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PORTFOLIO ALLOCATION OF PRECAUTIONARY ASSETS: PANEL EVIDENCE FOR THE UNITED STATES

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PORTFOLIO ALLOCATION OF PRECAUTIONARY ASSETS: PANEL EVIDENCE FOR THE UNITED STATES

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Economic theory predicts that earnings uncertainty increases precautionary saving and causes households to include relatively liquid assets in their portfolios. Risk avoidance and the demand for liquidity cause these portfolio choices. Studies investigating United States evidence of precautionary portfolio allocation are nonexistent. With panel data, our results confirm the precautionary motive, and indicate that the desire to moderate total exposure to risk (temperance) and the demand for liquidity each affect the household's portfolio. Both permanent and transitory earnings uncertainty boost total wealth, and this precautionary wealth tends to be invested in safe, liquid assets. These results are particularly pronounced for people facing borrowing constraints. Such behavior is consistent with consumer utility functions that exhibit decreasing absolute risk aversion and decreasing strength of the precautionary motive (prudence). Our findings are important because both unemployment compensation and income taxes provide insurance that reduce earnings uncertainty. As a result, precautionary saving is both curtailed and reallocated. These policies could have large effects on capital formation and interest rates, through changes in the composition of household asset demand.

1. Introduction

A young assistant professor learns that her college faces unpredictable enrollments in the next five years. Faced with future earnings uncertainty and associated liquidity concerns, will her saving patterns change? Economic theory predicts that earnings risk stimulates saving, and that this precautionary wealth will be channeled into safe, liquid assets. The professor will more likely add to her savings account than buy a house.

The problem of household portfolio composition has attracted considerable attention in the literature. This paper is an empirical exploration of a new channel of influence--the effect of labor income (earnings) uncertainty on portfolio allocation.[1] From a fiscal policy perspective, evidence of this new channel is important for understanding how income tax cuts may discourage saving and encourage riskier portfolios. Since wealth gains from tax cuts are certain, whereas future tax liabilities are contingent on uncertain income, future income taxes provide insurance which reduces the precautionary motive (Barsky, Mankiw and Zeldes (1986) and Kimball and Mankiw (1989)). Such tax cuts may not only discourage individual saving, but also may induce more risky investments affecting capital formation and asset returns.

A similar argument applies to understanding the influence of unemployment compensation on saving (Hubbard, Skinner and Zeldes (1995)). Incentives to reduce precautionary saving and adjust portfolios arise from insurance of an otherwise uninsurable asset--human capital. Given the enormous size of human capital relative to other assets (Davies and Whalley (1991)), precautionary saving effects may be large.

Our investigation is also relevant for consumer theory. If earnings uncertainty affects the level and composition of saving via the precautionary motive (Kimball (1991)) we must then question certainty equivalence assumptions in Life-Cycle consumption studies. Instead, observed risk-induced saving patterns may be more consistent with utility

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[1] Substantial literature explaining the effect of financial risks on portfolios stems from Sharpe (1964), Lintner (1965), Merton (1971), and Ross (1976). Our focus is new because earnings uncertainty, unlike financial risks, is neither fully diversifiable nor insurable.

functions characterized by decreasing absolute risk aversion. Evidence of these precautionary influences also emphasize the shortcomings of traditional mean-variance security pricing models such as the capital asset pricing model (CAPM).[2]

Though the precautionary saving motive is clearly important, the existing empirical literature is in its early stages. Empirical work focuses primarily on the presence rather than allocation of precautionary wealth. Yet Guiso et al. (1996), and Hochguertel (1997) using cross-sectional data both find evidence of precautionary portfolio allocation in Italy and the Netherlands respectively. This paper uses a single panel data source--the National Longitudinal Survey (NLS)--to explore empirically both the presence *and* allocation of precautionary assets in the face of credit constraints in the United States.

We present the first econometric evidence that earnings uncertainty influences the portfolio composition of households, using both real (non-financial) and financial assets. Panel earnings data allows us to construct an uncertainty proxy for each family--the standard deviation of the log-earnings profile residual. We capture the persistence of the earning's shock by decomposing total uncertainty into its permanent and transitory components, following Hall and Mishkin (1982), and Carroll (1992).[3] With the panel we also create a family-specific measure of permanent earnings (following King and Dicks-Mireaux (1982)) to control for Life-Cycle behavior.

We find strong support for an allocation toward safe and liquid assets, in response to increases in both permanent (persistent), and transitory earnings uncertainty. Directing precautionary wealth toward safe and liquid assets is magnified for people with a higher probability of being credit constrained. The results accord with Kimball's (1991) claim that both the desire to moderate total exposure to risk (temperance) and the precautionary demand for liquidity contribute to portfolio choice. Our evidence that transitory uncertainty

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[2] The CAPM cannot account for observed risk induced saving patterns because it generally does not allow for utility functions with non-vanishing third and fourth derivatives.

[3] A permanent shock, such as a raise, is expected to continue while an example of a transitory shock is winning the lottery. It is important to disect the shocks because only permanent (persistent) shocks should affect portfolio composition through the precautionary motive (Skinner (1988), Blanchard and Mankiw (1988)).

increases savings further supports the presence of credit constraints, and suggests that people may save for a buffer-stock as predicted by models of Deaton (1991) and Carroll (1997).[4]

In section 2, we review the existing work relevant to both precautionary saving, and precautionary portfolio allocation. Section 3 and appendices contain the empirical models of our key regressors--permanent earnings, earnings uncertainty and credit constraints--as well as the precautionary saving and portfolio choice estimating equations. Section 4 describes the NLS panel, and section 5 provides evidence of uncertainty induced portfolio allocation. A summary of results, policy implications, directions for future research and concluding remarks compose section 6.

2. Existing Work

A. Theory

Dreze and Modigliani (1972) were the first to demonstrate that if insurance markets are incomplete, uninsurable risks (earnings uncertainty, for example), could not only affect the level of wealth (precautionary savings) but also the composition of the portfolio.[5] Their analysis introduced the idea that both the size and composition of an optimal portfolio may be simultaneously chosen.

More recently Kimball (1993) and Elmendorf and Kimball (1991) investigate the relationship between risk aversion and higher derivatives of utility, which has been particularly important for understanding portfolio composition. They show that if a utility function exhibits decreasing absolute risk aversion and decreasing prudence, then idiosyncratic earnings shocks will decrease the demand for risky assets.[6] For example, when a person expects her earnings to become more uncertain, she will compensate for this

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[4] See Carroll and Samwick (1992a,b) for empirical evidence.

[5] Leland (1968) and Sandmo (1970) were first to show that a utility function with a positive third derivative (convex marginal utility) is necessary for precautionary saving. Their results were generalized to a multiperiod analysis by Miller (1974 ,1976), Sibley (1975), and Levhari and Srinivisan (1969).

[6] Kimball (1990) defines prudence as the strength of the precautionary motive. It is similar in form to Pratt's measure of risk aversion. While risk aversion is the second derivative of utility divided by the first, prudence is the third derivative divided by the second.

unavoidable (and uninsurable) risk by reducing exposure to another risk such as rate of return risk. She may respond by adjusting her portfolio to include fewer risky assets. This desire to reduce overall risk exposure even if both risks are statistically independent, is termed "temperance" (Kimball (1991)).[7] Koo (1997) reports similar findings in a multiperiod dynamic setting, where consumers have constant absolute risk aversion and are unable to borrow against future earnings.

Changes in portfolio composition in response to uninsurable earnings risk is also influenced by imperfect capital markets. Credit concerns are important since a substantial fraction of households appear constrained.[8] This has important implications for the allocation of precautionary assets. Suppose an asset is both risky and illiquid, such as housing. Expected credit constraints will magnify the effect of temperance and lead the consumer away from housing in response to earnings uncertainty. We present evidence below that suggests this is true--as the probability of being constrained rises, savers decrease the risky, illiquid portion of their wealth in the face of mounting earnings risk.[9]

B. Empirical Evidence

Despite recent theory explaining how people *allocate* their precautionary assets, empirical literature focuses almost exclusively on the *existence* of the precautionary motive. The results are mixed on both the motive's existence and strength. Using cross-sectional saving data, Dardanoni (1991) finds strong positive precautionary saving, Lusardi (1993) finds some evidence, while Skinner (1988) finds none. Using panel consumption neither

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[7] Kimball calls decreasing prudence "temperance," which is the strength of the precautionary motive (prudence) decreasing in wealth. Intuitively, statistically independent risks affect the marginal utilities as substitutes--hence, increase in one risk (earnings) reduces the marginal utility of consumption of that risky asset. The choice of a relatively safer portfolio in the face of earnings uncertainty equalizes marginal utilities. By describing this behavior (temperance) Kimball extends Dreze and Modigliani's (1972) finding of non-separability by showing exactly where precautionary saving is directed.

[8] Empirical evidence of liquidity constrained households is quite substantial. For example, Hall and Mishkin (1982) report 20% of families in the PSID are liquidity constrained. Jappelli (1990) finds 19% of the families in the 1983 Survey of Consumer Finances are rationed in the credit market.

[9] Paxson (1990) shows that when portfolio composition does not affect borrowing limits (i.e. exogenous borrowing constraints) earnings uncertainty unambiguously leads savers towards more liquid portfolios. This is in contrast to borrowing limits endogenous to portfolio composition, where borrowing constraints are relaxed (due to available collateral) as the portfolio becomes increasingly non-liquid.

Dynan (1993) nor Kuehlwein (1991) find evidence of the precautionary motive. Yet Carroll and Samwick (1992a) and Kazarosian (1997) use panel earnings to measure uncertainty's effect on wealth and both find a large, significant precautionary motive.[10]

While we know little about whether the precautionary motive exists, we know even less about how earnings uncertainty affects portfolio allocation. Feldstein (1976), King and Leape (1984) and Hubbard (1985) for example, show that personal taxes change portfolio composition in United States households. Hochguertel, et. al (1997) find that both the level of financial wealth and the marginal tax rate influence household portfolio allocation. Dicks-Mireaux and King (1982) find a small effect of pension wealth on household portfolio composition in Canada. Bertaut and Haliassos' (1996) computational model predicts that career uncertainty should affect the distribution of stockholding. This literature provides clues that the earnings uncertainty-portfolio relationship is present, yet none of the papers connect changes in family portfolio composition to any direct measures of earnings uncertainty.

Guiso et al.(1996), find that a cross section of Italian households reduce their exposure to risky financial assets as a result of short run subjective earnings uncertainty and expected borrowing constraints. Unfortunately, housing is excluded from their analysis, because of legal and tax provisions governing their purchases. Hochguertel (1997) also shows that Dutch households hold more liquid portfolios in response to increased subjective uncertainty. In the sense that our panel data allows us to incorporate uncertainty's persistence, and both real and financial United States wealth in our estimates, our paper complements those of Guiso et al. and Hochguertel.

[10] Each author measures earnings uncertainty differently. For brevity, we refer the reader to Browning and Lusardi (1996) for an excellent survey of the precautionary saving literature.

3. The Empirical Model

Given we observe substantial precautionary saving (evidence in Appendix A1), which assets are favored by this rainy-day motive? After presenting the empirical model to investigate the portfolio allocation question, we provide a detailed description of the explanatory variables.

We follow an asset component specification akin to Feldstein (1976).

$$\frac{A_{ij}}{W_i} = f(Y_i^P, h(W_i), \sigma_\eta, \sigma_\tau, P_i, \mathbf{X}_i) + \varepsilon_i. \qquad (1)$$

Our forward looking model explains how people choose to apportion their assets in response to *future* earnings uncertainty. $\frac{A_{ij}}{W_i}$ is the asset share of total net assets (W_i) in 1966 for person i, while permanent earnings Y_i^P is calculated by exploiting the 1965 to 1975 panel. A_{ij} is the asset category, j=risky and illiquid (housing, real estate, and business), safe and liquid (U.S. bonds, and saving accounts) and risky and liquid (stocks, bonds, and mutual funds). We control for Life-Cycle saving by including a quadratic in both permanent earnings, $k(Y_i^P)$, and total net assets $h(W_i)$, as independent variables.[11] The terms σ_η and σ_τ designate uncertainty associated with permanent and transitory earnings shocks respectively, P_i is the probability of being credit constrained, and $\mathbf{X}_i$ is a vector of personal characteristics including a quadratic in age, that are assumed to influence the asset share.

Two-tailed Tobit estimation of equation (1) yields consistent estimates since the asset share is never below zero or above one. Tables 3 and 4 contain our main results, discussed in detail in section 5. The uncertainty coefficients in all specifications indicate

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[11] We experimented with other forms to control for Life-Cycle saving. For example, more closely following Hubbard (1985), we replaced the quadratic in wealth and earnings with the wealth to permanent earnings ratio. We also entered wealth and permanent earnings linearly. In all cases, the qualitative portfolio allocation shift we discuss in the results does not change. We chose the table 4 specification (a quadratic in permanent earnings and in wealth) to compare with the analysis of Guiso et al. (1996) who use a similar specification.

that people allocate their precautionary wealth toward liquid assets--both risky and safe, and avoid illiquid assets.

A. Permanent Earnings

A key feature of the permanent income and the buffer-stock models is that individuals' saving behavior is based on expected resources. It is therefore crucial to distinguish expected (permanent) earnings from current earnings in an empirical exploration of asset accumulation.

King and Dicks-Mireaux (1982) model permanent earnings, and develop a method for estimating it using cross-sectional data. We adapt their model for panel data (described in detail in Appendix A2).[12] Our empirical implementation of the permanent earnings model reflects the buffer-stock idea that a saver considers a short term future earnings stream--ten years--rather than her lifetime earnings stream.[13]

To estimate permanent earnings we pool all familys' time-series earnings data within each of nine occupations, and express family log earnings as a cubic in age. We then estimate earnings with nine separate occupation-specific random effects models. Each of the occupations has as many earnings profiles as there are families in that occupation, and each profile is distinguished by a unique intercept.

One advantage of this profile estimate is that it incorporates family-specific earnings determinants, such as ability or luck. Another advantage is that since the profile is derived from each family's time-series earnings rather than a single cross-sectional observation, it helps to eliminate transitory earnings. Also, by using a panel we can directly measure

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[12] Others have used the KDM model with cross-sectional data to estimate permanent earnings, e.g. Cox (1987), Cox and Jappelli (1990). Yet KDM suggest their permanent earnings model is more precisely applicable to panel data.

[13] Carroll (1991) argues that the correct interpretation of Friedman's permanent earnings is roughly expected earnings (earnings in the absence of transitory shocks) or the expected value of a probability distribution. This expected earnings, rather than the annuity value of total lifetime resources, is closer to the permanent earnings concept that Friedman described. Our panel estimate of KDM's permanent earnings below closely follows Carroll's interpretation.

uncertainty around the family-specific earnings profiles. This idiosyncratic uncertainty measure is impossible without time series earnings data.

Estimated permanent earnings Y_i^P is the annual average of the present discounted value of expected (predicted) earnings, from the family-specific profile (equation A2.4, Appendix A2), within a standardized age bracket (55-60).[14] This proxy helps to control for Life-Cycle behavior in our portfolio allocation regressions. The next sections describe earnings uncertainty, and credit constraints--also used as key regressors in the asset share equations.

B. Earnings Uncertainty

Earnings uncertainty is unobservable. Yet in the NLS, families' earnings over time is observable. Under reasonable assumptions outlined above, we construct a measure of permanent earnings from the family's time-series earnings process. As observed earnings become more errant around expected earnings, we assume uncertainty increases. The standard deviation of each family's log-earnings profile residual is our total uncertainty proxy.[15]

There are important advantages to this uncertainty proxy. First, since the earnings profile incorporates predictable growth, the proxy is desirably void of expected changes in human capital. Because of this, uncertainty will be less likely overstated. Second, since the proxy comes from up to seven earnings observations over ten years, its value incorporates the degree of persistence in the earnings generating process that is specific to each family. Kimball and Mankiw (1989) and Caballero (1990) indicate that the magnitude of precautionary saving effects in a multiperiod context depends critically on the persistence of earnings shocks.

Using panel data is only a necessary first step in capturing the different magnitude of precautionary saving effects predicted by permanent and temporary shocks. The

[14] For present value calculations we use real returns on 1, 2, 3, and 5 year constant maturity bonds at age 55.
[15] Since earnings are in log form, the uncertainty measure is relative to earnings size (i.e. the coefficient of variation).

observation-specific log-earnings profile's residual must be dissected into its permanent σ_η and transitory σ_τ standard deviation (uncertainty) components. To isolate these components of total uncertainty, Appendix A3 describes our application of the decomposition technique developed by Hall and Mishkin (1982) and Carroll (1992).

C. Credit Constraints

There is mounting evidence in the literature that a substantial proportion of United States households is either denied credit, or discouraged to apply. The presence of credit constraints is important to our study since Kimball (1991) shows that households change their portfolios in response to earnings risk through two channels--temperance, and concern for liquidity. We therefore explore how the probability of being constrained will affect our portfolio choice regressions.

Since credit constrained consumers are not identified in the NLS we investigate the connection between portfolio choice and the *probability* of being constrained. The 1982 Survey of Consumer Finances (SCF) directly identifies credit constrained consumers. Using the SCF data, Jappelli (1990) provides parameter estimates of observed variables that determines the probability of being constrained.[16] Fissell and Jappelli (1990) show that these SCF estimates effectively determine the proportion of credit constrained consumers in fourteen years of the Panel Study of Income Dynamics (PSID). We adopt their procedure to calculate the expected probability of being constrained for each family in the NLS.[17]

Based on our simulation, 13.5 percent of our (NLS) sample is liquidity constrained.[18] This percentage is lower than the 17-19 percent found in the PSID, yet the NLS proportion makes sense given the nature of the differences in sample characteristics.

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[16] The logit specification includes earnings, wealth, debt, age, education, employment, marital status, race, sex, family size, home ownership, saving, and location dummies.
[17] We received useful suggestions from Tullio Jappelli in creating this proxy.
[18] This result follows from the interpretation that the average sample probability of being constrained equals the fraction of credit constrained consumers.

Our sample's average age of 51 versus Jappelli's 45 accounts for about 3 percent of our lower estimate since each additional year reduces the probability of being constrained by 0.5 percent. Moreover, our sample has 30 percent more married people and 20 percent more homeowners, which further contribute to our sample's lower probability of being constrained. Taking these differences into account, our simulated probability is in line with that found in the PSID. Also given our smaller average probability of being constrained, the average fraction of earnings controlled by liquidity constrained consumers in the NLS (9.4%) is consistent with the PSID's 11.05-11.98%.

In our asset component estimations (equation (1)) we include the probability of being constrained (P_i) as an explanatory variable. We find (Table 3) that as the probability of being constrained rises, the proportion of safe, liquid assets in a family portfolio increases (column 2) while the proportion of illiquid assets declines (column 1). We also find that rising credit constraints enhance precautionary wealth allocation away from risky assets (Table 4--interactive uncertainty-credit constraint variables). The Empirical Estimates section contains more details of these findings.[19]

4. Data

The Older Men cohort of the NLS is a pooled cross-sectional time-series (panel) of 5,020 men and their families. The main objective of the NLS is to gain information on labor market experiences such as job characteristics, and attitudes about work. Other variables influencing saving behavior such as income, wealth, and education are also created. Unlike the Consumer Expenditure Survey for example, the NLS queries the same families over many years. The representative panel begins in 1966, when the men are aged 45 to 59. Some questions, such as income level, represent the previous year.

[19] In appendix A4, following Zeldes (1989), we present results from an alternative method of categorizing liquidity constrained families, where if total wealth is less than one sixth annual permanent earnings, the family is constrained. Using this method does not alter our qualitative portfolio allocation results. Since our dependent variable involves total wealth, splitting the sample by wealth-earnings ratios to categorize liquidity constrained consumers may cause endogeneity problems. Instead, using the continuous probability variable based on a broad vector of social and demographic characteristics helps to avoid this endogeneity. We thank Orazio Attanasio for bringing this issue to our attention.

Non-capital family before tax income (earnings) is available for seven years between 1965 and 1975, of which we use all--1965, 1966, 1968, 1970, 1972, 1974, and 1975.[20] We use non-capital income to avoid endogeneity in our portfolio regressions. Since our dependent variable is the family's asset share, earnings uncertainty should not be determined by that asset choice. To further avoid capital income endogeneity, we drop farmers and the self employed from our sample.[21] We also delete earnings observations in years that the male of the household is over 65, use only those families that have three or more earnings observations over time, and those with permanent earnings greater than $100.

Net wealth in 1966 includes housing, business assets, investment real estate, deposits in financial institutions (saving accounts), US Savings Bonds, and stocks, bonds and mutual funds, minus all debt. We use only families with non-missing assets in each category, and only families with positive total net assets. Expected pension income is not available to include as part of wealth. All earnings and wealth values are in 1976 dollars using the GNP deflator. The above screens reduce our sample to 2,022 from 5,020.

Table 1 offers a detailed outline of our data by the characteristics of our explanatory variables. The permanent earnings and total wealth values (columns 3 and 4) across demographic categories are as expected, e.g., married, higher educated, whites, professionals, and healthier people have both the highest earnings, and wealth. A notable result is that the graduate school educated have less wealth than college grads.

The composition of total wealth (columns 5-7) indicates that housing, business and real estate (as a proportion of total assets) is greater for those who are married as well as those with more children. Single people have a greater proportion of wealth in saving accounts and U.S. Bonds. The proportion of wealth in stocks, bonds and mutual funds

[20] The next available year with earnings data corresponding to our definition is 1980. Since it would violate our assumption that individuals consider a short future time horizon we chose not to include it. Including 1980 to calculate permanent earnings does not alter our qualitative results.
[21] See Sandmo (1970), pg. 359 for a careful discussion of the theoretical implications of this issue. See Kazarosian (1997) for empirical evidence of the precautionary motive using both non-capital and total family income.

rises with education, and is largest for professionals, and managers. People with poor health hold a smaller proportion of wealth in saving accounts, perhaps depleting these liquid assets for medical care.

The composition of earnings uncertainty (columns 8-9) makes sense across characteristics. Categories with the highest permanent and transitory uncertainty are single, non-white, managers, farm laborers, and poor health. One notable, yet expected result is that transitory uncertainty rises for people in transitional educational categories, i.e. with some high school, some college, or grad school education. Similar to Carroll and Samwick (1992a), we find that the size of permanent uncertainty varies little across groups, compared to transitory uncertainty.

Table 2 provides information about household portfolios. For each of our six assets, and three asset groups used as dependent variables, we report asset level, that asset as a proportion of total wealth, and the proportion of households owning that asset. Housing is the largest component of the household portfolio (61 percent) (Table 2, column 4). Also, more people (79 percent) own housing than any other asset (last column).

5. Empirical Estimates

A. Main Results

Table 3 contains estimates of equation (1) above which addresses our main question--into which assets do families allocate their precautionary wealth? In all Table 3 specifications we find both permanent and transitory earnings shocks have a statistically significant effect on portfolio choice. The evidence conforms to theoretical predictions that rising earnings uncertainty directs precautionary assets into the safe and liquid categories.

Negative, significant uncertainty coefficients (Specification 1) indicate that people reduce risky, illiquid assets in their portfolios due to both permanent and transitory shocks. Specifications 2 and 3 show that families choose to buffer liquid assets, both safe and risky. The positive relationship between uncertainty and safe, liquid assets in Specification 2 is consistent with both the concern to avoid overall risk (temperance) and the demand for liquidity. Yet the positive uncertainty coefficients in Specification 3 (risky, liquid assets) suggest that the desire for liquidity outweighs the risk avoidance motive.

Permanent earnings shocks have a larger influence (by 25-65%) on portfolio choice than have transitory shocks in all specifications.[22] Since permanent shocks are expected to persist (e.g., a raise) and transitory shocks (a bonus) are not long lasting, we expect higher coefficients on permanent uncertainty. Our significant transitory coefficients emphasize the importance of decomposing the total shock, and are in line with saving models that include credit constraints, and buffer stock behavior.

At sample means, doubling both permanent and transitory earnings uncertainty reduces the risky, illiquid share of total assets by 5 percent (specification 1), while boosting the liquid asset share by a total of 32 percent (specification 2 and 3).[23] These elasticities translate into an approximate $1,100 decline in housing, real estate, and business assets (specification 1). The decline is counteracted by an $800 increase in saving accounts and U.S. bonds (specification 2--safe, liquid), and a $300 increase in stocks, bonds and mutual funds (specification 3--risky, liquid).

Recall that the theory predicts demand for liquidity also affects portfolio choice. The credit constraint coefficient in Specification 1 indicates a highly significant, inverse relationship between the choice of risky, illiquid assets and the probability of being constrained. A 10 percent *increase* in the probability is associated with a 4.4 percent *decline* in the proportion of total assets allocated to housing, business and real estate. The positive credit constraint coefficient in Specification 2 also conforms to intuition, indicating that families choose more safe, liquid assets as they become more constrained. A 10 percent *increase* in the probability of being constrained is associated with a 12 percent *increase* in the share of safe, liquid assets (saving accounts and U.S. bonds). These point estimates suggest that at sample means, households increase their safe, liquid assets by an

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[22] Carroll and Samwick (1992) also find that permanent shock coefficients are larger than their transitory counterparts.

[23] The elasticities are calculated after transforming the Tobit coefficients into marginal effects following Greene (1997), pg. 966.

average of $950, and counteract this by decreasing their risky, illiquid assets. Specification 3 results indicate that the influence of credit constraints on stocks, bonds and mutual funds (risky, liquid assets) is statistically insignificant. This result may reflect the liquidity-risk tradeoff inherent in these assets.

B. Additional Results

Focusing on all three specifications in Table 3 and the additional explanatory variables, exactly how and why household portfolios change becomes more clear. As permanent earnings rise to $34,000, liquid assets are favored--both safe and risky--over illiquid assets (housing etc.). As earnings rises beyond $34,000, behavior changes and people begin to invest *more* in housing, real-estate and business assets. This asset share-earnings pattern is intuitive--higher earnings families have the luxury of choosing illiquid assets. On the other hand, asset share's response to total wealth is counterintuitive. Our results indicate that as total wealth increases from zero, families choose risky liquid assets over their safe counterparts and begin to favor the safe categories only after wealth approaches the half million mark.

The age coefficients suggest that portfolio composition becomes less liquid after age seventy-one, presumably due to the standard Life-Cycle explanation. Predictably, those who are married, and people with more children allocate a larger proportion of wealth to housing when compared to single folks, and people with fewer children. Finally, safe liquid assets constitute a larger proportion of total wealth for healthier people. The unhealthy would likely tap their saving accounts, and cash in U.S. Bonds to pay for medical care, before selling their homes.

In Table 4 we re-estimate the Table 3 specifications to investigate whether the portfolio allocation of precautionary saving depends on liquidity concerns. We introduce two new variables--the interaction of both permanent and transitory earnings uncertainty with the probability of being credit constrained. In specification 1 (housing, business and real-estate), the interactive variables' negative coefficients indicate that a rising probability of being constrained magnifies the allocation of precautionary wealth away from risky, illiquid assets. Specification 2's positive interactive coefficients confirms that this precautionary wealth is channeled into safe liquid assets at a greater rate as families become more constrained. The coefficients of the social and demographic variables for all specifications remain in line with Table 3 results.

6. Conclusion

This investigation indicates that precautionary wealth is targeted toward safe and liquid assets. The precautionary portfolio shift is particularly pronounced for credit constrained households. Our evidence is consistent with the theory of portfolio choice under earnings uncertainty when preferences exhibit decreasing absolute prudence. Saving level decisions are not independent from decisions of portfolio allocation, contradicting the prediction of certainty-equivalence models.

Our findings are important given the presence of income taxes, and the scope of various government safety nets. The evidence that earnings uncertainty both increases and redistributes wealth should be carefully considered while these policies are crafted. Future work should analyze the macroeconomic effects of the reallocation of precautionary saving in response to ongoing tax structure changes, recent welfare overhauls, and the potential redesign of social security. Also, since our results cast doubt on traditional mean-variance assumptions in financial modeling, empirical research on security pricing may benefit by incorporating utility functions that allow for the precautionary motive.

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Appendix A1: Precautionary Saving

Does labor income uncertainty cause people to hold more wealth as a percentage of their permanent earnings? We investigate this, and find strong evidence that supports the precautionary motive.

We must demonstrate the precautionary motive before we consider how earnings uncertainty influences a portfolio change. While the demand for liquidity will increase with earnings risk regardless of the existence of the precautionary motive, the demand for safer assets (temperance) will be unresponsive to this risk unless the precautionary motive exists (Elmendorf and Kimball (1991), Paxson (1990)).

Modifying King and Dicks-Mireaux (1982) by adding earnings uncertainty, we arrive at:

$$\frac{W_i}{Y_i^P} = f(Y_i^P, U_i, \mathbf{X}_i) + \varepsilon_i \,. \tag{A1.1}$$

For consistency with our forward looking model that asset accumulation responds to future earnings uncertainty, W_i is total net assets in 1966 for person i, Y_i^P is permanent earnings calculated with 1965 to 1975 data (Section 3A above), U_i is future earnings uncertainty (Section 3B above), and $\mathbf{X}_i$ is a vector of personal characteristics that is assumed to influence wealth, including a quadratic in age to test for the predicted humped shape of the $\frac{W_i}{Y_i^P}$ vs. age profile. The error term $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$. Specification 1 in Table A1 (OLS regressions testing for the existence of precautionary saving) uses the total uncertainty proxy $\sigma_{\hat{\mu}_{it}}$ which is the standard deviation of each family's log-earnings profile residual. Specification 2 uses the uncertainty components σ_τ (transitory uncertainty) and σ_η (permanent uncertainty).

The large, positive influence of earnings uncertainty on the wealth to earnings ratio shows a strong precautionary motive in both specifications of equation A1.1. Shocks to transitory earnings significantly affect asset accumulation (Specification 2), supporting the buffer stock saving theory, and suggesting that credit constraints plague some consumers.

As expected permanent uncertainty has a larger affect on asset accumulation than has transitory uncertainty.

Appendix A2: Construction of Permanent Earnings

The formal permanent earnings model begins with:

$$Y_i^P = \mathbf{Z}_i\beta + \delta_i \qquad \text{(A2.1)}$$

where permanent earnings (Y_i^P) is annual earnings with no transitory component, evaluated at the same age for everyone.[24] $\mathbf{Z}_i$ is a vector of observable characteristics, with the parameter vector β . $\delta_i = N(0, \sigma_\delta^2)$ is the time constant family-specific error.

Current and permanent earnings differ by virtue of the family's position on their age-earnings profile $g(AG_{it})$, and by a transitory earnings component. Current earnings E_{it} in any particular year for family i, in terms of permanent earnings is:

$$E_{it} = Y_i^P + g(AG_{it}) + \mu_{it} \qquad \text{(A2.2)}$$

where μ_{it} is the current, observation-specific error, assumed to have an arbitrary covariance structure that is constant across familys, and is uncorrelated with the family-specific error δ_i .

The observation-specific error μ_{it} includes both permanent and transitory shocks, because in estimation the profile's slope is not updated over time. An ideal measure of permanent earnings would include only the permanent component of μ_{it}. Although we cannot decompose μ_{it} into its permanent and transitory components, we can isolate the standard deviation of the components which serve as proxies for permanent and transitory earnings uncertainty.

Substituting equation (A2.2) into equation (A2.1) yields:

$$E_{it} = \mathbf{Z}_i\beta + g(AG_{it}) + \delta_i + \mu_{it} \qquad \text{(A2.3)}$$

Equation (A2.3) shows the components of current earnings and its associated errors.

[24] The standard certainty-equivalence definition of permanent *income* includes the annuity value of current financial wealth as a component. We choose the KDM permanent earnings--expected earnings, which excludes financial wealth because our dependent variable is the share of assets.

μ_{it} and δ_i must be separated in estimation to identify the family-specific component $\hat{\delta}_i$ of each intercept $(\bar{\beta} + \hat{\delta}_i)$. This separation is possible only with panel data.[25]

To distinguish permanent from current earnings using panel data, the estimating equation is:

$$\ln E_{it} = \sum_{k=1}^{9} \bar{\beta}_1 J_k + \sum_{k=1}^{9} \bar{\beta}_{2k} J_k g(AG_{it}) + \delta_i + \mu_{it} \tag{A2.4}$$

$\ln E_{it}$ is the log of current earnings for person i in year t, J_k are occupation dummies, and $g(AG_{it})$ is a cubic in age. The log specification ensures that the uncertainty measure--the standard deviation of the log-earnings profile residual-- is not necessarily proportional to the level of permanent earnings.

We estimate (A2.4) using a random effects model. The family-specific profiles are defined by an average of 5.4 observations per family, and distinguished by a unique random intercept $\hat{\beta}_{1i} = \bar{\beta}_1 J_k + \hat{\delta}_i$, with mean $\bar{\beta}_1$ and variance $\hat{\sigma}_{\delta}^2$. The predicted value doesn't include either permanent or transitory earnings shocks. Both shocks are embodied in the residuals μ_{it} of each profile.

Estimated permanent earnings Y_i^P is the annual average of the present discounted value of expected (predicted) earnings, from the family-specific profile (equation A2.4), within a standardized age bracket (55-60).

Identifying each family-specific slope as well as intercept is possible, yet impractical since there are approximately five observations per family. To save degrees of freedom, we pool the data and allow the coefficients for the time-series earnings process to differ only across occupations by estimating the random effects model separately for each occupation, with the slope $\hat{\beta}_{2k}$ invariant within each occupation.[26] Using a panel, rather

[25] Cross-sectional studies that separate these error terms must use outside panel estimates to weigh the unobserved individual-specific trait embodied by the lone earnings observation in the cross section (e.g. Cox, 1990).

[26] We account for possible serial correlation in μ_{it} by imposing no restrictions on its process and by treating the random effects regression as a seemingly unrelated regression system (SUR)--one equation for each time period--following Chamberlain (1982). If the μ_{it} are correlated, SUR will yield efficient estimates.

than a cross-section, to locate the profile and estimate permanent earnings reduces error in measuring both the direction and size of the family-specific effect δ_i, and the slopes of the profiles.

Appendix A3: Construction of Earnings Uncertainty

Earnings are assumed to be more uncertain the more erratic the variation around an expected trend. We use two related methods to proxy earnings uncertainty. Each is generated from the current, observation-specific residuals of the family's profile ($\hat{\mu}_{it}$ --5.4 per family on average), and is therefore less likely to confound the effects of predictable earnings growth and uncertainty. The residuals $\hat{\mu}_{it}$ contain both permanent and transitory shocks because the profile's slope is not updated over time.

The first proxy, which includes both shocks, is the standard deviation of each family's profile residuals $\sigma_{\hat{\mu}_{it}}$. The second uncertainty proxy isolates the transitory and permanent components that compose total uncertainty. The uncertainty decomposition complements our method of measuring family-specific profiles, in creating a unique value for both permanent and transitory uncertainty, measured directly from time series residuals of each profile.

Carroll (1992) shows that if the permanent shock η and the transitory shock τ are i.i.d. and uncorrelated, then

$$Var(r(d)) = Var(\ln E_{it+d} - \ln E_{it}) = d\sigma_{\eta}^2 + 2\sigma_{\tau}^2 \qquad \text{(A3.1)}$$

where d is the number of years between earnings observations.[27] First we identify predictable Life-Cycle earnings changes using equation (A2.4) estimates, then apply (A3.1) to decompose the variance of the remaining time-series change $\hat{\mu}_{it+d}$.[28] Equation (A3.1) shows that permanent shocks are cumulative whereas transitory shocks are not. Current earnings in any year E_{it+d} consists of permanent earnings in year t, all past permanent shocks, growth, and the current transitory shock. Two or more d values solves (A3.1) for each family, because if the mean of $r(d) = 0$, then $[r(d)]^2$ provides an unbiased estimate

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[27] Carroll's permanent and current earnings (in logs) are $Y_{t+1}^P = g + Y_t^P + \eta_{t+1}$, and $E_t = Y_t^P + \tau_t$ where g is predictable Life-Cycle growth. These definitions and recursive methods yield $r(d) = dg + \eta_{t+1} + .. + \eta_{t+d} + \tau_{t+d} - \tau_t$, which in turn yield equation A3.1 above.

[28] In year t if one expects $\hat{E}_{it+d}$, then after removing the predictable Life-Cycle element, $r(d) = \hat{\mu}_{it+d}$. If instead one expects $\hat{E}_{it}$ plus the predicted growth rate, then $r(d) = \hat{\mu}_{it+d} - \hat{\mu}_{it}$. Our specifications below adopt the first interpretation. Both interpretations generate the precautionary result.

of (A3.1). Although this sample's mean $\hat{\mu}_{it}$ is close to zero (<.01), an F-test can not reject family-specific earnings growth rates.

Appendix A4: Alternate Credit Constraint Measure

We re-investigate the influence of credit constraints on portfolio allocation, this time separating the sample by the ability to borrow, following Zeldes (1989). If total wealth is one sixth annual permanent earnings, we categorize the family as credit constrained. Descriptive statistics in Table A4.1, column 5 show that the unconstrained hold a much larger portion of their assets in the risky, liquid form (77%) than do the constrained (26%). As expected, credit constrained families store most of their wealth (72%) in the safe liquid category. Also, it is not surprising that the percentage of households holding risky assets (illiquid and liquid--columns 5, and 7) for the unconstrained far surpasses the percentage held by their credit constrained counterparts.

The negative point estimate of transitory uncertainty is larger for the liquidity constrained for risky, illiquid assets (Table A4.2, Specification 1). Also, the positive impact of transitory uncertainty on safe, liquid assets is larger for the liquidity constrained (Specification 2). The uncertainty coefficients in both specifications confirm that liquidity is less important for families that can borrow freely. Families that have difficulty borrowing move more assets away from the illiquid form (housing, business, and real-estate--Specification 1), and more assets toward the liquid form (saving accounts and US Bonds--Specification 2).[29]

There are two notable results (both specifications) in Table A4.2. One is that the liquidity constrained do not significantly respond to permanent earnings shocks. This lends credence to the buffer stock saving theory. The other is that the liquidity constrained households respond much more strongly to transitory shocks than do their unconstrained counterparts. This is expected, since families that cannot borrow should be more concerned that a transitory shock might influence their purchases.

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[29] A specification with the dependent variable: stocks, bonds and mutual funds, will not converge for the liquidity constrained since so few hold this asset.

Table 1
Sample Means of Key Variables by Characteristics

Characteristic	Sample Size	Permanent Earnings	Total Wealth	Composition of Total Wealth (Asset Class/Total Wealth): Housing, Business & Real Estate	Saving Accounts & U.S. Bonds	Stocks, Bonds & Mutual Funds	Composition of Earnings Uncertainty: Standard Deviation of Permanent Shock	Standard Deviation of Transitory Shock	Probability of Being Credit Constrained
Total Sample	2,022	14,395	31,163	0.71	0.25	0.04	0.09	0.19	0.13
Mariatal Status									
Married	1,859	14,745	32,617	0.73	0.22	0.04	0.08	0.18	0.13
Single	163	10,402	14,586	0.39	0.57	0.04	0.10	0.27	0.21
Education									
Elementary	789	10,897	16,490	0.74	0.25	0.01	0.09	0.18	0.16
Some High School	414	13,638	30,538	0.72	0.25	0.04	0.21	0.38	0.13
High School	486	15,985	34,127	0.69	0.26	0.05	0.08	0.17	0.12
Some College	144	19,391	43,768	0.61	0.29	0.10	0.12	0.21	0.10
College	95	22,107	87,058	0.66	0.21	0.13	0.07	0.19	0.08
Grad School	94	23,409	65,966	0.61	0.26	0.13	0.06	0.24	0.09
Children									
Zero	299	12,322	27,281	0.54	0.41	0.04	0.10	0.20	0.15
One	350	14,656	32,421	0.67	0.27	0.05	0.07	0.18	0.12
Two-Four	1,058	15,292	33,379	0.00	0.00	0.03	0.06	0.17	0.17
Five	118	14,137	33,297	0.73	0.24	0.03	0.07	0.19	0.15
Six	197	12,410	21,645	0.80	0.18	0.02	0.06	0.24	0.20
Race									
White	1,498	15,540	36,846	0.70	0.25	0.05	0.09	0.18	0.11
Non-White	524	11,120	14,917	0.73	0.25	0.01	0.08	0.20	0.21
Occupation									
Prof./technical	214	22,049	43,240	0.64	0.27	0.10	0.06	0.19	0.10
Managerial	215	18,347	91,264	0.66	0.23	0.11	0.14	0.25	0.08
Clerical	150	15,443	25,196	0.67	0.28	0.05	0.09	0.15	0.13
Sales	85	18,880	40,158	0.70	0.22	0.08	0.09	0.19	0.10
Craftsman	505	13,957	26,938	0.75	0.22	0.03	0.08	0.17	0.12
Operative	481	11,714	17,088	0.73	0.26	0.01	0.08	0.17	0.15
Services	157	11,760	16,547	0.66	0.32	0.02	0.06	0.19	0.18
Farm laborers	38	6,402	8,929	0.64	0.36	0.00	0.07	0.36	0.18
Laborers	177	9,882	12,340	0.75	0.24	0.01	0.07	0.20	0.19

Continued next page

Table 1 Continued

Sample Means of Key Variables by Characteristics

Characteristic	Sample Size	Permanent Earnings	Total Wealth	Composition of Total Wealth (Asset Class/Total Wealth): Housing, Business & Real Estate	Saving Accounts & U.S. Bonds	Stocks, Bonds & Mutual Funds	Composition of Earnings Uncertainty: Standard Deviation of Permanent Shock	Standard Deviation of Transitory Shock	Probability of Being Credit Constrained
Health									
Excellent	775	15,709	36,843	0.70	0.25	0.05	0.09	0.16	0.13
Good	886	14,508	30,336	0.70	0.26	0.04	0.08	0.18	0.13
Fair	292	11,933	21,060	0.71	0.26	0.03	0.09	0.23	0.15
Poor	69	8,590	20,747	0.79	0.18	0.03	0.10	0.30	0.18
Bequest									
Intended	1,374	14,459	31,815	0.72	0.24	0.04	0.08	0.19	0.13
Not Intended	648	14,258	29,782	0.26	0.28	0.05	0.10	0.19	0.14

Table 2

Household Portfolios By Key Characteristics

	Sample Size	Mean Asset Level	Assets as a % of Total Assets	% of Households Holding Assets
Individual Assets				
Business Assets (1)	2,022	2,984	0.02	0.05
Housing Assets (2)	2,022	14,991	0.61	0.79
Real Estate Assets (3)	2,022	4,551	0.08	0.20
Savings Accounts (4)	2,022	4,378	0.21	0.74
U.S. Bonds (5)	2,022	918	0.04	0.35
Stocks, Bonds, Mutual Funds (6)	2,022	3,341	0.04	0.20
Asset Classes				
Risky, Illiquid (1, 2, & 3)	2,022	22,527	0.71	0.84
Safe, Liquid (4 & 5)	2,022	5,296	0.25	0.79
Risky, Liquid (6)	2,022	3,341	0.04	0.20
Asset Classes by Earnings				
Highest Earnings Decile				
Risky, Illiquid (1, 2, & 3)	202	52,697	0.67	0.95
Safe, Liquid (4 & 5)	202	13,591	0.21	0.98
Risky, Liquid (6)	202	17,153	0.12	0.49
Lowest Earnings Decile				
Risky, Illiquid (1, 2, & 3)	203	13,193	0.74	0.80
Safe, Liquid (4 & 5)	203	2,384	0.24	0.47
Risky, Liquid (6)	203	1,160	0.02	0.07

Table 3

Tobit Analysis--Asset Share's Response to Earnings Uncertainty

Variable	Specification 1		Specification 2		Specification 3		Variable Mean
	Estimated Coefficient (t-value)						
Uncertainty							
Uncertainty of Permanent Shock (σ_η)	-0.23	-(3.93)	0.19	(3.47)	0.17	(3.14)	0.09
Uncertainty of Transitory Shock (σ_τ)	-0.18	-(4.61)	0.11	(3.17)	0.13	(3.72)	0.19
Credit Constraint Probability (P_i)	-3.73	-(18.46)	3.45	(18.74)	-0.10	-(0.40)	0.13
Life Cycle & Demographic							
Permanent Earnings (Y^p_i)	5.20E-05	-(7.69)	4.60E-05	(7.38)	2.58E-05	(3.49)	14,395
Earnings Squared	7.55E-10	(4.83)	-6.87E-10	-(4.77)	-3.61E-10	-(2.31)	2.51E+08
Total Wealth	1.14E-07	(0.36)	-6.40E-07	-(2.16)	2.41E-06	(6.14)	31,163
Wealth Squared	-2.16E-13	-(0.70)	6.11E-13	(2.13)	-2.82E-12	-(4.78)	5.92E+09
Age	-0.11	-(1.58)	0.10	(1.60)	0.01	(0.09)	50.99
Age Squared	7.49E-04	(1.14)	-7.05E-04	-(1.16)	-5.77E-05	-(0.08)	2,617
Married (1 if married)	0.28	(6.23)	-0.25	-(6.05)	-0.02	-(0.34)	0.92
Children	0.06	(10.61)	-0.05	-(10.52)	-0.02	-(2.61)	2.66
Race (1 if not white)	0.36	(11.45)	-0.33	-(11.34)	-0.08	-(2.17)	0.74
Bequest (1 if intend bequest)	0.03	(1.33)	-0.02	-(0.81)	-0.03	-(1.35)	0.68
Health							
Excellent Health	-0.16	-(2.46)	0.17	(2.76)	-0.06	-(0.71)	0.38
Good Health	-0.18	-(2.77)	0.18	(2.96)	-0.04	-(0.53)	0.44
Fair Health	-0.20	-(2.96)	0.21	(3.20)	-0.04	-(0.47)	0.14
Education							
Elementary	0.15	(2.35)	-0.07	-(1.16)	-0.25	-(4.11)	0.39
Some High School	0.10	(1.61)	-0.05	-(0.78)	-0.09	-(1.53)	0.20
High School	0.06	(1.03)	-0.01	-(0.23)	-0.07	-(1.26)	0.24
Some College	0.03	(0.45)	-0.01	-(0.09)	-0.02	-(0.37)	0.07
College	0.07	(0.97)	-0.05	-(0.80)	0.01	(0.15)	0.05
Constant	4.92	(2.81)	-3.73	-(2.31)	-0.62	-(0.33)	1.00
Chi-squared (29)	637		611		483		
Observations	2,022		2,022		2,022		
Dependent variable mean	0.71		0.25		0.04		
Censored at 0	325		434		1,620		
Censored at 1	416		275		1		

Notes:

Specification 1 Dependent Variable--proportion of risky, illiquid assets (i.e., Housing, Business, and Real-Estate/Total Assets).

Specification 2 Dependent Variable--proportion of safe, liquid assets (i.e., Saving Accounts, and U.S. Bonds/Total Assets).

Specification 3 Dependent Variable--proportion of risky, liquid assets (i.e., Stocks, Bonds and Mutual Funds/Total Assets).

The following reference categories are used for dummy variables: Health--Poor, Education--Graduate School.

The regression also controls for nine occupational categories.

Table 4

Tobit Analysis--Asset Share's Response to Interactive Variables

Variable	Estimated Coefficient (t-value)						Variable Mean
	Specification 1		Specification 2		Specification 3		
Uncertainty							
Uncertainty of Permanent Shock (σ_η)	0.57	(4.39)	-0.57	-(4.76)	0.20	(1.61)	0.09
(σ_η) x Credit Constraint Probability (P_i)	-6.61	-(6.41)	6.27	(6.63)	-0.31	-(0.28)	0.01
Uncertainty of Transitory Shock (σ_τ)	0.01	(0.15)	-0.09	-(1.70)	0.17	(3.38)	0.19
(σ_τ) x Credit Constraint Probability (P_i)	-1.42	-(3.73)	1.58	(4.52)	-0.49	-(1.05)	0.03
Life Cycle & Demographic							
Permanent Earnings (Y^p_i)	-3.50E-05	-(4.85)	0.00	(4.66)	0.00	(3.36)	14,395
Earnings Squared	5.96E-10	(3.52)	-5.56E-10	-(3.56)	-3.38E-10	-(2.16)	2.51E+08
Total Wealth	8.09E-07	(2.33)	-1.24E-06	-(3.87)	2.37E-06	(6.14)	31,163
Wealth Squared	-7.21E-13	-(2.15)	1.05E-12	(3.38)	-2.79E-12	-(4.80)	5.92E+09
Age	-0.01	-(0.17)	0.01	(0.21)	0.01	(0.12)	50.99
Age Squared	0.00	(0.04)	0.00	-(0.07)	0.00	-(0.11)	2,617
Married (1 if married)	0.44	(9.19)	-0.39	-(8.98)	-0.02	-(0.45)	0.92
Children	0.04	(6.92)	-0.04	-(6.86)	-0.02	-(2.66)	2.66
Race (1 if not white)	0.14	(4.55)	-0.13	-(4.54)	-0.08	-(2.33)	0.74
Bequest (1 if intend bequest)	0.03	(1.10)	-0.01	-(0.60)	-0.03	-(1.33)	0.68
Health							
Excellent Health	-0.13	-(1.76)	0.13	(2.03)	-0.06	-(0.70)	0.38
Good Health	-0.14	-(2.03)	0.15	(2.22)	-0.04	-(0.53)	0.44
Fair Health	-0.16	-(2.13)	0.16	(2.36)	-0.04	-(0.46)	0.14
Education							
Elementary	0.12	(1.65)	-0.04	-(0.57)	-0.24	-(4.11)	0.39
Some High School	0.08	(1.11)	-0.02	-(0.37)	-0.09	-(1.53)	0.20
High School	0.05	(0.71)	0.00	(0.01)	-0.06	-(1.23)	0.24
Some College	0.00	(0.02)	0.02	(0.30)	-0.02	-(0.35)	0.07
College	0.05	(0.63)	-0.03	-(0.48)	0.01	(0.15)	0.05
Constant	1.17	(0.62)	-0.31	-(0.18)	-0.64	-(0.35)	1.00
Chi-squared (30)	353		334		484		
Observations	2,022		2,022		2,022		
Dependent variable mean	0.71		0.04		0.25		
Censored at 0	325		1,620		434		
Censored at 1	416		1		275		

Notes:

Specification 1 Dependent Variable--proportion of risky, illiquid assets (i.e., Housing, Business, and Real-Estate/Total Assets).

Specification 2 Dependent Variable--proportion of safe, liquid assets (i.e., Saving Accounts, and U.S. Bonds/Total Assets).

Specification 3 Dependent Variable--proportion of risky, liquid assets (i.e., Stocks, Bonds and Mutual Funds/Total Assets).

The following reference categories are used for dummy variables: Health--Poor, Education--Graduate School.

The regression also controls for nine occupational categories.

Table A1

Existence of the Precautionary Motive--Least Squares Estimation of Equation A1.1

Variable	Estimated Coefficient (t-value)				Variable Mean
	Specification 1		Specification 2		
Uncertainty					
Total Earnings Uncertainty (σ_μ)	5.26	(19.84)	-	-	0.34
Uncertainty of Permanent Shock (σ_η)	-	-	8.97	(13.85)	0.09
Uncertainty of Permanent Shock (σ_τ)	-	-	6.26	(15.20)	0.19
Life Cycle and Demographic					
Permanent Earnings (Y^p_i)	1.28E-05	(0.50)	0.00	-(0.26)	14,395
Age	3.96E-01	(0.52)	1.06E+00	(1.39)	50.99
Age Squared	-3.34E-03	-(0.46)	-1.01E-02	-(1.37)	2,617
Married (1 if married)	6.96E-01	(1.53)	8.19E-01	(1.80)	0.92
Children	-0.09	-(1.55)	-0.09	-(1.57)	2.66
Race (1 if not white)	-0.23	-(0.79)	-0.26	-(0.87)	0.26
Bequest (1 if intend bequest)	0.29	(1.12)	0.29	(1.14)	0.68
Health					
Excellent Health	0.43	(0.63)	0.73	(1.06)	0.38
Good Health	0.11	(0.16)	0.37	(0.54)	0.44
Fair Health	0.54	(0.76)	0.73	(1.01)	0.14
Education					
Elementary	-1.35	-(1.82)	-1.22	-(1.63)	0.39
Some High School	-1.05	-(1.44)	-0.98	-(1.32)	0.20
High School	-1.05	-(1.49)	-0.93	-(1.31)	0.24
Some College	-1.52	-(2.03)	-1.46	-(1.93)	0.07
College	0.38	(0.49)	0.45	(0.57)	0.05
Constant	-11.72	-(0.61)	-27.88	-(1.43)	1.00
Adjusted R-squared	0.21		0.20		
F-statistic	23.20		21.27		
Observation	2,022		2,022		
Dependent Variable Mean	2.29		2.29		

Notes:

Dependent variable--Total Net Family Wealth in 1966 Divided by Permanent Earnings

Specification 1 measures the influence of total earnings uncertainty.

Specification 2 measures the influence of permanent and transitory earnings uncertainty separately.

The following reference categories are used for dummy variables: Health--Poor, Education--Graduate School.

The sum of the uncertainty components (specification 2) does not equal total uncertainty (specification 1), because the calculation methods differ (see appendix A2).

The regression also controls for nine occupational categories.

Table A4.1

Alternate Measure of Credit Constrained Families (Zeldes 1989)
Summary Statistics of Constrained and Unconstrained Families by Key Characteristics

				Composition of Total Wealth and (% of Households Holding These Assets)			Composition of Earnings Uncertainty	
Characteristic	Sample Size	Permanent Earnings	Total Wealth	Housing, Business & Real Estate	Saving Accounts & U.S. Bonds	Stocks, Bonds & Mutual Funds	Standard Deviation of Permanent Shock	Standard Deviation of Transitory Shock
Unconstrained Families	1,756	14,959	35,723	0.77 (.98)	0.18 (.78)	0.13 (.22)	0.01	0.18
Constrained Families	266	10,671	1,066	0.26 (.29)	0.72 (.81)	0.04 (.04)	0.08	0.20

Table A4.2

Tobit Analysis--Asset Share's Response to Earnings Uncertainty for Credit Constrained and Unconstrained Families.

Variable	Estimated Coefficient (t-value)								Variable Mean
	Specification 1				Specification 2				
	Unconstrained Families		Constrained Families		Unconstrained Families		Constrained Families		
Uncertainty									
Uncertainty of Transitory Shock (σ_η)	-0.12	-(3.74)	-1.35	-(1.89)	0.05	(1.73)	1.33	(2.39)	0.19
Uncertainty of Permanent Shock(σ_τ)	-0.11	-(2.31)	0.71	(0.43)	0.07	(1.57)	0.43	(0.34)	0.09
Permanent Earnings (Y^p_i)	-2.12E-05	-(3.83)	-4.90E-04	-(2.74)	1.57E-05	(3.19)	4.53E-04	(3.30)	14,395
Earnings Squared	3.10E-10	(2.43)	1.10E-08	(1.71)	-2.43E-10	-(2.14)	-1.10E-08	-(2.25)	2.51E+08
Total Wealth	-1.12E-07	-(0.45)	2.96E-03	(3.58)	-3.93E-07	-(1.77)	-2.56E-03	-(4.09)	31163.33
Wealth Squared	1.32E-13	(0.54)	-5.44E-07	-(2.42)	2.55E-13	(1.18)	4.73E-07	(2.75)	5.92E+09
Age	0.01	(0.15)	0.30	(0.26)	-0.02	-(0.38)	0.17	(0.19)	50.99
Age Squared	-1.43E-04	-(0.27)	-3.06E-03	-(0.27)	2.36E-04	(0.49)	-1.25E-03	-(0.15)	2617.424
Married (1 if married)	0.31	(8.22)	2.28	(3.24)	-0.29	-(8.57)	-1.52	-(3.21)	0.92
Children	0.04	(8.32)	0.12	(1.68)	-0.03	-(8.49)	-0.09	-(1.54)	2.66
Race (1 if not white)	0.13	(5.43)	0.07	(0.18)	-0.12	-(5.55)	0.09	(0.31)	0.74
Bequest (1 if intend bequest)	0.06	(3.03)	-0.57	-(1.43)	-0.04	-(2.56)	0.51	(1.68)	0.68
Health									
Excellent Health	-0.13	-(2.06)	-1.30	-(1.77)	0.14	(2.62)	0.89	(1.57)	0.38
Good Health	-0.13	-(2.10)	-1.30	-(1.80)	0.14	(2.57)	0.87	(1.58)	0.44
Fair Health	-0.13	-(2.11)	-1.05	-(1.47)	0.15	(2.63)	0.76	(1.37)	0.14
Education									
Elementary	0.12	(2.35)	-0.45	-(0.18)	-0.04	-(0.91)	0.09	(0.05)	0.39
Some High School	0.09	(1.71)	-1.85	-(0.72)	-0.03	-(0.74)	0.82	(0.42)	0.20
High School	0.04	(0.82)	-0.01	(0.00)	0.01	(0.17)	-0.23	-(0.12)	0.24
Some College	0.01	(0.15)	-11.28	-(1.09)	0.01	(0.27)	9.68	(1.02)	0.07
College	0.04	(0.69)	2.99	(1.23)	-0.03	-(0.53)	-2.37	-(1.24)	0.05
Constant	0.62	(0.43)	-8.12	-(0.27)	0.61	(0.48)	-4.13	-(0.18)	1.00
Pseudo R-Squared	0.18		0.36		0.17		0.34		
Chi-squared	405.32		151.42		317.39		156.14		
Observations	1756		266		1756		266		
Dependent variable mean	0.77		0.26		0.18		0.72		
Censored at 0	136		189		384		50		
Censored at 1	367		49		96		179		

Notes: The reference categories for dummy variables: Health--Poor, Education--Graduate School. The regression also includes nine occupational dummies.
Specification 1--Dependent Variable: Housing, Business, and Real-Estate/Total Assets--(Proportion of Risky, Illiquid Assets)
Specification 2--Dependent Variable: Saving Accounts, and U.S. Bonds/Total Assets--(Proportion of Safe, Liquid Assets)