HOUSEHOLD CONSUMPTION AND HOUSEHOLD TYPE: 
WHAT CAN WE LEARN FROM MORTGAGE REFINANCING?

Erik Hurst
University of Chicago
Graduate School of Business

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In one of Aesop’s classic fables, a sharp distinction is drawn between ants and grasshoppers. The ants worked during the summer setting aside enough resources to sustain themselves throughout winter. The grasshoppers, however, saved little during their season of prosperity leaving them ill prepared for the future winter hardship. The first goal of this paper is to use mortgage refinancing behavior to isolate a group of ‘economic grasshoppers’ – households who persistently save little for their given lifecycle position. Analysis of this group of households who appear to behave myopically with respect to their mortgage refinancing and their long-term savings behavior provides insight into household consumption behavior more generally.

Over the last two decades, empirical tests of consumption Euler equations have yielded mixed results as to whether households behave as predicted by the Permanent Income Hypothesis. I find that an identifiable segment of the population can be characterized as consuming according to a ‘rule-of-thumb’ (as discussed in Campbell and Mankiw (1989)), altering their consumption in response to both predictable income increases and decreases; a result which is inconsistent with both the standard Permanent Income Hypothesis with patient consumers and a story of capital market imperfections. From observed mortgage refinancing behavior in the early 1990s, two distinct groups are identified: households who refinanced as part of an overall wealth management plan and households who refinanced at a rate premium in order
to access home equity for current consumption. I show that these latter households, who exercised a ‘consumption option’ when refinancing, persistently held less liquid wealth than other refinancers, persistently saved less throughout the 1980’s compared to other homeowners with similar observables and followed a rule-of-thumb consumption plan in the mid 1990’s.

Since Fisher (1929) and Keynes (1936), a major focus of economic research has been how and why individuals save. There has been a preponderance of recent empirical research illustrating that some households save much less than others for a given life cycle position. Venti and Wise (1996, 1998), using data from the Health and Retirement Survey and from Social Security records, give credence to the existence of an economic grasshopper by showing that when controlling for household lifetime income, some households have persistently lower lifetime wealth accumulation (including social security and pension wealth). Smith (1995), conditioning on income, finds that there is significant disparity in saving behavior across racial and ethnic groups in the Health and Retirement Survey (HRS). Smith concludes that income differences explain part, but certainly not all, of the wealth disparities that exist. Using data from the Panel Study of Income Dynamics (PSID), Hurst, Louh and Stafford (1998) show that over a third of the senior baby boom cohort had less than $10,000 of non-pension wealth as they enter their retirement years while the top third had wealth in excess of $150,000.²

Although it has been documented that saving behavior differs dramatically across households with similar lifetime incomes, little attention has focused on why these differences occur. Browning and Lusardi (1996), in their recent extensive survey of household savings, state that “one relatively unexplored area (in the savings literature) is the importance of heterogeneity across the population in explaining cross-sectional variation in (savings) behavior”.³⁴ During a

² Hurst, Luoh and Stafford assign a household to the senior baby boom cohort if the household head was born between 1945 and 1954.
³ Browning and Lusardi, pg. 1850.
⁴ Recent notable exceptions include Lawrance (1991) and Samwick (1997). Barsky et. al. (1997) report measures of preference parameters relating to risk tolerance, time preference, and intertemporal substitution for households in the
lifetime, many random events not directly under the control of the household may affect savings and consequently the accumulation of wealth. Shocks to earnings resulting from unexpected job loss or changes in work availability (perhaps due to health status) can cause households to dissave in order to smooth their marginal utility of consumption over time. Unexpected consumption contingencies, such as those associated with child-rearing, health expenditures or those linked to altering family structure can lead to a reduction in the stock of wealth in times of need. Households with steep income profiles would prefer to borrow when young and save when old, causing differences in observed wealth in the pre-retired years even after adjusting for expected lifetime income. Likewise, households with a more variable income stream may prefer to hold a larger wealth buffer for protection against the potential of receiving a negative income shock (Carroll, 1994). Finally, differences in expected bequests (either ones they plan to receive or plan to bestow) can cause differences in saving behavior across households with like lifetime incomes. Heterogeneity in savings behavior resulting from any of the above can be classified as stemming from differences in household situations.

In contrast to differences in situations, some households may differ in type. Even if all households behave as life cycle consumers with similar expected income trajectories, certain households may have high intertemporal discount rates causing them to consume earlier in life (saving less over time). Samwick (1997), calibrating a standard lifecycle model with stochastic income shocks, used observed wealth holdings from the Survey of Consumer Finances to solve for individual time preference rates. He found the median discount rate was close to 3.16 percent with twenty percent of the sample having discount rates lower than –15.0 percent and eight percent of the sample having discount rates over 20 percent. Lawrance (1991) also found

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5 Using PSID data, Hurst, Lupton and Stafford (1999) find that households who receive adverse health shocks draw down their wealth and decrease their propensity to save.
significant heterogeneity in individual discount rates. After controlling for changes in age, family composition, education and race, she finds that subjective rates of time preference for \textit{PSID} families with low levels of presample labor income are three to five percentage points higher than those for the richest families.

Empirical findings of household heterogeneity are consistent with some of the recent theories of consumer spending. Campbell and Mankiw (1989), using aggregate data, find that a substantial fraction of households appear to follow a rule-of-thumb spending plan, myopically consuming most of their income in each period with out regard to future states of the world. While Campbell and Mankiw attribute their findings to the existence of a large portion of myopic households in the population, other authors have developed optimizing models in which differences in preference parameters can result in consumption tracking predictable movements in income. Laibson (1996) has theorized that some households may hold hyperbolic preferences – consumers who have inconsistent time preferences with higher discount rates in the short term as compared to the longer term. Simulations reveal that such preferences can lead to a strong positive correlation between predictable movements and consumption growth. Deaton (1991) and Carroll (1994) classify households that are prudent and at the same time impatient as being buffer stock savers. Such households desire to hold a target level of wealth. Once this target level of wealth is obtained, households will consume all remaining income. In each of these above cases, hypothesized differences in underlying preference parameters or consumption rules, or what I define as differences in type, can lead to differences in savings behavior across households beyond differences arising from situational factors and can cause consumption to respond to predictable changes in income. In Aesop’s fable, the grasshopper chose to use all of her resources during the early stage of her life to satisfy current consumption needs leaving her no stock of savings to draw upon in the future. Analogously, some households may behave as proverbial grasshoppers, choosing to sacrifice saving for short-term consumption gains leaving
themselves with less resources to smooth future income or expenditure shocks or to maintain their desired lifestyle during retirement years.

In this paper, I use differences in observed household mortgage refinancing behavior in the 1990s to isolate households who persistently saved less over time and explore whether differences in type are important in household saving decisions. According to standard mortgage lending rules, households with a post refinancing mortgage-balance-to-house-value ratio in excess of 0.8 must pay an interest rate premium. I show that households who paid this rate premium when refinancing almost exclusively removed equity at the same time. These households, on average, converted 60 percent of every dollar of equity removed into current consumption. In addition, I find that the households who were willing to pay the rate premium to access home equity persistently saved less over time compared to other homeowners. These same families were less likely to hold liquid assets – both in the year of refinancing and a full decade prior to the refinancing. Between 1984 and 1989, these households saved, on average, approximately $3,000 less per year than other refinancers did, controlling for income trajectories and demographics.

After establishing that there is distinct long-term heterogeneity in savings behavior between the above two refinancing groups of households, I then set out to explore whether the observed differences in behavior can be attributed to differences among families in their preferences for saving versus differences in resources out of which the household could have saved. In other words, were those looking to access home equity for current consumption merely households who received an income or consumption shock (ants in grasshopper’s clothing) or are there real distinctions in type between the two groups. To explore this issue, I examine the income processes of both refinancing groups. Theory predicts lower saving for those with: 1) higher income growth, 2) less income variability or 3) temporarily low income. I find that differences in short term income variability or long term trends in income levels do not explain the differences in savings behavior between the refinancing groups that I have identified. Furthermore, I analyze
whether there were differences in consumption contingencies between the two groups. Households who borrowed on their home to the point of paying a rate premium did not appear to do so as a result of changing health needs or changing family structure.

Having established behavioral differences across the groups in their long-term savings behavior, the focus turns to the estimation of consumption Euler equations derived from the household’s optimization process. I first test whether differences in discount rates explain differences in the observed saving behavior between the refinancing groups. The results are inconclusive. I then test whether those refinancing households who appear to persistently undersave relative to other households with similar situations do indeed follow a consumption rules-of-thumb. Contrary to the results predicted by the standard Permanent Income Hypothesis (where households are not impatient), I find that predictable increases in income have statistical power in predicting consumption growth for the refinancing households who exercised a consumption option - indicating that these households, to some extent, follow rule-of-thumb consumption behavior. I show that predictable decreases in income also have statistical power in predicting consumption declines for this set of refinancing households, ruling out that the results were driven by liquidity constraints. Predictable changes in income were not significant in predicting the growth in consumption for the other group of refinancing households. I am not, however, able to distinguish whether this apparent rule-of-thumb behavior results from myopia or from buffer stock behavior. But, in either case, differences in type, or heterogeneity across households, appear to cause the differences in observed saving behavior.

The paper is organized as follows. The first section reviews the theory of intertemporal consumption optimization and establishes empirical tests for rule-of-thumb consumption behavior in micro data. In this section, the existing literature on consumption Euler equation estimation, with an emphasis on tests of myopia and buffer stock behavior, is discussed. The next section reviews the work on the consumption option embedded in the refinancing decision and sets out the rationale for how differences in refinancing behavior signal differences in savings behavior.
It is here that I outline the procedure for splitting the refinancing sample into Group G (grasshopper) and Group A (ant) households. I then describe the data from the Panel Study of Income Dynamics (PSID) that are used for the analysis. In the following section, I show that these differences in refinancing behavior are not explained by a difference in underlying income process or by unexpected consumption contingencies facing the households. Given this similarity in income streams, I then show that a full decade prior to the refinancing event, Group G households saved less than other households with similar situations. In the second to last section, the empirical tests isolating rule-of-thumb consumption behavior as outlined in the first section are estimated for the Group G and Group A refinancers. Here, credit market imperfections are ruled out as driving the rejection of the standard Permanent Income Hypothesis. The final section of the paper concludes and offers some directions for future research.

**Empirical Specification and Econometric Tests**

Neoclassical consumption theory assumes that households are forward looking and that credit markets are perfect. According to the Permanent Income Hypothesis, expected income growth between period \( t \) and \( t+1 \) should not have statistical power in predicting consumption growth between period \( t \) and \( t+1 \) (Hall 1978). Any predictable future changes in the household’s income stream should already be incorporated into the household’s current consumption plan. Specifically, a household who expects their income to change in the future should borrow or save today so that their discounted marginal utility of consumption is equated through time. Since Hall, theoretical and empirical work on consumption has been characterized by consideration of the consumption Euler equations – that is the first order conditions of the consumer’s maximization problem. Early work by Flavin (1981) and Hall and Miskin (1982) found that changes in consumption over-responds to predictable changes in income. Since then, the
empirical findings with regard to the ‘excess sensitivity’ of consumption to predictable changes in income have been mixed.\textsuperscript{6}

Three popular explanations for the rejection of the Permanent Income Hypothesis using micro data have emerged over the last one and a half decades. If households behave myopically (or according to a Keynesian rule-of-thumb), consumption will respond to predictable changes in income. Rule-of-thumb consumers, by not planning for the future, consume a fixed fraction of their income as it is earned, regardless of their lifecycle position. The Permanent Income Hypothesis may also be rejected in empirical tests even if households are optimizing according to a permanent income rule. The existence of exogenous liquidity constraints may prevent households who wish to smooth their discounted marginal utility of consumption over time from borrowing against future human wealth. If the liquidity constraints are binding, household consumption will respond to predictable income increases. Finally, if households are sufficiently ‘impatient’ and if households are risk averse and income is uncertain, households will hold a savings buffer (Carroll (1994)). Once households reach their target level of wealth, consumption will move with predictable changes in income as households’ preferences for current consumption dominate their desire to protect themselves against future income shocks.

As noted by Altonji and Siow (1987), Zeldes (1989) and Shea (1995), it is possible to empirically test whether the existence of liquidity constraints is driving the rejection of the Permanent Income Hypothesis in micro data. Liquidity constraints prevent a household from borrowing but do not place any restrictions on a household’s ability to save. As a result, the consumption growth of liquidity constrained households should only respond to predictable increases in income, but not predictable income declines. If households truly expect their income to decline, they could save a percentage of their income today so as to fund consumption in the future, leaving their discounted marginal utility of consumption unchanged. However, the

\textsuperscript{6} For a recent survey of tests of the Permanent Income Hypothesis using consumption Euler equation, see Browning
consumption of either rule-of-thumb households or buffer stock households will respond to both expected income increases and declines. In the remainder of this section, I review the standard life cycle model and outline the empirical tests for liquidity constraints, rule-of-thumb behavior and buffer stock behavior. I then discuss some of the recent work that has found violations of the standard Permanent Income Hypothesis.

**Theoretical Motivation**

The usual model for discussing household saving decisions is the life-cycle model (Modigliani, 1954; Friedman, 1957). The theory states that rational forward looking agents will not want expenditures to be worth more (in discounted utility terms) in one period than in any other. As in Zeldes (1989), assume the household solves the following maximization problem:

\[
\max_{C_t} \quad u(C_t, \Theta_t) + E_t \sum_{s=t+1}^{T} \frac{1}{1 + \delta_k} ^{(s-t)} u(C_t, \Theta_t) \\
\text{s.t.} \quad X_{i,t+1} = (1 + r_{i,t+1})(X_{it} - C_{it}) + Y_{i,t+1} \\
Y_{it} = P_{it} \pi_{it} \\
P_{it} = g_{i}P_{i,t-1}N_{it} \\
u(C_{it}, \Theta_{it}) = \frac{C_{it}^{1-\rho}}{1-\rho_k} \exp(\Theta_{it}), \quad \rho_k > 1;
\]

where \(C_{it}, X_{it}, \) and \(Y_{it}\) are, respectively, household \(i\)'s consumption, asset level available for household \(i\)'s consumption, and household income in period \(t\); \(r_{i,t+1}\) is the household specific interest rate between years \(t\) and \(t+1\) and \(\delta_k\) is the discount rate that pertains to a household in group \(k\).\(^7\) The household’s utility function is of the Constant Relative Risk Aversion form with a

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\(^7\) In the following section, two groups, indexed by \(k\), will be identified (a group of grasshoppers and a group of ants). The assumption made is that \(\delta\) and \(\rho\) are constant within each group but can differ across groups.
time invariant coefficient of relative risk aversion $\rho$, which differs across different types of households. Utility of the household is also dependent upon the household’s tastes in period $t$, $\Theta_{it}$. Household income can be decomposed into two parts; a permanent component ($P_{it}$) and a transitory component ($V_{it}$). Permanent income in the current period is equal to permanent income in the previous period multiplied by a nonstochastic growth factor ($g_i$), specific to the household, and a stochastic shock ($N_{it}$). The stochastic components to income $\{N_{it}, V_{it}\}$ are assumed to be independently and identically distributed jointly lognormally with zero means and variances of the underlying distributions equal to zero and $\{\sigma_{N,i}^2, \sigma_{V,i}^2\}$, respectively.

The Euler Equation to the above optimization problem can be estimated with the familiar specification:\(^8\)\(^9\)

\(^8\) As is well known (Hall, 1978), the solution to this model obeys the following consumption Euler equation:

$$E_i \left[ \frac{(1 + r_{i,t+1})}{(1 + \delta_k)} \exp (\Theta_{i,t+1} - \Theta_{i}) \left[ \frac{C_{i,t+1}}{C_{i,t}} \right]^{-\rho_k} \right] = 1.$$  

(3.N1)

If expectations are rational and prices adjust to clear markets, household $i$ satisfies (3.N1) up to a random forecast error, $e_{i,t+1}$. Rewriting (N1), we get:

$$\frac{(1 + r_{i,t+1})}{(1 + \delta_k)} \exp (\Theta_{i,t+1} - \Theta_{i}) \left[ \frac{C_{i,t+1}}{C_{i,t}} \right]^{-\rho_k} = 1 + e_{i,t+1}.$$  

(3.N2)

The nonlinear equation (3.N2) is difficult to estimate consistently with panel data because of measurement error in consumption data. Linearization of (3.N2) potentially allows identification of the consumption measurement error. As in Lawrance (1991), suppose that measured consumption, $C$, is related to true consumption, $C^*$, according to:

$$C_i = C_i \exp (v_{it}),$$  

(3.N3)

where $v_{it}$ is the mean zero random measurement error of household $i$ at time $t$. According to this specification, measurement error is distributed across households as a percentage of consumption rather than by an absolute amount. Taking logarithms of (3.N2) and (3.N3) and substituting yields the following estimable equation in terms of measured consumption:

$$\Delta \ln C_{i,t+1} = -\ln(1 + \delta_k) + \frac{\omega_v^2}{2\rho_k} + \frac{\ln(1 + r_{i,t+1})}{\rho_k} + \frac{(\Theta_{i,t+1} - \Theta_{i})}{\rho_k} + e_{i,t+1},$$  

(3.N4)
\[
\Delta \ln C_{i,t+1} = \frac{-\ln(1 + \delta_t)}{\rho_k} + \frac{\omega_k^2}{2\rho_k} + \frac{\ln(1 + r_{i,t+1})}{\rho_k} + \frac{(\Theta_{i,t+1} - \Theta_i)}{\rho_k} + \epsilon_{i,t+1},
\]  
(3.2)

where \( \epsilon_{i,t+1} \), the expectations forecast error, has mean zero and the law of iterated expectations implies that it is uncorrelated with any variable known at time \( t \) (Hall, 1978) and where \( \omega_k^2 \) is the variance of the forecast error.

Household tastes can be defined as:

\[
\Theta_i = b_0 age_i + b_1 age_i^2 + b_2 \ln(famsize_i) + \tau_i + \mu_i + \xi_{i,t+1}
\]  
(3.3)

where \( age_i \) is the age of the household head in year \( t \) and \( famsize_i \) represents the number of members in the household. The unobservable (to the econometrician) component of the taste shifter includes a family fixed component which is constant over time \( \tau_i \), an aggregate component that is constant across families but varies across time \( \mu_i \), and a remaining component that is orthogonal to the other two \( \xi_{i,t+1} \). Substituting (3.3) into (3.2), one gets:

\[
\Delta \ln C_{i,t+1} = \alpha_0 + \gamma_k \ln(1 + r_{i,t+1}) + \alpha_1 \Delta \ln famsize_{i,t+1} + \alpha_2 age_i + \mu_i + \epsilon_{i,t+1}^*,
\]  
(3.4)

where \( \epsilon_{i,t+1} \) is \( (\epsilon_{i,t+1}^2/2 - \omega_k^2/2) / \rho_k - \nu_{i,t+1} + \nu_t \), has mean zero and the law of iterated expectations implies that it is uncorrelated with any variable known at time \( t \) (Hall, 1978), where \( \omega_k^2 \) is the variance of the forecast error \( (E(\epsilon_{i,t+1}^2)) \), and where consumption and the interest rate are jointly lognormal (see Hansen and Singleton (1983)).

9 Among others, Shapiro (1984), Zeldes (1989) and Lawrance (1991) used the linearized Euler equation for estimation. Even if consumption and the interest rate are not jointly lognormal, (3.4) is valid up to a second order Taylor series expansion of \( \epsilon_{i,t+1} \).

10 Innovations to \( \xi \) are assumed to be persistent such that \( E_t[\xi_{i,t+1} - \xi_i] = 0 \).

11 It is assumed that \( \rho_k \) and \( \delta_k \) are not constant across all households in the population, but are constant across all households for which (3.4) will be estimated. This is done so as to isolate differences in average parameter values across the two refinancing groups that will be isolated below.
where \( \varepsilon^*_{i,t+1} = \varepsilon_{i,t+1} + (\xi_{i,t+1} - \xi_i)/\rho_k \) and has mean zero. The constant, \( \alpha_0 \), can be expressed as \( \gamma_k (\delta_k - \alpha_0^2/2 + b_0 + b_1) \), where \( \gamma_k \) is the intertemporal elasticity of substitution (1/\( \rho_k \)). If \( r_{i,t+1} \) is uncorrelated with \( \varepsilon^*_{i,t+1} \), then OLS estimation can be used to get consistent estimates of \( \alpha_0 \) and \( \gamma_k \).12

To test whether household consumption responds to predictable changes in income, the following regression can be estimated:

\[
\Delta \ln C_{i,t+1} = \alpha_0 + \gamma_k \ln (1 + r_{i,t}) + \alpha_1 \Delta \ln famsize_{i,t+1} + \alpha_2 \ln e_{i,t} + \\
\alpha_3 \ln (y^*_{i,t+1}/y_{i,t})^p + \mu_i + \varepsilon^*_{i,t+1}
\]

(3.5)

where \( \ln (y^*_{i,t+1}/y_{i,t})^p \) is the predictable component of income growth rate between \( t \) and \( t+1 \) estimated simultaneously with (3.5). If households are not sufficiently ‘impatient’, the Permanent Income Hypothesis predicts that consumption growth between periods \( t \) and \( t+1 \) should be unaffected by forecastable changes in income between periods \( t \) and \( t+1 \).13 Any predictable change in income should already be included in the household’s consumption plan. If \( \alpha_0 \) is positive and significant, predictable income growth has statistical power in predicting consumption growth and the standard Permanent Income Hypothesis with no liquidity constraints and patient consumers can be rejected.

The above test does not isolate whether the correlation between changes in consumption and predictable changes in income result from the existence of liquidity constraints. If market imperfections prevent households from borrowing when expected income growth is positive, predictable income growth will have statistical power in predicting consumption growth. It is possible, however, to test for the existence of liquidity constraints. Consumption growth for

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12 Given that changes in family size are planned in advance, \( \Delta \ln famsize_{i,t} \) is assumed to be uncorrelated with \( \varepsilon^*_{i,t+1} \). The following results were also run omitting changes in family size as a control but with consumption per capita as the dependent variable. The results were unchanged.

13 ‘Impatient’ households are classified as households who wish to borrow, all else equal, in the current period. Formally, households are deemed ‘impatient’ if the following condition is satisfied: \( \gamma_k (r_{i,t+1} - \delta_k) + (\rho_k/2) \sigma^2_{i,N} < g_i - \sigma^2_{i,N}/2 \). This impatience condition is necessary to generate buffer stock saving behavior. (Carroll, 1997).
liquidity constrained permanent income patient households should be unaffected when income is predicted to decline. Such households could smooth their marginal utility of consumption over time by saving. To test whether liquidity constraints are causing the rejection of the Permanent Income Hypothesis, the following equation can be estimated:

\[
\Delta \ln C_{i,t+1} = \alpha_{0,k} + \gamma_k \ln (1 + r_i) + \alpha_1 \Delta \ln famsize_{i,t+1} + \alpha_2 age_i + \\
\alpha_4 D^{up} \ln(y_{i,t+1} / y_i)^p + \alpha_4 D^{down} \ln(y_{i,t+1} / y_i)^p + \mu_i + \varepsilon_{i,t+1},
\]

where \(D^{up}\) and \(D^{down}\) are dummy variables indicating whether the household income growth between \(t\) and \(t+1\) was positive or negative. To isolate predictable components, both income growth and income declines were instrumented for using information known prior to period \(t\).\(^{14}\) If \(\alpha_5\) is positive and significant, the liquidity constraint hypothesis can be rejected.

It is rather straightforward to see that if households are rule-of-thumbers, consuming a fraction of their cash on hand in each period, consumption will respond to both predictable income increases and predictable income declines. Additionally, if a household pursues a buffer stock savings pattern, their consumption growth can optimally respond to both predicted income increases and declines. If households are sufficiently impatient, are risk averse, and face the potential of zero income in any given period, households will choose never to borrow for fear of having zero consumption, despite having large discount rates.\(^ {15}\) Instead, these households will hold some positive amount of saving to buffer themselves against bad income draws. Once households have reached their target level of saving, their high discount will dominate causing them to consume all additional resources above those needed to maintain their savings buffer. At

\(^{14}\) In the results section, I discuss in depth how I instrument for predictable income increases and declines.

\(^{15}\) Buffer stock behavior could result from high expected growth rate in income as opposed to high intertemporal discount rates. I look at the income processes of households in my sample below.
their buffer, household consumption will track income quite closely. See Carroll (1997) for simulation results of how consumption responds to various income processes.

The different predictions stemming from the theory of liquidity constraints as compared to a model of rule-of-thumb or buffer stock behavior can be tested empirically. A liquidity constrained, non-buffer stock household will respond only to predictable income increases, not to predictable income declines. Under the standard liquidity constraint hypothesis, when (3.6) is estimated, \( \alpha_4 \) would be predicted to positive while \( \alpha_5 \) would be predicted to equal. This result would not be true if the household was somehow different in type. If the household follows a consumption rule-of-thumb, \( \alpha_4 \) and \( \alpha_5 \) would both be positive and of similar orders of magnitude. Additionally, if the household saved according to a buffer stock rule, both \( \alpha_4 \) and \( \alpha_5 \) would again be positive. Simulations by Carroll (1997) show that the two coefficients need not be of similar size. Estimation of (3.5) allows for a test of whether the standard permanent income model with no exogenous liquidity constraints and patient consumers can be rejected. Estimation of (3.6) would isolate whether rule-of-thumb or high intertemporal discount rates, as opposed to exogenous liquidity constraints, exists in the groups identified below.

**Existing Literature on Consumption Euler Equation Estimation**

Certain authors have tested for whether liquidity constraints or myopia explains the rejection of the Permanent Income Hypothesis in aggregate or micro data. Campbell and Mankiw (1989) suggest that some consumers do not optimize their consumption according to a life cycle rule. Using aggregate data and instrumenting for the predictable level of income growth between period \( t \) and \( t+1 \), they conclude that one half of households are rule-of-thumb consumers. But,
the fact that consumption responds to predictable changes in income does not rule out the possibility that households are liquidity constrained.\textsuperscript{16}

Zeldes (1989) formulates empirical tests to determine if credit market imperfections are important in the rejection of the Permanent Income Hypothesis. For liquidity constrained households, an increase in current income should relax the liquidity constraint allowing the household to consume more in the current period, lowering consumption growth between periods $t$ and $t+1$. Zeldes splits his sample into those with high and low asset levels at the beginning of the period and then includes first period income in the Euler equation for each asset group. A priori, Zeldes hypothesizes that households with low asset levels are more likely to be liquidity constrained. He finds that the current income term is significant and has the predicted negative sign only for the low asset group.\textsuperscript{17} However, Zeldes’s results are also consistent with rule-of-thumb or buffer stock behavior. If income growth follows any sort of mean reverting process, high current income will proxy for lower income growth, predicting lower consumption growth for myopic households. Given that myopic households, by definition, will not accumulate significant amounts of wealth, Zeldes’s test can be recast as a test for rule-of-thumb behavior in a segment of the population that is more likely to have been behaving myopically.\textsuperscript{18}

Shea (1995) creates a sample of households from the Panel Study of Income Dynamics (PSID) who belong to a union to test for liquidity constraints and myopia in micro data. Taking advantage of information on union status, occupation and county of residence, Shea used published information on long-term union contracts as an instrument for expected wage growth. Rejecting the predictions of the Permanent Income Hypothesis, he found that household

\textsuperscript{16} In the discussion to Campbell and Mankiw, Hall made the point out that Campbell and Mankiw’s results are consistent with the effects of liquidity constraints.

\textsuperscript{17} The negative sign is predicted; a liquidity constrained household which receives a positive income shock in the current period will consume more in the current period thereby reducing their consumption growth. Zeldes’s results are not universally accepted. See Keane and Runkle (1992). Carroll (1994) interprets Zeldes’s results as potential evidence for a precautionary saving motive as opposed to the existence of liquidity constraints.

\textsuperscript{18} See Carroll (1994) for how Zeldes’s test can be recast as a test for buffer stock saving behavior.
consumption responded to predictable changes in income. By isolating expected income growth from expected income declines, Shea showed that consumption responds more strongly to predictable decreases in income than to predictable rises in income – a result that is inconsistent with both liquidity constraints and myopia.\(^{19}\) Shea suggests that his asymmetric findings are consistent with loss aversion on the part of households.

One approach to shed light on the debate as to why the Permanent Income Hypothesis is often rejected using micro data is to identify a group of households who undertake actions which appear to be consistent with myopia, liquidity constraints, or buffer stock saving behavior. Just because a household is poor does not imply that they wish to borrow. In the next section, I identify a group of mortgage refinancers who pay a premium to access home equity to fund current consumption. Ex ante, this behavior is consistent with any of the theories of consumption. However, analysis of their recent income trajectories and long-term saving behavior indicate that these households are not likely to be liquidity constrained, but they do save persistently little for their given level of income. I then formally test whether the standard Permanent Income Hypothesis can be rejected for these households and whether the rejection is consistent with differences in ‘type’ or consistent with binding liquidity constraints by estimating (3.5) and (3.6) on the two different refinancing samples.

**The Consumption Option and Refinancing**

The refinancing behavior of households makes it possible to identify a group of consumers who act as if they have strong preferences for current consumption. Hurst and Stafford (1998) note that the traditionally emphasized financial option embedded in the refinancing decision fails

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\(^{19}\) Myopia implies that households should respond equally to predicted increases and decreases in income. As discussed above, liquidity constraints imply that household consumption should respond only to predicted income increases.
to explain all variation in observed refinancing behavior. Specifically, some households
refinance when current interest rates exceed their original contract rate and others do not
refinance even when their coupon rate is well above current rates. The amount of refinancing
in periods when current rates exceed original contract rates have been increasing through-out the
1990s. Hurst and Stafford explain this phenomenon by noting that the home is used as a saving
vehicle for many households; home equity provides a consumption option to the household
allowing them to remove equity to alter their portfolio or increase spending. If the desire to
increase current consumption is strong enough or if the return to altering their portfolio is large
enough, some households will be willing to incur a refinancing penalty – in terms of a higher
marginal borrowing rate – in order to refinance and access home equity. To explain fully
observed refinancing behavior, it is necessary to embed the refinancing decision in a model that
accounts for household borrowing and saving decisions.

Using institutional features of the mortgage market, it is possible to identify a group of
refinancing households who were interested in increasing current consumption. To reduce the
risks associated with default, traditional lending institutions use a loan-to-value (LTV) criterion
when deciding whether to accept a mortgage application. With an increasing LTV, banks will
be less likely to recover the full amount of the loan if the household defaults. According to
traditional U.S. banking practices, a household with a LTV lower than 0.8 will be accepted,

20 When current mortgage rates are below the existing contract rate, households have an incentive to replace their
existing fixed rate mortgage with one at a lower rate. The benefit to the household is a present value wealth gain. This
benefit only need exceed the time and money costs of acquiring the new mortgage plus the potential loss associated
with exercising the option to refinance in the current period as opposed to waiting until a future period. See Chen and
Ling (1989) and Kau and Keehan (1995) for models incorporating the dynamic financial option to refinance.
21 See Stanton (1995) for a discussion of the failure of the financial option to refinance to explain recent refinancing
behavior.
22 Bennett, Peach and Perisitianni (1998) provide evidence that the fixed cost to refinancing had decreased due to
technological, regulatory, and structural changes in the mortgage market. The decreased costs of refinancing during the
1990s have presumably made it easier for households to access home equity.
23 A household’s loan-to-value ratio is calculated as the ratio of a household’s outstanding mortgage balance to their
current house price and serves as a measure of equity remaining in the home. Given the need to standardize lending
practices for the sale of loans in the secondary markets, lending rules related to LTV are similar across different lending
institutions. Ex-post loan to value ratio refers to the LTV of the household after they refinanced their mortgage
contract.
conditional on meeting established credit and debt-to-income tests.\textsuperscript{24} If a household has a loan-to-value ratio of between 0.8 and 0.9, then lender will require the household purchase private mortgage insurance, thereby boosting marginal borrowing costs associated with refinancing. A household with a loan-to-value ratio above 0.9 may be relegated to an even higher rate segment of the mortgage market; in recent years some lenders have been offering zero equity mortgage (LTV = 1) or even mortgages at 125 percent of house value.\textsuperscript{25} Some borrowers who do not meet the lending criteria of traditional lenders may seek to borrow from other lending institutions which may charge a borrowing premium at loan-to-value ratios in excess of 0.7 (Capozza and Hurst, 1998).\textsuperscript{26}

Using data from the Panel Study of Income Dynamics (\textit{PSID}), Hurst and Stafford test for the significance of the consumption option in explaining refinancing behavior for some households. Hurst and Stafford regressed the rate paid by refinancing households on ex-post equity position, along with other mortgage characteristics (i.e., whether they secured a fixed rate mortgage, year of refinancing), a measure of permanent income, pre-refinancing net worth, and demographics. As predicted, households with a post refinancing LTV of between 0.8 and 0.9 were found to have paid, on average, an additional quarter of a point in interest. This number lines up closely with institutional features in the mortgage market. For those households where private mortgage insurance is required, the standard insurance premium usually is in the range of an additional 25 basis points.\textsuperscript{27} Also in line with institutional data, \textit{PSID} households who borrowed over 90 percent of their house value were found to pay a premium in excess of one and a quarter points.

\textsuperscript{24} For a full discussion of credit and debt to income tests, see Caplin, Freeman and Tracey (1997).
\textsuperscript{25} High risk lending institutions like “The Money Store” have been offering mortgages in excess of 80 percent of house value for over a decade.
\textsuperscript{26} I refer to traditional lenders as any lender who makes a mortgage which conforms to secondary market regulations established by Freddie Mac and Fannie Mae. Non-conforming loans need not meet the secondary market guidelines.
\textsuperscript{27} It should be noted that the \textit{average} rate for these households is a quarter of a point higher. The \textit{marginal} rate far exceeds the average rate because the household has to pay that rate not just on the last dollar borrowed, but on the whole outstanding loan balance.
Hurst and Stafford identify two refinancing groups: households who paid the rate premium by having an ex-post LTV greater than 0.8 (Group G refinancers) and those refinancers who had an ex-post refinancing LTV below 0.8 (Group A refinancers). From Table 3.1, eighty percent of those with an ex-post LTV greater than 0.8 removed at least $10,000, with the amount of equity removed averaging $29,000. Conversely, for the Group A refinancers, only 52 percent removed more than $10,000 worth of equity. As Hurst and Stafford recognized, the fact that households removed equity at a premium does not imply that the households were interested in current consumption. Some households may have chosen to remove equity when they refinanced to optimally reallocate their portfolio between various assets. Especially during the early 1990s, some households in both refinancing groups may have transferred equity from their home to the stock market to capture some of the historic gains in equities.

Hurst and Stafford, by looking at changes in the household balance sheet, test for whether Group G households converted the equity they removed into current consumption. If households removed equity when refinancing to reallocate their portfolio, any dollar of equity removed would reappear in another of the household’s asset components. On the other hand, if the household was only interested in increasing current consumption, total household wealth (including housing equity) should decrease by the amount of equity removed. Hurst and Stafford hypothesize that the marginal propensity to convert equity into current consumption (MPCE) should be close to zero for the Group A refinancers if they were primarily interested in removing equity to reallocate their portfolio and that the MPCE should be close to 1 for the Group G refinancers, if they were interested in removing equity to fund current consumption.

Controlling for household permanent income and demographics, Hurst and Stafford (1998), found that PSID households who refinanced in the early 1990s and who had an ex-post loan to value ratio above 0.8 had a marginal propensity to convert housing equity into current

28 The Group G designation refers to households who appear to behave as economic grasshoppers while the Group A
consumption equal to 0.6 at the mean; for every one dollar of equity removed when Group G households refinanced, total wealth fell, on average, by sixty cents. The coefficient was statistically significant at all standard levels. They also found that Group A refinancing households converted little of the equity they removed into consumption. The point estimate for the marginal propensity to convert housing equity into current consumption for households with an ex-post LTV of below 0.8 was close to zero and was not statistically significant at any standard level. However, consistent with the portfolio reallocation story, Hurst and Stafford found that Group A households converted, on average, 7 percent of the equity they removed into new stock acquisitions even after controlling for income and demographics. Group G refinancers, with loan to value ratios in excess of 0.8, were not found to convert any of the removed housing equity into stocks.\(^{29}\)

In summary, Hurst and Stafford found that the Group A refinancers (proverbial ants), did not, on average, convert any of the equity they removed into current spending. They did, however, find that the Group A households were likely to use the some of the equity removed to reallocate their portfolio towards corporate equities. They also found that the Group G households (proverbial grasshoppers) were interested in current consumption, converting on average 60 percent of the equity they removed into spending by 1994.\(^{30}\) This behavior is consistent with a theory of myopia, liquidity constraints or buffer stock behavior. Households who expect their human wealth to increase in the near future may be willing to incur the borrowing penalty associated with an ex-post LTV greater than 0.8 in order to transfer consumption to the current period. The next portion of the paper tests whether the differences in

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29 The point estimate for the marginal propensity to convert housing equity into debt reduction was close to zero and not statistically significant for either refinancing group.

30 As Hurst and Stafford recognize, a point estimate of 0.6 for the marginal propensity to convert equity into current consumption (MPCE) does not mean that the household did not spend the remaining 40 percent. The MPCE measures changes in wealth between 1989 and 1994. It is possible that refinancing households could have saved the equity they removed for spending beyond the time they were interviewed in mid-1994. Furthermore, it is possible that not all designation refers to the remaining non-grasshopper (or ant) households.
observed refinancing behavior are due to liquidity constraints, myopia or high intertemporal discount rates.

**Data**

Observations from the Panel Study of Income Dynamics (*PSID*), a large-scale longitudinal study of U.S. households starting in 1968, were used for the research. Since 1980, the *PSID* has tracked housing decisions with detailed mortgage information. In each year of the survey, households are asked to report their own value of their house and if applicable, to report the outstanding balance on their mortgage. In 1996, a special supplement to the *PSID* core survey focused on mortgage shopping. In this supplement, households were asked whether they refinanced their mortgage during the 1990s and if so, in what years. Additionally, households were asked to provide the rate they are paying on their current mortgage and the effort they put forth in searching for their current mortgage lender.

The core *PSID* survey asks detailed questions on the respondent’s earnings, family structure and demographics. The *PSID Wealth Supplements*, in 1984, 1989 and 1994, asked respondents questions about their current financial position. In 1989 and 1994, questions pertaining to the amount of active saving undertaken by the household were also added. Respondents were asked about the amount of money put in or the amount taken out of the stock market or life annuities during the last 5 years and the amount invested (or disinvested) in private business enterprise or

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31 Data on market house value, annual mortgage payments net of taxes and insurance, the remaining mortgage balance and the number of years remaining on the mortgage were collected throughout the sample. Starting in 1993, information on second mortgages and the year the household acquired the mortgage were collected. Some mortgage variables were omitted from the survey in 1988 and 1989.

32 Household wealth is defined to include real estate – main home, second home, real estate investments, land contract holdings – cars, trucks, motor homes, boats, farm or business, stocks, bonds, mutual funds, saving and checking accounts, money market funds, certificates of deposit, government savings bonds, Treasury bills, IRAs, bond funds, cash value of life insurance policies, valuable collections for investment purposes, and rights in a trust or estate, less mortgage, credit card, and other outstanding collateralized and non-collateralized debt. The *PSID* does not ask questions concerning the wealth in private pensions or about expected social security retirement benefits. For a full
into real estate. As will be explained below, the measure of active saving used in this paper excludes saving in the home which results from paying down one’s mortgage or removing equity from one’s home.

Two main samples were used for analysis. The first sample included all households in the PSID owning their main home continuously between 1991 and 1996 and who did not move any time during the period. In total, the sample included 2,135. For 1994 – 1997, PSID data were only available in early release form, meaning many of the outliers in the data had not been hand edited, coding errors corrected or missing values imputed. As a result, some observations with unprocessed data or obvious coding errors were dropped causing the sample size to be reduced to 1,814 observations. For certain wealth regressions, I also required the household be in the sample in either 1989 and/or 1984. Corresponding sample sizes are listed where applicable.

The second main sample was a sub-set of the first. As in Hurst and Stafford (1998), I plan to use differences in observed refinancing outcomes to look at differences in saving behavior. Again, because of the use of early release data, some observations had to be dropped due to missing data or obvious coding errors. Of the 1,814 households, 516 refinanced between 1990 and 1996. Corresponding to aggregate data, the PSID data show that the majority of refinancing took place between 1992 and 1994.33

**Income and Demographic Comparisons of Refinancing Households**

At a descriptive level, who are the households who chose to draw down their home equity at a rate premium as they refinanced? In the next section, I provide evidence that Group G refinancers (those who refinanced and had an ex-post LTV above 0.8) not only used the equity

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33 For a thorough discussion of the data used in this paper, and for a justification of sample selection, see Hurst and Stafford (1998).
they removed to fund current consumption but also persistently saved less over the decade prior to the refinancing event. But first, this section explores whether differences in demographics, consumption contingencies, or income trajectories between the two groups can explain the differences in refinancing and saving behavior.

**Comparison of Demographics and Consumption Contingencies between Refinancing Groups**

Table 3.2 compares Group G refinancers both with other refinancers (Group A refinancers) and the population of all homeowners. From the first panel of Table 3.2, the major difference between the two refinancing groups was that Group G refinancers were, on average, 7 years younger. Given the way the sample is subsetted, this should not be surprising. Only the households who removed substantial equity so as to trigger the rate premium when they refinanced were included in Group G. It is possible that some refinancers removed substantial equity for current consumption without triggering the penalty associated with crossing the 0.8 ex-post loan-to-value ratio threshold. These omitted households would tend to be older, on average, having had the opportunity to pay down their mortgage over time. As a result, Group G refinancers will be biased towards younger households and the control group of Group A refinancers may contain some households who are exercising a consumption option. To correct for this, all comparisons between the two groups will be conditioned on the age of the household head.

Group G refinancers tended to be similar to other refinancers (and homeowners in general) along many other demographic characteristics. On average, these refinancers with an ex-post loan to value ratio above 0.8 achieved the same level of educational attainment as other refinancing households, had the same probability of being married in 1994 and had similar numbers of children. For the reasons stated above, the way the sample of refinancers was split between the two groups biases our sample towards households who recently purchased a home. As seen in the first panel of Table 3.2, Group G refinancers tended to have a lower housing tenure
then both the general population of homeowners and other refinancing households. An OLS regression predicting housing tenure in 1993 on age, age squared, education, current income, whether the household refinanced during the 1990s and whether the household had an ex post LTV of greater than 0.8 revealed that there are no differences in housing tenure between the refinancing groups beyond those associated with differences in age.

Current shocks to household income or unexpected consumption contingencies may induce the household to pay a borrowing premium in order to access home equity. There does not appear to be differences across the refinancing groups in situations that could cause unplanned consumption contingencies. A very small percentage of both refinancing groups experienced declining health status between 1993 and 1994. The percentage of households with adverse health conditions in the Group G sample was similar to the amount found in the general population of homeowners. Additionally, the proportion of households who became divorced between 1992 and 1994 was negligible for both refinancing groups. Group G refinancers were more likely to give birth to a child between 1992 and 1994. Given the differences in age between the two refinancing groups and the fact that younger households are more likely to be expanding their family size, this result is also not surprising.

It is possible that households would want to remove equity from their home to fund their children’s college expenditure. Table 3.2 shows that the percentage of Group G households who have children aged 15 to 18 is almost half the percentage of Group A refinancers who have

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34 A careful examination of the data reveals that there is substantial misreporting of housing tenure by Group G refinancers. The PSID questions ask “How long have you been paying on your current mortgage?” The question was not asked before 1993. Many of the Group G households report paying on their mortgage for zero years when asked in 1993. It seems they interpreted the refinancing event as acquiring a new mortgage. The interpretation of the question in this way will bias the housing tenure variable towards zero. Although some households in Group A also responded with zero to the housing tenure question in 1993, it appeared to be more prevalent for households in Group G.

35 Results not reported.

36 The PSID, in 1993, started to record individual reports of current health status. The question asked respondents to classify their current health status as either being excellent, very good, good, fair or poor. For this study, a households was classified as being in ‘Good Health’ if they reported their current health status as being excellent, very good or good. A household’s health was deemed to be deteriorating between 1993 and 1994 if their health status declined from being in ‘Good Health’ in 1993 to not being in ‘Good Health’ in 1994.
children in this range. It does appear, given their age, that the percentage of Group G refiners with children 19-21 is relatively high. Table 3.3 shows the results of a descriptive multivariate probit analysis predicting which refinancing households were in Group G conditioned on many demographic variables, including the number of college aged children in the household.\textsuperscript{37} As evidenced in Table 3.2, Group G refiners were much younger. None of the other demographic variables had any power in predicting which households chose to pay the rate premium by securing an ex-post loan-to-value ratio greater than 0.8.

\textit{Comparison of Income Trajectories between the Refinancing Groups}

Can the difference in refinancing behavior between the two refinancing groups be explained by differences in income trajectories? Households with temporarily low income or high projected income growth may choose to use housing equity to smooth their marginal utility of consumption over time. From the second panel of Table 3.2, as expected because of the age differences between the two groups, Group A refiners had higher levels of income, both on average and at the median, during the 1990s than the younger Group G refiners. Between 1992 and 1993 – the period proceeding the majority of refinancing activity, total household pre-tax labor income fell slightly for the Group G refiners, while median income growth between 1993 and 1994 was actually 18 percent higher than the corresponding income growth for Group A refiners.

To test for differences in short term income fluctuations prior to refinancing as an explanation of the differences in refinancing activity, the following earnings growth equation is estimated:\textsuperscript{38}

\[ \ln(\text{income}_{i,t+1} / \text{income}_{i,t}) = a_0 + a_1 \text{age}_{i,t} + a_2 \text{age}_{i,t}^2 + a_3 \text{education}_{i,t} + a_4 \text{married}_{i,t} + \]

\textsuperscript{37} The sample for the probit analysis was all PSID households who refinanced 1991-1995 and who had a complete report of all demographic variables (496 households).
\[ + \alpha_4 \ln(\text{income}_{it}) + \alpha_5 \text{refinance}_{90-94} + \alpha_6 \text{Group}_{90-94} + \epsilon_{i,t+1} \] (3.7)

Table 3.4 shows the results of estimating (3.7). The first column of Table 3.4 shows the results of an OLS regression of the log of pre-tax household labor income growth between 1992 and 1993 on the age of the household head in 1994, age squared, the education level of the household head in 1994, a dummy variable indicating whether the household head is married in 1994, whether the household refinanced during the early 1990s and whether the household had an ex-post LTV greater than 0.8 conditional on refinancing. Columns II compares household labor income growth between 1993 and 1994 for the two refinancing groups. As expected, income growth over both periods is predicted by age, age squared, education level of the head, the head’s marital status and first period income. However, there is no difference in income growth between Group G and Group A refinancers in either period prior to the majority of the refinancing activity, once controlling for demographics.

Table 3.5 summarizes the results of an OLS regression similar to those ran above with the dependent variable being the log of average household income 1990-1995 and 1985-1989 respectively. There is no difference in long term permanent income measures between the two refinancing groups. There is, also, no statistical difference in the log of income levels during the peak refinancing years (1992-1994) between Group G and Group A refinancers. Overall, there is little evidence that Group G households differ in their income trajectories over longer periods or in the years proceeding the majority of the refinancing activity.

The fact that the average level of income and the average growth rate of income are similar across the refinancing groups does not imply that the variability of the income streams will be

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38 The regression equation in (3.7) is a modified earnings growth equation from Mincer (1974).
39 Sample: All homeowners who owned a home continuously between 1991 and 1994 and who did not move during this period and had positive household income in both 1992 and 1993 (column I) or had positive household income in both 1993 and 1994 (column II).
similar. Recent literature on precautionary savings predicts that households with more volatile income streams would prefer to hold more assets to buffer themselves against consecutive bad income draws (Carroll 1994). If the Group G refinancing households had a more stable income stream, the precautionary saving motive would be smaller affording them the opportunity to save less, all else equal, providing a rational why they would hold lower levels of wealth. Examination of the income streams for both groups yielded no difference in their volatility over time. For Group G refinancers, the average coefficient of variation for household labor income between 1989 and 1995 was equal to 0.25.\textsuperscript{41} The similar statistic for the remaining Group A refinancers was 0.27. Furthermore, over the longer time period between 1984 and 1995, income volatility for both groups were again of similar orders of magnitude.\textsuperscript{42} Given that household income trajectories are similar across both refinancing groups, it does not appear that differences in household income situations explain differences in household refinancing behavior or the differences in long term savings behavior documented below.

**Persistent Differences In Savings Between Refinancing Groups**

While short run shocks to income or consumption needs do not adequately explain the differences in refinancing behavior between the two groups, there is evidence that those who chose to pay a rate premium when refinancing by having an ex-post loan to value ration in excess of 0.8 tend to persistently exhibit myopic or liquidity constrained behavior by consistently saving less for their given life cycle position. Table 2 shows the large disparity in wealth holdings between the two refinancing groups. The Group G refinancers had median wealth equal to

\textsuperscript{40} The regressions in Table 3.4 were also estimated using a quantile regression at the median. Median (or quantile) regressions minimize the absolute deviations of the predicted model. See Koenker (1979) for a discussion. At the median, like at the mean, no difference in income growth between the two refinancing groups was found.

\textsuperscript{41} The coefficient of variation is defined as the standard deviation of income stream between 1989 and 1995 divided by the mean value of household income between 1989 and 1995.

\textsuperscript{42} The average value of the coefficient of variation for income between 1984 and 1995 was equal to 0.35 for both refinancing groups.
$34,500 in 1994 while the Group A refinancers had median wealth in excess of $110,000. The disparity in total net worth in 1994 was even larger at the means. The same disparity occurs in both 1989 and 1984. The first group had median wealth equal to $20,000 in 1989 while the second group had median wealth in 1989 slightly above $84,000 (double the median wealth of the Group G refinancers in 1994). A similar pattern is found with liquid wealth holdings. Those refinancers willing to pay the rate premium held $9,500 in median liquid assets in 1994 with less than 15 percent holding more than $30,000 and approximately 25 percent holding less than $1,000. Conversely, those refinancing to an ex-post loan to value ratio under 0.8 held almost $21,000 in liquid wealth at the median. The same pattern exists for liquid wealth holdings in 1989 with the Group G refinancers holding less than $9,000 in liquid assets at the mean and Group A households holding over $28,000 on average. The Group G refinancers were more likely to hold higher levels of non-collateralized debt in both 1989 and 1994.

Differences in Liquid Wealth Holdings in 1994, 1989 and 1984 between Refinancing Groups

To test for if the differences in liquid wealth holdings between the two refinancing groups persist after controlling for demographics, the following regression is estimated:

\[
\ln(\text{liquid}_{it}) = b_0 + b_1 \ln(\text{income}_{it}) + b_2 X_{it} + b_3 \text{refinance}_{i,90–94} + b_4 \text{Group}_{i,90–94} + \varepsilon_{it} \quad (3.8)
\]

where \(\text{liquid}_{it}\) is the amount of liquid wealth held by the household in year \(t\), \(\text{income}_{it}\) is a measure of household \(i\)’s permanent income as of year \(t\), and \(X_{it}\) is a vector of demographics representing the household in year \(t\) including the age of the household head, the level of education of the household held, the marital status of the head, the number of children in the household and region dummies. Two additional dummy variables are include to capture differences in liquid wealth

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43 Liquid wealth is defined as the sum of money in checking or savings accounts, money market funds, certificates of deposit, government savings bonds, or Treasury bills, IRAs, and the value shares of stocks in publicly held
holdings between refinancing groups: $refinance_{i,90-94}$ is a dummy indicating if the household refinanced between 1990 and 1994 and $GroupG_{i,90-94}$ is a dummy variable equal to one if the refinancing household had an ex-post loan to value ratio in excess of 0.8.

The results of the regressions of the log of liquid wealth in 1994, 1989 and 1984 on demographics, a measure of permanent income and refinancing activity are seen in Tables 3.6. Columns I, III, and V of Table 3.6 shows the results of an OLS regression predicting the log of liquid wealth holdings for 1994, 1989 and 1984, respectively. The demographics match the year liquid wealth was measured. Permanent income is measured as average household labor income over the five years prior to the wealth measurement. As expected, households with higher log permanent income, with more years of education and who were older all possessed higher levels of liquid wealth. Being married has no statistical power in predicting liquid wealth in 1994 or 1984, but did have power in 1989. However, having children reduces the amount of liquid wealth for the family by about 13 percent per child at the mean.44

As noted in Hurst, Luoh and Stafford (1998), the distribution of liquid wealth tends to be skewed with some households having extremely large holdings. It is possible that ordinary least squares (OLS) regressions will find a difference in wealth holdings between the groups simply because of the lack of Group G refinancers in the upper tail of the liquid wealth distribution. I account for this potential by additionally running quantile regressions on the full sample.45 Columns II, IV, and VI of Table 3.6 show the results of quantile regressions at the median for the three wealth years.

Refinancing households held approximately 30 percent more liquid wealth in 1994 than did non-refinancing homeowners. As was seen in the above section, Group A refinancing

corporations, mutual funds and investment trusts.

44 The results are inline with the results from Hurst, Luoh and Stafford (1998). These authors give a full interpretation of the statistical coefficients.

45 Median (or quantile) regressions minimize the absolute deviations of the predicted model. See Koenker (1979) for a discussion.
homeowners converted up to a third of the housing equity they removed during the refinancing process into stocks (a component of liquid assets). Given that some refinancing households were able to easily reallocate their portfolio towards more liquid assets during the refinancing process, this result is unsurprising. Those refinancers willing to pay a rate premium held less liquid assets in 1994 at the mean, but not the median (Column II). This results from the skewness of the wealth distribution with very few Group G refinancing households in the upper end of the liquid asset distribution. As discussed above, only 60 percent of the equity removed from the home by Group G refinancers was used to fund current consumption leaving 40 percent on hand in the form of liquid assets to fund future consumption. The mere fact that Group G households refinanced and did not immediately spend all the equity they removed will bias my results toward not finding a statistically significant difference between the two groups with respect to the amount of liquid assets they hold in 1994.

Transitory shocks which cause households to over-borrow on their home in the early 1990s may also cause households to have lower liquid wealth in 1994, all else equal. By focusing on differences in liquid wealth holdings in 1994, one cannot distinguish whether the differences in observed behavior occur from differences in situation or difference in underlying household type. To focus on whether there is persistent differences in saving behavior across some households, I examine whether these same households who were willing to access home equity at a premium in the early 1990s also held less liquid wealth in 1989 and in 1984. It is difficult to imagine a shock to household income or consumption that would cause the household to borrow at a premium in the early 1990s and hold lower levels of liquid assets a decade earlier.

The differences in liquid wealth holdings between the two refinancing groups in 1989 and 1984 are striking. The later columns of Table 3.6 show these results. In 1989, refinancing households with an ex-post LTV in excess of 0.8 held, on average, over 50 percent less liquid assets than other refinancing households at the mean and over 20 percent less than other non-refinancing homeowners. When comparing to the median, these Group G refinancing households
held over 65 percent less liquid assets than their refinancing counterparts. Not only did households who paid the rate premium when borrowing in the 1990s hold less liquid wealth in 1994; they held less liquid wealth a full decade prior to when they refinanced. At both the median and the mean, Group G refinancers (defined by their refinancing activity in the early 1990’s) had over 70 percent less liquid wealth in 1984 when compared with Group A refinancing households and over 50 percent less refinancing than non-refinancing homeowners. The persistently low levels of liquid wealth held by the Group G refinancers throughout time gives credence to the theory that these households are systematically different from the other refinancing group.46

Differences in Active Saving 1984-1989 between Refinancing Households

Active saving represents the actions the household undertook during the period to accumulate wealth.47 Did Group G refinancers (the economic grasshoppers) save less over time? The answer appears to be yes. As seen from the means in Table 3.2, Group G refinancing households actively saved less on average between both 1984 and 1989 and between 1989 and 1994. The average Group G household only saved $200 between 1984 and 1989 while the average Group A refinancer saved over $38,000 during the same time period.

To test whether the differences in active savings persist even after controlling for differences in demographics, active saving was regressed on household income, a vector of demographics, whether the household refinanced between 1990 and 1994 and whether the refinancing household borrowed above 80 percent of their house value during the process. Table 3.7 shows the results

46 A similar analysis was performed to test for persistent differences in the amount of non-collateralized debt owned by the two refinancing groups. No differences in the propensity to hold debt were found between the two groups.

47 In 1989 and 1994, the PSID asked respondents specifically about the actions they took during the prior 5 years to accumulate wealth (i.e., How much did you put into the stock market during this period?) The active saving measure used here does not include saving in the home via paying down home mortgage. Given that the sample was split according to those who removed equity from their home, endogeneity issues would be encountered if active saving (dissaving) in the home were included. For a thorough discussion of the active savings measure in the PSID see Hurst, Luoh and Stafford (1998) or Lupton (1998).
of estimating this equation. Households, on average, actively saved 4 percent per year out of their permanent income between 1989 and 1994. Conditional on a five-year permanent income measure and other demographics, Group G refinancers saved $8,500 less at the mean than other refinancers and $4,500 less than non-refinancing households did between 1989 and 1994. The results are less clear when looking at the median regression predicting active saving in the early 1990s. The point estimate on the Group G refinancing dummy is much smaller and not significant at the median of the active saving distribution. The differences between the OLS results and the quantile regression results are again due to the fact that relatively few Group G refinancers actively saved large amounts. Given that active saving does not include saving (dissaving) in one’s home, it is again not surprising there are no statistical differences between Group G refinancers and other refinancing households at the median of the active savings distribution. Group G refinancers who removed equity from their home only spent 60 percent by 1994. The remaining 40 percent would show up as active saving in the household’s balance sheet biasing the results against finding differences in saving behavior.48

The difference in active saving becomes evident in by analyzing the last two columns of Table 3.7. Between 1984 and 1989, Group G refinancers saved statistically significant lower amounts at the mean and at the median. Households who paid a premium when refinancing in 1993 and 1994 saved over $2,500 less per year between 1984 and 1989 compared to other homeowners.49 Consistent with the hypothesis that the Group G refinancers behave as economic grasshoppers, they consistently hold levels of liquid wealth and consistently save less during the decade prior to their mid-1990’s refinancing activity.

48 The same problem would occur if active saving was defined to include saving or borrowing via main home. The mere fact those households refinanced and removed equity for current consumption would bias the results toward finding differences in saving behavior. I chose the former so as to isolate differences in saving behavior beyond housing.

49 The coefficient on whether the household was a Group G refinancer was $13,291 – representing a five year change in active saving or $2,658 per year.
The above results provide evidence that households of different type can be sorted by refinancing behavior. Households who were willing to pay a premium when refinancing were more likely to remove equity and to spend that equity on current consumption. These households were similar along many demographic characteristics. The households who paid a rate premium when refinancing because they had an ex-post loan to value ratio in excess of 0.8 were less likely to hold liquid assets in both 1989 and 1984 – a full decade prior to the refinancing event. These same households actively saved over $3,000 a year less between 1984 and 1989. Differences in income levels, income growth rates or income volatility do not appear to explain any of the differences in saving/refinancing behavior between these two refinancing groups nor does differences in consumption contingencies associated with altering the family structure or declining health.

Consumption Euler Equation Estimation and Differences in Household Type

The previous two sections identified a group of refinancers who: 1) refinanced to access housing equity to fund current consumption, 2) looked similar to other refinancers along many income and demographic dimensions, and 3) persistently saved less for their given lifecycle position. The behavior of these households is consistent with myopia; the households consume their income as it is earned, saving little for the future. Yet, it can be argued that this behavior is also consistent with either imperfect capital markets or high intertemporal discount rates. Under both of the alternative hypotheses, households would have incentives to save little, even to the point of being willing to incur a rate premium to draw down housing equity. Using the empirical specification set forth in the first section, one can test for whether rule-of-thumb behavior, liquidity constraints or high discount rates explains the saving behavior refinancing of Group G households.
Sample Selection and Data Description

Equations (3.5) and (3.6) can be estimated using OLS if the independent variables are uncorrelated with the error term, $\epsilon_{i,t+1}^*$. Given that the sample was split based upon refinancing activity, which is endogenously determined as part of the household’s maximization problem, there could be a potential bias built into the coefficients. To account for this, households were only included in the sample for the years after the refinancing event to avoid these issues of potential endogeneity. Since dividing the sample between Group A and G refinancers took place prior to period $t$ and that the error terms in (3.5) and (3.6) only include new information between $t$ and $t+1$, the sample split will not bias the estimated coefficients. Almost all of the refinancing households were included in the sample for at least one period.\(^{50}\) For the Group A refinancers, there were 720 observations representing 370 households. The 85 Group G refinancers resulted in a sample of 155 observations.

Consumption growth is defined as the percentage increase in annual food expenditures between year $t$ and year $t+1$. The PSID annually collects information on the cost of food consumed at home, the amount spent away from home in restaurants and the value of food purchased with food stamps.\(^{51}\) Food consumption in the PSID, used by many authors to estimate consumption Euler equations, is a good measure to test household consumption behavior. First, food consumption has little aspects of durability. Second, because households can substitute away from eating in restaurants or from buying more expensive brands, food consumption will be sensitive to changes in income. To the extent there is habit formation in food consumption or if food consumption responds little to income changes, the estimation of (3.5) and (3.6) will be biased against finding significant coefficients on $\alpha_3$, $\alpha_4$, and $\alpha_5$. Aside from the potential

\(^{50}\) If the household refinanced in 1995, they would not be included in the estimation of the Euler equations because PSID food data has not been released for 1997 making it impossible to calculate consumption growth between 1996 and 1997.

\(^{51}\) None of the sample of refinancing households received food stamps in any period for which the Euler Equations were estimated.
measurement error in the reporting of consumption data, researchers also must deal with the potential uncertainty surrounding the time period to which the respondents’ answers refer. Questions dealing with the amount of non-food stamp consumption the household undertakes in an average week are asked primarily during April through August of each year, with the median interview date occurring in May. To obtain an estimate of annual food consumption flow, the PSID editors multiply this response by 52. A potentially important question is the time frame used by consumers in determining average consumption since that will determine the appropriate timing of the interest rate, current consumption, consumption growth and the relevant income growth. It is likely that consumption in May of year $t$ corresponds more closely with income in year $t$ as opposed to income in year $t-1$. Given this, I date all food consumption reported during the early summer of year $t$ as applying to year $t$.

Unlike other studies that assume interest rates only differ across households due to marginal tax rates, this study uses actual mortgage rates paid as a measure of the rate the borrower faces. Given that the mortgage rate is fixed for households after refinancing, households can save by paying down their mortgage. If a household chooses to borrow, I assume they face a one-year rate equal to the real one-year risk free rate plus an individual risk premium. Formally, a household’s borrowing rate can be expressed as $r_{t+1} = r_{t+1}^{\text{bill}} + r_i^p - \pi_{t+1}^e$, where $r_{t+1}^{\text{bill}}$ equals the average nominal rate on a one year treasury starting in year $t$, $r_i^p$ equals the risk premium associated with borrower $i$, and $\pi_{t+1}^e$ is the expected inflation rate between $t$ and $t+1$. The borrower specific risk premium is defined as the rate the household paid on their x-year mortgage less the average rate of a x-year Treasury bond in the year they refinanced.\footnote{Most households refinanced into a 7 year, 15 year or 30 year mortgage. I calculate the individual risk premium for each household by adjusting their 7 year mortgage rate or their 30 year mortgage rate by the 7-year government bond or the 30-year government bond. For the 15-year mortgage, I calculate the premium using the 20-year Treasury bond.} For example, households who refinanced into a 30-year mortgage faced a risk premium in year $t$ equal to the rate they paid on the 30 year mortgage in the year they refinanced less the rate on a risk free 30-
year government Treasury bond in the year they refinanced. Because inflation is unpredictable, the household in period \( t \) may not know the real rate that it will face between \( t \) and \( t+1 \). Using the actual inflation rate between \( t \) and \( t+1 \) may bias estimated coefficients because of the potential correlation with the error term. To account for this, most researchers use the actual inflation rate when calculating the return and instrument using lagged inflation rates. Instead, I calculate the household’s expected borrowing rate using the Livingston Inflation Forecast, where the forecast runs from June of year \( t \) to June of year \( t+1 \).^{53} All values were converted into 1996 dollars.

As indicated in earlier sections, household consumption response to predictable changes in income can shed light on whether the household is a permanent income consumer, liquidity constrained or different in type (myopic or ‘impatient’ as the result of a high intertemporal discount rate). Unlike Shea (1995), I do not have a direct measure of the household’s expected income changes. However, if household income growth follows an autoregressive or moving average process, past income growth will have predictive power in determining expected future income growth. Therefore, when estimating (3.5) and (3.6), I instrument for the predictable component of income growth using 5 lags of income growth and the education level of the household head.\(^{54}\) Given that I estimate (3.5) and (3.6) separately for Group A and Group G refinancers, I do not impose that the two groups have the same income process. For estimation of (3.6), I instrumented for predictable income increases and predictable income declines separately.

A descriptive table of the results from the first stage regression of current income growth on five

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53 The Livingston Survey of Inflation Forecasts is maintained by the Philadelphia Federal Reserve. I also used the Survey of Professional Forecaster’s inflation forecast in place of the Livingston forecast. The results were nearly identical.

54 As a measure of income, I use the sum of household labor income for both the head and the wife.
lags of income growth and education for the sample of each refinancing group are shown in Table 3.8.\textsuperscript{55}

\textit{Results}

Using the above instruments for current income growth, equation (3.5) is estimated. The results are shown in Table 3.9. The first column of Table 3.9 lists the results for the Group G refinancers. The point estimate for the intertemporal elasticity of substitution ($\gamma$) is close to zero for both refinancing groups and is not significant at any standard level. This result is consistent with much of the existing empirical research on consumption Euler equation estimation.

By analyzing the constant term and the coefficient on predicted income growth, we can explore the extent to which the refinancing groups differ in terms of their discount rate or the extent to which they consume according to the Permanent Income Hypothesis. From Section I, the constant term, $\alpha$, can be expressed as $-\gamma(\delta - \omega^2/2 + b_0 + b_1)$. Assuming that $b_0$ and $b_1$ (the coefficients from the taste parameter equation) are similar across both refinancing groups, one can test for differences in discount rates ($\delta$) between Group G and Group A refinancers. Define $\omega_g$ and $\gamma_g$ as Group G refinancers’ consumption growth forecast error and intertemporal elasticity of substitution, respectively, and define $\omega_a$ and $\gamma_a$ as Group G refinancers’ consumption growth forecast error and intertemporal elasticity of substitution. Recent work by Carroll (1997a) suggest that the variance of consumption growth need be neither zero nor constant across the wealth distribution. Via numerical parameterization of a standard model with CRRA utility, he

\textsuperscript{55} Because income is measured over the calendar year and consumption is measured over the PSID interview year, there is, on average, a six-month overlap between one-year lagged income growth and current consumption growth. If this overlap is anticipated (possibly due to the existence of wage contracts or advanced notice of layoffs), the first lag of income growth would be a valid instrument. As a test of robustness, I excluded the first lag of income growth from the instrument set. The F-test for the set of the new set of instruments for the Group G refinancers was still significant at the one percent level. The F-test for the new set of instruments for the Group A refinancers was only significant at the ten percent level. All of the following results still hold with the second set of instruments.
finds that the variance of the consumption growth forecast declines as the wealth-to-income ratio increases. This implies that $\omega g^2$ will tend to be higher for households with lower levels of wealth – the Group G refinancers. If $\omega G^2$ is greater than (or equal to) $\omega A^2$ and $\gamma g$ is equal to $\gamma a$ (as seen from the point estimates from Table 3.9), a lower $\alpha 0g$, as compared to $\alpha 0a$, the constant term for Group A refinancers, will imply that $\delta g$ (the discount rate for Group G refinancers) will exceed $\delta a$ (the discount rate for Group A refinancers). The converse, however, is not true. If $\alpha 0g$ exceeds $\alpha 0a$, we will not be able to sign whether the discount rate for Group G refinancers exceeds the discount rate for Group A refinancers. From Table 3.9, $\alpha 0$ for the Group G refinancers is not lower than $\alpha 0$ for the Group A refinancers. Because of the opposing effect of the variance of the forecast error, one cannot conclude whether $\delta g$ exceeds $\delta a$.

Table 3.9 also indicates that the Permanent Income Hypothesis can be rejected for Group G households. The coefficient on current income growth, $\alpha 3$, is positive and significant at the 5 percent level. A one percent increase in expected income growth leads to a 0.21 percent increase in consumption growth. However, the standard Permanent Income Hypothesis with patient consumers cannot be rejected for the Group A refinancers. The coefficient on income growth for this refinancing group has a point estimate of near zero and is not significant at any standard level.

As discussed above, a significant effect of income growth on consumption growth does not necessarily imply that the Group G refinancers are not permanent income consumers. Such households may be prevented from pursuing their permanent income plan because of market inefficiencies resulting from binding household liquidity constraints. If households know their income will be increasing in the future, liquidity constraints may prevent them from borrowing today to smooth their marginal utility over time. In this case, predictable income increases will

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56 The intuition is straightforward. At low levels of wealth, the marginal propensity to consume is high, so for a poor consumer, a given amount of variation in income will induce a larger amount of variation in consumption than the same
have statistical power in predicting consumption growth. The converse, however, is not true. Predictable income declines should not affect the consumption plan of liquidity constrained households. Liquidity constraints do not prevent the household from saving to smooth their consumption. To test whether the above results for the Group G refinancers were driven by liquidity constraints, equation (3.6) is estimated, instrumenting separately for both income growth and income declines using lagged income changes and education. The results are shown in Table 3.10. While $\alpha_4$ for the Group G refinancers, the coefficient on income growth, is not significant, the point estimate is large and positive as predicted. The coefficient on income declines is both positive and statistically significant. Predicted income declines predict actual consumption declines. This result is not consistent with a theory of liquidity constraints with patient consumers. However, the results do suggest that households different in type, either having higher discount rates making them impatient buffer stock savers or simply following a myopic consumption rule-of-thumb. Group A refinancers did not respond to either predictable income increases or predictable income declines.

Consistent with the evidence on past saving behavior, Group G refinancers appear to behave as economic grasshoppers. Their consumption behavior appears myopic; predictable income increases and declines lead to corresponding changes in consumption growth – a result contradicting the Permanent Income Hypothesis. These households borrowed on their home when refinancing to increase current consumption, actively saved less through-out the 1980’s and held extremely low levels of liquid wealth for their given lifecycle position. These results do not hold for the group of refinancers who primarily refinanced for portfolio management reasons.

\hspace{1cm} income variation would induce for a consumer with more wealth.
Conclusion

Over the last two decades, there have been volumes of research discussing the empirical validity of the Permanent Income Hypothesis. The results have been mixed. Much of the research has found that consumption growth responds to predictable changes in income. This finding alone does not imply that households are not Permanent Income consumers. The existence of liquidity constraints may prevent households from equating their discounted marginal utilities over time resulting in a positive correlation between predictable income growth and consumption growth. In this paper, evidence in micro data from the Panel Study of Income Dynamics suggests a segment of households do not follow the Permanent Income Hypothesis with patient consumers. Using observable household refinancing behavior, two groups are identified: households who refinanced as part of an overall wealth management plan and households who refinanced, in part, to transfer housing equity into current consumption. Those in this second group, by retaining less than 20 percent of their housing equity as they refinanced, were willing to incur a borrowing cost penalty. I find that, compared to other refinancers, households who exercised this consumption option as they refinanced in the mid 1990s persistently saved less between 1984 and 1989 and persistently held lower levels of liquid assets during the prior decade. Differences in demographics or income trajectories do not appear to explain the differences in savings behavior between the two refinancing groups.

The households who paid the borrowing premium when refinancing not only persistently saved less, they tended to follow consumption paths which were different than other refinancing households. This group of refinancers altered their consumption in response to both predictable income increases and declines, a result inconsistent with the Permanent Income Hypothesis or liquidity constraints with patient consumers. This finding, combined with evidence on the lower long term savings relative to other homeowners suggest that some households appear to behave as the proverbial grasshopper from Aesop’s fable – consuming their income as it is earned, consistently saving little for the future (as compared to what is predicted by the life cycle model).
The findings in this paper provide insights into the role that individual heterogeneity (i.e., differences in type) play in household financial decision making. There has been little empirical work exploring why some households have under saved for their lifecycle position while other households have saved a tremendous amount. Understanding the differences across individuals, how these differences are correlated with observables and how these differences evolve over time would be an important input into policy making. This paper has one of the first empirical tests which shows that observable behavior (mortgage refinancing activity) can predict household consumption behavior. There exists a segment of the population, which looks identical across most dimensions, that consistently saves little for their lifecycle position, is willing to access housing equity at a premium and alters their consumption in response to predictable changes in income. Conversely, I also found that a large group of households, many of whom are young, follow the consumption behavior predicted by the standard lifecycle model with patient consumers. Unlike the results of other studies, all young households are not buffer stock savers. I document that there are persistent differences in type across otherwise similar households.

The work in this paper leaves many important question unanswered. The group of grasshoppers identified in this paper is a small segment of the population – homeowners, who refinanced, and who were willing to pay the borrowing premium. The true economic grasshoppers may be the non-homeowners, households who were never able to secure the money needed for a down payment. How big is this group in the general population? Can they be identified? Also, do household preferences for saving remain constant over a households’ lifetime? Do households begin as economic grasshoppers and evolve into life cycle ants as they age? Can we distinguish between rule-of-thumb myopic behavior and buffer stock optimizing saving behavior? All of these questions remained to be answered via future research.
References


