3.332</td>
</tr>
</tbody>
</table>

(note) The point estimate of the coefficient that is significant is denoted by *'s.

*: significant at the 10% level.

**: significant at the 5% level.

***: significant at the 1% level.
### Table 5.

**Sample Statistics of Two Subsamples**

Total observations: 252

Number of Non-limit observations: 77
Number of Limit observations: 175

Threshold value: \( G = 0.85 \times (\text{NFI8} + 0.2 \times \text{MAS7}) \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFI8</td>
<td>$27938</td>
<td>16235</td>
<td>$25220</td>
<td>17346</td>
</tr>
<tr>
<td>AST7</td>
<td>$10307</td>
<td>19251</td>
<td>$9613</td>
<td>15331</td>
</tr>
<tr>
<td>SAV8</td>
<td>$12099</td>
<td>10159</td>
<td>-$3234</td>
<td>6495</td>
</tr>
<tr>
<td>CON8</td>
<td>$15839</td>
<td>11675</td>
<td>$28454</td>
<td>19309</td>
</tr>
<tr>
<td>DEB7</td>
<td>$17022</td>
<td>34338</td>
<td>$9366</td>
<td>18989</td>
</tr>
<tr>
<td>MAS7</td>
<td>$2732</td>
<td>5268</td>
<td>$2042</td>
<td>4674</td>
</tr>
<tr>
<td>VRP7</td>
<td>$13595</td>
<td>28730</td>
<td>$10044</td>
<td>24942</td>
</tr>
<tr>
<td>AGE8</td>
<td>26.64</td>
<td>2.25</td>
<td>26.96</td>
<td>2.22</td>
</tr>
<tr>
<td>HGR8</td>
<td>13.47</td>
<td>2.19</td>
<td>12.63</td>
<td>2.32</td>
</tr>
<tr>
<td>MRS8</td>
<td>0.61</td>
<td>0.49</td>
<td>0.46</td>
<td>0.50</td>
</tr>
<tr>
<td>EMP8</td>
<td>0.92</td>
<td>0.27</td>
<td>0.82</td>
<td>0.38</td>
</tr>
<tr>
<td>FSZ8</td>
<td>1.79</td>
<td>1.12</td>
<td>2.11</td>
<td>1.28</td>
</tr>
<tr>
<td>SCH8</td>
<td>0.12</td>
<td>0.32</td>
<td>0.05</td>
<td>0.22</td>
</tr>
<tr>
<td>ERN8</td>
<td>1.42</td>
<td>0.59</td>
<td>1.18</td>
<td>0.59</td>
</tr>
</tbody>
</table>
Table 6.

Limited Dependent Variable Estimation.
(Tobit Estimation)

\[
\text{CON} = X'b + (e + v) \quad \text{if } X'b + (e + v) < G
\]
\[
\text{CON} = G \quad \text{otherwise}
\]

where \[ G = 0.85 \times (\text{NFI8} + 0.2 \text{ MAS7}) \]

Sample Size: 252
Dependent Variable: CON8
Final Value of Loss Function = 0.463034E+11
Estimate of Variance = 20.474

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
<th>A.S.E</th>
<th>Lower (95%)</th>
<th>Upper</th>
<th>t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>2608</td>
<td>1234</td>
<td>178</td>
<td>5038</td>
<td>2.113</td>
</tr>
<tr>
<td>NFI8</td>
<td>0.911***</td>
<td>0.043</td>
<td>0.826</td>
<td>0.996</td>
<td>21.186</td>
</tr>
<tr>
<td>MRS8</td>
<td>-3502**</td>
<td>1380</td>
<td>-6221</td>
<td>-783</td>
<td>-2.538</td>
</tr>
<tr>
<td>AST7</td>
<td>0.144***</td>
<td>0.049</td>
<td>0.048</td>
<td>0.240</td>
<td>2.939</td>
</tr>
<tr>
<td>DEB7</td>
<td>-0.094***</td>
<td>0.031</td>
<td>-0.156</td>
<td>-0.033</td>
<td>-3.032</td>
</tr>
</tbody>
</table>

(note) Tobit estimation was carried out by maximum likelihood estimation using Quasi-Newton method. A.S.E. means asymptotic standard error.

The point estimate of the coefficient that is significant is denoted by **'s.

*: significant at the 10% level. **: significant at the 5% level.

***: significant at the 1% level.
Table 7.

The Mean Comparison for Measured and Predicted Desired Consumption for Young Households.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured Consumption</td>
<td>$ 24600</td>
</tr>
<tr>
<td>Predicted Desired Consumption with G=0.85*(NFI8+0.2 MAS7)</td>
<td>$ 24890*</td>
</tr>
<tr>
<td>Ratio of measured consumption to predicted desired consumption</td>
<td>0.98</td>
</tr>
<tr>
<td>Predicted Consumption with OLS estimate of b</td>
<td>$ 24610**</td>
</tr>
<tr>
<td>Disposable Income(NFI8)</td>
<td>$ 26051</td>
</tr>
<tr>
<td>Ratio of predicted desired consumption to disposable income</td>
<td>0.95</td>
</tr>
<tr>
<td>Total Number of Cases</td>
<td>252 cases</td>
</tr>
<tr>
<td>Number of Cases where CON &gt; G (limit observation)</td>
<td>175 cases</td>
</tr>
<tr>
<td>Number of Cases where CON &lt; X'bTobit among limit observations</td>
<td>59 cases</td>
</tr>
<tr>
<td>% of liquidity constrained households out of total sample(59/252)</td>
<td>23.4 %</td>
</tr>
</tbody>
</table>

(note) *Predicted desired consumption X'b is evaluated at the Tobit estimate of b with G=0.85*(NFI8+0.2 MAS7).

**Predicted consumption X'b is evaluated at the OLS estimate of b.
### Table 8.

The Mean Comparison for Measured and Predicted Desired Consumption for Young Households.

(1987-88 NLSY vs. 1963-64 SFCC)

<table>
<thead>
<tr>
<th>Specification</th>
<th>NLSY(87-88)</th>
<th>SFCC(63-64)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>22-30</td>
<td>18-33</td>
</tr>
<tr>
<td>Measured Consumption</td>
<td>$24600</td>
<td>$4808</td>
</tr>
<tr>
<td>Predicted Desired Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with $G=0.85 \times (NFI8+0.2 \text{ MAS7})$</td>
<td>$24890^*$</td>
<td>$5304$</td>
</tr>
<tr>
<td>Ratio of measured consumption to predicted desired consumption</td>
<td>0.98</td>
<td>0.90</td>
</tr>
<tr>
<td>Predicted Consumption with OLS estimate of $b$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$24610^{**}$</td>
<td>$4816$</td>
</tr>
<tr>
<td>Disposable Income(NFI8)</td>
<td>$26051$</td>
<td>$5209$</td>
</tr>
<tr>
<td>Ratio of predicted desired consumption to disposable income</td>
<td>0.95</td>
<td>1.01</td>
</tr>
<tr>
<td>Specification</td>
<td>NLSY(87-88)</td>
<td>SFCC(63-64)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Total Number of Cases</td>
<td>252 cases</td>
<td>271</td>
</tr>
<tr>
<td>Number of Cases where</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CON &lt; G (non-limit observation)</td>
<td>77 cases</td>
<td>86</td>
</tr>
<tr>
<td>Number of Cases where</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CON &gt; G (limit observation)</td>
<td>175 cases</td>
<td>185</td>
</tr>
<tr>
<td>Number of Cases where</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CON &lt; X'bTobit among limit observation</td>
<td>59 cases</td>
<td></td>
</tr>
<tr>
<td>% of liquidity constrained households</td>
<td></td>
<td></td>
</tr>
<tr>
<td>out of total sample</td>
<td>23.4 %</td>
<td></td>
</tr>
</tbody>
</table>

(note) *Predicted desired consumption X'b is evaluated at the Tobit estimate of b with G=0.85*(NFL8+0.2 MAS7).

**Predicted consumption X'b is evaluated at the OLS estimate of b.

1963-64 SFCC: 1963-64 Survey of Financial Characteristics of Consumers
Table 9.

Two stage least squares on all samples(!)

1. First stage F-tests

<table>
<thead>
<tr>
<th>Instrument</th>
<th>(1)all instruments</th>
<th>(2)omit education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-ratio/P-value</td>
<td>F-ratio/P-value</td>
</tr>
<tr>
<td>EMP5</td>
<td>0.149/0.700</td>
<td>0.277/0.599</td>
</tr>
<tr>
<td>SCH5</td>
<td>1.566/0.212</td>
<td>-</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.448/0.815</td>
<td>0.647/0.664</td>
</tr>
<tr>
<td>HGR5</td>
<td>0.892/0.568</td>
<td>-</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.527/0.469</td>
<td>0.265/0.607</td>
</tr>
<tr>
<td>AGE5</td>
<td>0.895/0.521</td>
<td>0.692/0.699</td>
</tr>
<tr>
<td>ERN5</td>
<td>7.005/0.001*</td>
<td>6.728/0.001*</td>
</tr>
<tr>
<td>First-stage $R^2$</td>
<td>0.131</td>
<td>0.074</td>
</tr>
</tbody>
</table>

2. Second stage Results

- $\text{avg}(\text{GC}^2)_i$: 0.009(0.002)* 0.008(0.002)*
- Implied $\rho$: 0.018(0.004) 0.016(0.004)
- T.O.R.: 0.962 0.954

*: significant at the 5% level.

Standard errors are in parentheses.

T.O.R. = Test of Overidentifying Restrictions(P-values)
Table 10.

Two stage least squares on all samples (II)

1. First stage F-tests

<table>
<thead>
<tr>
<th></th>
<th>(3) all instruments</th>
<th>(4) omit education</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-ratio/P-value</td>
<td></td>
<td>F-ratio/P-value</td>
</tr>
<tr>
<td>EMP5</td>
<td>0.133/0.716</td>
<td>0.271/0.603</td>
</tr>
<tr>
<td>SCH5</td>
<td>1.589/0.208</td>
<td>-</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.452/0.812</td>
<td>0.636/0.673</td>
</tr>
<tr>
<td>HGR5</td>
<td>0.895/0.565</td>
<td>-</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.502/0.479</td>
<td>0.258/0.612</td>
</tr>
<tr>
<td>AGE5</td>
<td>0.913/0.506</td>
<td>0.699/0.693</td>
</tr>
<tr>
<td>ERN5</td>
<td>7.038/0.001*</td>
<td>6.737/0.001*</td>
</tr>
<tr>
<td>AST5</td>
<td>0.183/0.669</td>
<td>0.075/0.785</td>
</tr>
<tr>
<td>First-stage R²</td>
<td>0.131</td>
<td>0.074</td>
</tr>
</tbody>
</table>

2. Second stage Results

- \(\text{avg}(G C^2)_i\) : 0.009 (0.002)*  
- Implied \(\rho\) : 0.018 (0.004) 
- T.O.R. : 0.970

* : significant at the 5% level.

Standard errors are in parentheses.

T.O.R. = Test of Overidentifying Restrictions (P-values)
Table 11.

Two stage least squares for unconstrained and constrained households (1)

1. First stage F-tests (F-ratio/P-value)

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained (n=68)</th>
<th>Constrained (n=262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMP5</td>
<td>1.389/0.245</td>
<td>0.066/0.797</td>
</tr>
<tr>
<td>SCH5</td>
<td>0.206/0.652</td>
<td>3.100/0.080</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.190/0.942</td>
<td>0.998/0.420</td>
</tr>
<tr>
<td>HGR5</td>
<td>1.195/0.325</td>
<td>0.603/0.850</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.203/0.655</td>
<td>0.022/0.882</td>
</tr>
<tr>
<td>AGE5</td>
<td>1.904/0.085</td>
<td>1.023/0.419</td>
</tr>
<tr>
<td>ERN5</td>
<td>4.591/0.016*</td>
<td>1.736/0.178</td>
</tr>
<tr>
<td>First-stage $R^2$</td>
<td>0.499</td>
<td>0.115</td>
</tr>
</tbody>
</table>

2. Second stage Results

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained (n=68)</th>
<th>Constrained (n=262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>avg(GC$^2$)$_i$</td>
<td>0.008(0.002)$^*$</td>
<td>0.025(0.009)$^*$</td>
</tr>
<tr>
<td>Implied $\rho$</td>
<td>0.016(0.004)</td>
<td>0.050(0.018)</td>
</tr>
<tr>
<td>T.O.R.</td>
<td>0.996</td>
<td>0.869</td>
</tr>
</tbody>
</table>

* : significant at the 5 % level.

Standard errors are in parentheses.

T.O.R. = Test of Overidentifying Restrictions (P-values)
Table 12.

Two stage least squares for unconstrained and constrained households (2)

1. First stage F-tests (F-ratio/P-value)

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained (n=68)</th>
<th>Constrained (n=262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMP5</td>
<td>2.932/0.093</td>
<td>0.007/0.935</td>
</tr>
<tr>
<td>SCH5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.139/0.967</td>
<td>1.050/0.389</td>
</tr>
<tr>
<td>HGR5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.181/0.672</td>
<td>0.021/0.886</td>
</tr>
<tr>
<td>AGE5</td>
<td>1.639/0.137</td>
<td>1.174/0.315</td>
</tr>
<tr>
<td>ERN5</td>
<td>4.176/0.021*</td>
<td>1.963/0.143</td>
</tr>
<tr>
<td>First-stage $R^2$</td>
<td>0.373</td>
<td>0.076</td>
</tr>
</tbody>
</table>

2. Second stage Results

avg($GC^2_i$) 0.008(0.002)* 0.014(0.013)
Implied $\rho$ 0.016(0.004) 0.028(0.026)
T.O.R. 0.965 0.943

*: significant at the 5% level.
Standard errors are in parentheses.
T.O.R. = Test of Overidentifying Restrictions (P-values)
Table 13.

Two stage least squares for unconstrained and constrained households (3)

1. First stage F-tests (F-ratio/P-value)

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained (n=68)</th>
<th>Constrained (n=262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMP5</td>
<td>1.364/0.250</td>
<td>0.065/0.799</td>
</tr>
<tr>
<td>SCH5</td>
<td>0.199/0.658</td>
<td>3.084/0.080</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.188/0.943</td>
<td>0.991/0.424</td>
</tr>
<tr>
<td>HGR5</td>
<td>1.154/0.350</td>
<td>0.599/0.854</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.194/0.662</td>
<td>0.022/0.882</td>
</tr>
<tr>
<td>AGE5</td>
<td>1.858/0.094</td>
<td>1.015/0.425</td>
</tr>
<tr>
<td>ERN5</td>
<td>4.477/0.017*</td>
<td>1.718/0.182</td>
</tr>
<tr>
<td>AST5</td>
<td>0.010/0.919</td>
<td>0.000/0.990</td>
</tr>
<tr>
<td>First-stage R²</td>
<td>0.499</td>
<td>0.115</td>
</tr>
</tbody>
</table>

2. Second stage Results

avg(GC²)ᵢ | 0.008(0.002)*        | 0.025(0.009)*       |
Implied ρ  | 0.016(0.004)         | 0.050(0.018)        |
T.O.R.     | 0.999                | 0.933               |

*: significant at the 5 % level.
Standard errors are in parentheses.
T.O.R. = Test of Overidentifying Restrictions (P-values)
Table 14.

Two stage least squares for unconstrained and constrained households (4)

1. First stage F-tests (F-ratio/P-value)

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained (n=68)</th>
<th>Constrained (n=262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMP5</td>
<td>2.953/0.092</td>
<td>0.005/0.943</td>
</tr>
<tr>
<td>SCH5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FSZ5</td>
<td>0.155/0.960</td>
<td>1.042/0.393</td>
</tr>
<tr>
<td>HGR5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MRS5</td>
<td>0.169/0.683</td>
<td>0.020/0.889</td>
</tr>
<tr>
<td>AGE5</td>
<td>1.606/0.147</td>
<td>1.159/0.325</td>
</tr>
<tr>
<td>ERN5</td>
<td>4.153/0.021*</td>
<td>1.923/0.148</td>
</tr>
<tr>
<td>AST5</td>
<td>0.117/0.733</td>
<td>0.029/0.865</td>
</tr>
<tr>
<td>First-stage $R^2$</td>
<td>0.374</td>
<td>0.076</td>
</tr>
</tbody>
</table>

2. Second stage Results

<table>
<thead>
<tr>
<th>Inverse Mills</th>
<th>avg($G_i^2$)</th>
<th>Implied $\rho$</th>
<th>T.O.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.008(0.002)*</td>
<td>0.016(0.004)</td>
<td>0.987</td>
</tr>
<tr>
<td></td>
<td>0.014(0.013)</td>
<td>0.028(0.026)</td>
<td>0.971</td>
</tr>
</tbody>
</table>

* : significant at the 5% level.

Standard errors are in parentheses.

T.O.R. = Test of Overidentifying Restrictions (P-values)
Table 15.

The Comparison of Results
(1985-88 NLSY vs. 1985 CEX)

<table>
<thead>
<tr>
<th>Specification</th>
<th>NLSY(85-88)</th>
<th>CEX(85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Data Type</td>
<td>Yearly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>(2) All Instruments</td>
<td>Employment</td>
<td>Education</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>Occupation</td>
</tr>
<tr>
<td></td>
<td>Family Size</td>
<td>Industry</td>
</tr>
<tr>
<td></td>
<td>Marital Status</td>
<td>Earners</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Initial Assets</td>
</tr>
<tr>
<td></td>
<td>Earners</td>
<td>Initial Assets</td>
</tr>
<tr>
<td>(3) First Stage R²</td>
<td>0.131</td>
<td>0.053</td>
</tr>
<tr>
<td>(4) Implied ρ</td>
<td>0.018</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.176)</td>
</tr>
<tr>
<td>(5) Test of Overidentifying Restrictions(P-values)</td>
<td>0.970</td>
<td>0.883</td>
</tr>
</tbody>
</table>

Standard errors are in parentheses.

ρ : coefficient of relative prudence

NLSY : National Longitudinal Survey of Youth

CEX : Consumer Expenditure Survey
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