THE INFLUENCE OF UNCERTAINTY AND LIQUIDITY CONSTRAINTS ON LIQUID ASSET HOLDINGS OF CREDIT CARD REVOLVERS

DISSERTATION

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ABSTRACT

  The behavior of simultaneously holding liquid assets and credit card debt looks puzzling because the cost of borrowing is higher than the return of saving. No previous study has carefully analyzed such behavior. The traditional utility maximization model cannot satisfactorily explain this behavior. A review of the modern models of saving and consumption introducing uncertainty and liquidity constraints into the process of utility maximization suggests that a precautionary saving model may explain the saving behavior of credit card revolvers.

  The main purpose of this dissertation was to explore the credit card revolver's behavior of holding substantial levels of liquid assets. This research includes two stages. In the first stage, factors associated with the likelihood of being financially sufficient revolvers are investigated. Results from this step support precautionary saving motives as explanations for the behavior of simultaneously saving and borrowing. Therefore, based on a precautionary saving model, the second stage further explores how factors related to uncertainty and liquidity constraints affect the level of liquid assets held by credit card revolvers. In addition, an objective precautionary saving model is compared with a subjective precautionary saving model.

The data used for the analyses were obtained from the 2001 Survey of Consumer Finances. The sample used for the first step of this research contains 1,579 financially sufficient credit card users, of which 928 are convenience users and 651 are revolvers. These credit card users have accumulated liquid assets more than one month's income. A logistic regression is used to estimate the likelihood of being financially sufficient revolvers, compared to being financially sufficient convenience users. The sample used for the second step contains 1,723 credit card revolvers, which represent 58% of active bank card users. An OLS regression is used to study the relationship between precautionary saving and factors measuring uncertainty and liquidity constraints. In addition, an OLS regression with subjective precautionary saving as the dependent variable is examined. An advantage of modeling the subjective precautionary saving is that the estimated effects of variables of interest will not be masked by the households' ability to save.

Empirical results show that having precautionary saving motives not only increases the likelihood of being financially sufficient revolvers, but also increases the level of liquid assets. This research suggests that revolvers save for precautionary purposes, though this may not be an optimal financial management decision. According to the precautionary saving model, revolvers facing higher uncertainty should hold more precautionary savings in order to buffer the possible future consumption shock. However, the actual amount of accumulated liquid assets is a combined result of both financial planning and consequences of past and current consumption needs. This study shows that expenditure needs relative to household income, which determine the amount of money the household can save, affect

revolver's actual holding of precautionary saving, regardless of their subjective level of precautionary saving. Therefore, estimated coefficients of uncertainty and liquidity constraints may not be consistent with what the normative economic theory predicts. This may explain why the empirical effects of some variables, such as health condition and health insurance coverage, turn out to have an effect in the opposite direction of the hypothesized effect in the objective saving model and in the existing literature; however, the results from the subjective precautionary saving model are more consistent with the hypotheses.

Dedicated to my parents

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CHAPTER 1

INTRODUCTION

Credit cards are a prevalent tool for borrowing. Over three quarters of all US

households have at least one credit card, and among households with credit cards over

one half actually carry a credit card balance (Laibson, Repetto, & Tobacman, 2000; Gross

& Souleles, 2002). These numbers likely underestimate the scale of credit card

borrowing, since credit card borrowing in the SCF suffers from underreporting (Laibson,

Repetto, & Tobacman, 2000). In aggregate, U.S. consumers hold approximately $800

billion in credit card debt at year-end 2004, and pay interest rates on credit card balances

of 13% on average (Federal Reserve Report, 2005). Dividing this debt by 112 million

U.S. households (Current Population Survey, 2004), the average credit card debt is over

$7,000 per household. If we focus on all credit card holders, including both those with

credit card balances and those who pay the balance in full each month, the average debt

increases to over $9,000. This large magnitude of credit card debt comes with substantial

costs. The average annual interest paid on credit card debt exceeds $1,000 per household

among all households with credit cards. On the other hand, most households who carry

credit card debt also hold financial assets, and almost 40% of these households hold

positive liquid assets in excess of one month's income (Gross and Souleles, 2002).

Though credit card issues attract attention of many researchers, little research has

considered the saving behavior of consumers who simultaneously borrow on credit cards, with an average interest rate above 10%, which is much higher than the average interest rate on monetary accounts.

Simultaneously borrowing and lending would be puzzling under the view of standard economic theories. A simple principle of standard economics is fungibility (Thaler, 1999), which means that economic resources in different accounts or in different forms are interchangeable. Under neoclassical economic theory, consumers will borrow when the amount of current financial resources, including current income and accumulated financial assets, is less than the desired consumption level. So, consumers should either borrow or save, but should not simultaneously save and accumulate debt. Life cycle saving theory (Ando & Modigliani, 1963) predicts that consumers will save and dissave at different points during their life time, in order to smooth consumption. When consumers' spending is less than their current income, they are expected to be savers, and when consumers' spending is more than their current income, they are expected to be debtors.

The above theories do not explicitly rationalize the behavior of simultaneous borrowing and lending. When the interest rates of borrowing and lending are not the same, a cost-benefit decision model suggests that it is rational for consumers to borrow and save simultaneously only if the rate of return gained from investment is higher than the interest rate paid for borrowing.

Based on these standard theories, we would expect that consumers would generally be either savers or borrowers. However, if the interest rate earned for saving exceeds the interest rate paid for borrowing, a consumer might choose to simultaneously

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borrow and save. Empirical data reveal that, in fact, many consumers simultaneously

borrow and lend (Spencer & Fan, 2002). Many of these consumers borrow through home

mortgages, non-mortgage home equity loans, home equity lines of credit, car loans,

education loans, or other consumer loans. Mortgages, car loans, and education loans have

relatively lower interest rates, and relatively large debt levels. These larger debt amounts

are more difficult to pay off at one time, and furthermore, homes, cars, and education

each represent a type of investment. Some of these debts even have tax benefits, such as

mortgage loans, home equity lines of credit, and education loans. Therefore, consumers

may rationally choose to acquire these debts, even if they have the ability to pay off the

balance in full.

Credit card debt is quite different in many ways. First, interest rates for credit card

debt are usually higher than interest rates for other kinds of consumer loans, with the

majority of credit card holders bearing interest rates above 10%[1]. Second, credit card debt

levels are usually small relative to levels of home secured debt and installment debt,

making it more feasible for consumers to pay off the credit card debt over a shorter

period of time. Third, the payment schedule for credit card debt is quite flexible. Unlike

some closed-end loans with fixed payment schedules, consumers can choose to pay off

their credit card debt at any time. We expect that consumers with financial assets will

normally avoid credit card debt, unless the opportunity cost of their money, the rate of

return on investment, is higher than the interest rate on their credit card. However, the

2001 SCF data show another story among US households: the behavior of simultaneously

carrying a credit card balance and holding financial assets is quite common. In 2001, the

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[1] Author's calculation using the 2001 Survey of Consumer Finances suggests that 72% of credit card users
pay interest rates higher than 10%.

average interest rate on credit cards with balances was 14.46% (Federal Reserve Report, 2001), while the interest rate on 3-month Treasury Bills was only 3.45% on average (Economic Report of the President, 2002). The interest rate on T-bills provides a reasonable estimate of the interest rate on saving accounts. Since returns on saving are taxable, the after-tax interest rate on saving is even lower, especially for high income households. As many personal finance educators would suggest, consumers should pay off their credit card debt first if they have money in their saving accounts. For example, if a consumer carries a credit card balance bearing an interest rate of 14.5%, which is the average interest rate on credit card balances in 2001 (Federal Reserve Board, 2005), and holds money in a saving account bearing an interest rate of 3.5%, then there is at least a net loss of 11% per dollar, since personal income tax further reduces the return on a saving account. Instead, if the consumer first pays off his credit card debt, he saves at least 11% per dollar. Another disadvantage of carrying credit card debt is that the borrowers forfeit the benefit of the grace period that provides credit card users with a free one month loan. However, for those who carry a balance, there is no grace period and interest charges start to accumulate at the moment the purchase is made. In addition, consumers carrying balances on their credit cards are exposed to the risk of paying more finance charges than they originally expected. According to the fine prints for card holders' accounts, credit companies can increase interest rates and other financial charges, such as late fees and over-the-limit penalties, at any time, provided that they send out a notice a short time in advance.

The puzzling behavior of simultaneously holding liquid assets and borrowing on credit cards makes research about saving behavior of credit card revolvers interesting and

important. The modern models of saving and consumption have introduced uncertainty and liquidity constraints into the process of utility maximization. Uncertainty and liquidity constraints induce or intensify the concavity of the consumption function, which promotes prudence and hence increases precautionary saving (Carroll & Kimball, 2001). This dissertation adopts a precautionary saving model incorporating uncertainty and liquidity constraints to explain the saving behavior of credit card revolvers, and to explore the effects of uncertain events, liquidity constraints, and the perception of future liquidity constraints on the precautionary saving of revolvers. The dissertation intends to answer the following questions. First, what are the characteristics of the population that simultaneously carries credit card debt and accumulates liquid assets? What are the costs of carrying credit card debt in terms of interest paid on the balance? Second, how can we explain the saving behavior of credit card revolvers? Some credit card users with a large amount of liquid assets choose to carry a credit card balance and pay interest charges, while others choose to pay off the credit card balance. Can precautionary saving motives explain the credit card revolver's behavior of holding substantial levels of liquid assets? Third, if precautionary saving motives induce credit card revolvers' saving behavior, then are uncertainty and liquidity constraints, either at the present time or in the future, further related to the level of liquid assets revolvers actually held?

The 2001 Survey of Consumer Finances (SCF), a cross-sectional survey dataset, is used for the empirical analysis in this study. The 2001 Survey of Consumer Finances collected detailed information about household assets, liability, income, and financial attitudes and expectations, as well as other household economic and demographic characteristics from 4,442 households across the US. A series of questions regarding

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credit card usage and saving behaviors were asked in this survey. This survey provides by far the most comprehensive information on American households' financial situations and practice.

No previous study has specifically examined the saving behavior of credit card revolvers. The investigation of saving behavior of credit card revolvers could help us better understand why these credit card users simultaneously hold costly debt and liquid assets. In order to evaluate households' financial practices and provide advice, it is important to understand their behavior first, knowing the rationale under their current practices. Furthermore, empirical studies show that many consumers borrowing from credit cards are poorer, compared to their counterparts who are not borrowing. Therefore, interest charges would represent a larger proportion of their income. So, understanding their financial practice, that is, whether they are inefficient due to ignorance or whether they do it for a reason, would shed light on the direction of financial education. From a theoretical point of view, this particular group of credit card revolvers provides a good sample to empirically test a precautionary saving model. Revolvers are more likely to satisfy the precautionary saving model's assumption of being impatient and may also be more likely to face liquidity constraints. Credit card revolvers are also a more homogeneous group than a mixed population of all credit card users, in terms of their financial situations. Some households might save more just because they have relatively high income and they choose not to spend a large proportion of their income. On the other hand, some households might have the intention to save but do not save more, because they have relatively low income and they need or they choose to spend a large proportion of their income.

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This dissertation begins by reviewing the literature relevant to credit card use and precautionary saving. The literature review section first summarizes the existing theoretical models dealing with household saving-consumption decisions and corresponding empirical issues for each model. And then, since no previous research has studied the behavior of simultaneously borrowing from credit cards and holding liquid assets, the rest of this section reviews literature related to credit card topics covered by existing studies, and precautionary saving. In Chapter 3, a precautionary saving model with uncertainty and liquidity constraints is presented, followed by the hypotheses. The empirical model and methodology based on the theoretical model are provided in Chapter 4. The data set used for the empirical analysis, 2001 Survey of Consumer Finances, and the measurements of variables are also introduced in this chapter. Chapter 5 presents and discusses the empirical results. Finally, a summary of this study and discussion of implications, limitations and suggestions for future research are laid out in Chapter 6.

CHAPTER 2

LITERATURE REVIEW

This review of literature covers theoretical models and empirical results related to household saving-consumption behavior with a special emphasis on precautionary saving, and previous studies on credit card. This chapter consists of three sections. The first section reviews the theoretical models prescribing household saving behaviors followed by the empirical results and findings by various studies. This section starts from the standard Permanent Income – Life Cycle Hypothesis, and moves on to extensions of Life Cycle Hypothesis model incorporating uncertainty, liquidity constraints, or saving motives, and to some non-standard behavioral models. Since no previous research has studied the behavior of simultaneously borrowing from credit cards and accumulating liquid assets, the following sections review literature related to credit card and precautionary saving respectively. The second section reviews previous empirical research on credit card use. The third section reviews empirical studies on precautionary saving, as this study attempts to explain credit card revolvers' behavior of accumulating liquid assets through a model of precautionary saving.

2.1 Theoretical Models and Empirical Works on Household Saving and Consumption

2.1.1 The Standard Life Cycle – Permanent Income Hypothesis

The standard life cycle hypothesis (Modigliani & Brumberg, 1954; Ando & Modigliani, 1963) and the permanent income hypothesis (Friedman, 1957) have been used widely to study household saving and consumption behavior. Major assumptions of the standard life cycle model include: consumers have intertemporally additive utility functions with a constant discount factor; consumers face a perfect capital market, i.e., consumers can borrow and lend money freely; there is a single and constant interest in the capital market, i.e., consumers can borrow and lend money at the same interest rate; either there is perfect certainty or consumers maximize expected utility; and consumers form rational expectations. The central principle of the standard model is that consumers attempt to keep the marginal utility of expenditure constant over time. The consumers seek to smooth their consumption in order to equalize the marginal utility of money from one period to the next and between now and the distant future.

For empirical and theoretical studies on household's consumption and saving, some types of utility function need to be assumed. The most widely used form is the Constant Relative Risk Aversion (CRRA) utility function. Following Hanna et al. (1995)'s notation, the utility function is expressed as:

$$U(C) = C^{(1-x)}/(1-x)$$

Where C is the consumption, x is the relative risk aversion level, which in the intertemporal context is the elasticity of marginal utility with respect to consumption. One of the appealing features of the CRRA is that it is consistent with the assumption that

intertemporal preferences are homothetic. The implication of the assumption is that in a

perfectly certain world, the consumption in each period is proportional to the total

lifetime wealth (Browning & Lusardi, 1996). The actual proportion depends on discount

factors, interest rates, life expectancy, and some demographic characteristics, but is

independent of the wealth level. However, in the real world, the consumption in each

period may also depend on the perceived future uncertainty and the accessibility of credit.

Empirical studies of PI-LCH model

Saving can be defined in two ways, the change in wealth over a certain time

period or income minus consumption (Browning & Lusardi, 1996). Saving behaviors

have been explored in many studies. The followings are some important factors found in

empirical studies that are associated with saving:

Age. Avery and Kennickell (1991), who measured saving by the change in wealth

over a certain time period, and Bosworth, Burtless, and Sabelhaus (1991), who measured

saving by both the change in wealth and income minus consumption, found saving is

positive for every age group, but the mean saving rates increase until the period around

retirement and then decrease (Bosworth, et al., 1991).

Composition of the household. Previous research has found evidence of a

relationship between saving and household types. Assets growth increases at a higher rate

among married households, compared to single, widowed, or separated households

(Smith, 1994). Saving rates are higher for married households with no children and lower

for married households with children, while single parents have the lowest saving rate

(Avery & Kennickell, 1991; Bosworth, et al., 1991).

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Income. Income has always been found to have a strong positive relationship with saving in simple bivariate analyses. A large proportion of saving in the nation is made by households at the top of the income distribution (Avery & Kennickell, 1991; Bosworth, et al., 1991).

Education. Browning and Lusardi (1996) pointed out that the observed positive correlation between income and saving might be due to the differences in permanent income, which could be indicated by education. The bivariate analyses also show a positive relationship between educational attainment and saving (Avery & Kennickell, 1991; Bernheim & Scholz, 1993; Attanasio, 1993). Saving rates are higher for higher education groups.

Wealth. Saving in the U.S. is very concentrated in the top part of the wealth distribution. For example, Avery and Kennickell (1991) found that the top 10% of the wealth distribution in 1986 made almost all of the net saving between 1983 and 1986. Also, saving is higher among homeowners and among stock and bond holders (Avery & Kennickell, 1991; Bosworth, et al., 1991).

2.1.2 The Extended LCH Model with Precautionary Saving – The Buffer-Stock Theory of Saving

One principal extension of the standard saving models has been to consider the precautionary saving motive (Browning & Lusardi, 1996). Precautionary saving depends on uncertainty associated with future exogenous variables and assets plus current earnings (cash-on-hand). Uncertainty could include high variance in future income, and uncertainty about future demographics. Higher uncertainty leads agents to increase

precautionary saving. Low level of current assets and income increases precautionary saving, since low cash-on-hand causes the variance of consumption in next period higher.

As closed form expressions for saving and consumption functions cannot be derived after uncertainty is added into the model, many researchers have used simulations to examine the effect of uncertainty on saving and consumption. Carroll, Hall, and Zeldes (1992) presented a buffer stock model of saving. In this model, the uncertainty about employment status is emphasized. Consumers hold assets mainly to shield their consumption against unpredictable fluctuations in income. Unemployment expectations are important because typically the most drastic fluctuations in a households' income are those associated with spells of unemployment.

Buffer-stock saving behavior can emerge from the standard dynamic optimization framework when consumers facing important income uncertainty are both impatient and prudent. Impatience makes consumers want to spend down their assets and borrow against future income to finance current consumption, while prudence makes them have a precautionary saving motive and reluctant to draw down assets too far. This tension will imply the existence of a target wealth stock. If wealth is below the target, prudence will dominate impatience and the consumer will try to save; while if wealth is above the target, impatience will dominate, and consumers will plan to dissave.

This model predicts that, even with unchanging expectations about the average future level of income, changes in the expected probability of a "bad event" have a major impact on current consumption and saving. For example, when consumers become more pessimistic about unemployment, their uncertainty about future income increases, therefore, their target buffer-stock increases, and they increase their saving to build up

wealth toward the new target. So, unemployment expectations are important to determine the amount and characteristics of buffer-stock saving.

As Browning & Lusardi (1996) summarized that results derived from models without a precautionary motive can be seriously misleading, even if the amount of uncertainty is small. The principal benefit is that a much wider range of behavior can be accommodated in the precautionary model, with the cost of less sharp predictions from the more general model.

The model with precautionary motives is compatible with a much richer variety of short-run and life-time consumption patterns than is suggested by the simple PI-LCH model.

Carroll (1992) shows that for particular income processes, if we have a precautionary motive and impatience, then consumption tracks income in the early part of life (agents have some small wealth/income ratio target.), and only in later years (say, after age 45) we observe significant saving.

Empirical Studies of Precautionary Saving Models

Browning and Lusardi (1996) summarized some measures of risk associated with precautionary saving that has been used in empirical studies. Some researchers use measures of income variance derived from observed income processes (e.g., Carroll, 1994; Carroll & Samwick, 1995; Kazarosian, 1997). This measure is sensitive to the assumptions of measurement error and the discrepancy between what the households know about their income and what the researchers know. Therefore, the calculated income variance from observed income data may not truely reflect the income

uncertainty. Another approach to estimate risk is to measure the variance of consumption in an Euler equation. Larger variance of consumption is expected to be associated with higher risk in this approximation. This measurement is subject to cross-agent variation, measurement error, or durability in the consumption measure. A more attractive approach is to use subjective measures directly, for example, subjective earning variance and health risk (Guiso, Jappelli, & Terlizzese, 1992, 1996; Lusardi, 1998). A potential problem of this measure is that the accuracy depends on the answers to questions that respondents may not fully understand or may not have incentive to answer accurately.

To quantify the importance of precautionary motive in a saving model, a wide variety of measurements have been used as regressors, for example, log wealth (Carroll & Samwick, 1995, 1998; Starr-McCluer, 1996), wealth relative to permanent income (Kazarosian, 1994; Engen & Gruber, 1995; Lusardi, 1998), or a saving indicator (Palumbo, 1995). Income risk has been found to have a positive relationship with wealth or saving (Kazarosian, 1994; Carroll & Samwick, 1995a; Engen & Gruber, 1995). Carroll and Samwick (1998) found that the precautionary motives explain about 40% of wealth accumulation. Contrary to the expectation, households with health insurance coverage had higher saving than households without health insurance coverage (Starr-McCluer, 1996). As Browning and Lusardi (1996) pointed out that there is a potential problem of self-selection associated with the test of precautionary saving models. If risk aversion and prudence are positively correlated, then risk averse agents will choose less risky jobs and, at the same time, be more prudent and save more. Therefore, even if there is a strong correlation between precautionary motive and saving, we may not observe a positive cross-section correlation between income risk and saving rates. Similarly, Starr-McCluer

(1996) explained the positive relationship between private health insurance coverage and saving as that it may be due to the unmeasured differences in income between the insured and uninsured. A job providing health insurance is more likely to have higher total remuneration and higher levels of other benefits, compared to a job without health coverage. Therefore, the insured households might be expected to have higher savings, for these reasons. In addition, precautionary saving may not be important to certain groups in the population. For instance, it is unlikely that the wealthy are significantly motivated to save by the fear of future income or consumption shocks (Browning & Lusardi, 1996). Therefore, the fact that a large proportion of saving is made by households at the top of wealth distribution may hide the possible quantitative importance of the precautionary motive.

2.1.3 The Extended LCH Model with Liquidity Constraints – Saving Model with Liquidity Constraints

The most questioned assumption in the standard PI-LCH model is the existence of perfect capital markets, which implies that there is a single rate of interest at which consumers can borrow or lend as much as they wish (Hayashi, 1987; Zeldes, 1989; Deaton, 1992; Browning & Lusardi, 1996). By relaxing this assumption, models considering liquidity constraints have emerged. The terms, liquidity constraints or borrowing constraints, are often used interchangeably in the literature. It refers to the situations that borrowing is not allowed or at least cannot exceed some fixed limit (Hayashi, 1985; Zeldes, 1989; Deaton, 1992; Browning & Lusardi, 1996). Browning and

Lusardi (1996) summarized research on the effects of liquidity constraints. Liquidity constraints are to be of interest only for agents who want to borrow. So many investigators concentrate on the case where either there is some income growth or agents have high time discount factors or the consumption needs captured by the demographic variable occur early in the life cycle. The behavior of a liquidity constrained agent may be similar to a precautionary agent without liquidity constraint. It may be difficult to empirically distinguish the effects of liquidity constraints and a strong precautionary motive. The possibility of borrowing provides some insurance for consumption. Therefore, the possibility of being liquidity constrained in the future may lead agents to behave as though they are less forward looking, for example, the agents may save more, than is suggested by the standard additive model. So, we may observe agents smoothing over the short run but not over the long run.

The framework of Deaton (1991)'s saving model is the standard model of intertemporal utility maximization, adding the borrowing restriction. Deaton assumes consumers are prudent and have a precautionary demand for saving, and at the same time the rate of time preference is larger than the real interest rate, which means consumers are impatient. In this model, the labor income process is uncertain, and consumer's believe about the stochastic process generating their income is very important. Precautionary motives interact with liquidity constraints because the inability to borrow when times are bad provides an additional motive for accumulating assets when times are good, even for impatient consumers.

Empirical Studies of Liquidity Constraints

        In the real world, not all the consumers can borrow at their will, some consumers face borrowing constraints. Empirical findings show that approximately 19% of U.S. households are liquidity constrained in 1982 (Jappelli, 1990). Crook (1996) concludes that the probability of being constrained is positively related to being Black and belonging to a larger household, and is negatively related to years at address, homeownership, income, years of schooling, age, and whether the family save. Jappelli (1990) also find younger families with low levels of income, wealth and saving, single, renters, and non-Whites are more likely to be rationed out of the credit market. Lyons (2003) confirms that the probability of being credit constrained decreases with age, marriage, and level of permanent income and increases with family size and being black. Though liquidity constraints do not result in a dramatic decline in aggregate consumption (Hayashi, 1985), they may significantly affect households' consumption and borrowing behavior (Cox & Jappelli 1993). For example, households' ability to purchase a house and some durable goods are limited. Consumption for liquidity constrained consumers will be below what it would have been without liquidity constraints at present. Even though this can be made up by higher consumption later in life, it incurs a net cost of welfare due to the forced intertemporal rearrangement (Deaton & Muellbauer, 1980). Browning and Lusardi (1996) summarized that if the standard model without liquidity constraints holds then the relaxation of borrowing restrictions should have no effect. On the other hand, if liquidity constraints are important, we will expect changes in borrowing or purchasing behavior. Cox and Jappelli (1993) estimate the degree to which household borrowing would increase if liquidity constraints were removed for the 1983 SCF sample.

They find an overall increase of 9.0% in total household borrowing and a 75% increase in

borrowing for those constrained, as a result of the removal of liquidity constraint. Gross

and Souleles (2002) found that increases in credit limits generate an immediate and

significant rise in debt. Also, the "marginal propensity to consume out of liquidity",

which is the amount of debt increased for every dollar increase of credit limit, is much

larger for credit card borrowers starting near their limits, compared to those starting well

below their credit limits. From their estimates, the long-run elasticity of debt to the

interest rate is approximately –1.3, and the elasticity is smaller for credit card users

starting near their credit limits. These results give evidence to the importance of liquidity

constraints. However, Gross and Souleles (2002) found the "marginal propensity to

consume out of liquidity" is significant for credit card borrowers starting well below their

limits as well. This is consistent with the buffer-stock model of precautionary saving.

Both empirically and theoretically, the effects of liquidity constraints and

precautionary saving are hard to be distinguished. They have similar effects on impatient

consumer's saving behavior, but whether one would intensify the effect of the other if

both liquidity constraints and precautionary saving motive exist is not necessary. Some

research found that liquidity constraints boost the effect of risk on saving, while on the

other hand, some other research has found that liquidity constraints and precautionary

saving are substitutes rather than complements (Carroll & Kimball, 2001).

2.1.4 Non-Standard Behavioral Models

As there are phenomena that cannot be fully explained by the economic models of

saving and consumption, and some assumptions of the models have been questioned,

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nonstandard behavioral economic models are emerged. These models question the simple assumptions of unbounded rationality of individuals and fungibility of money, and posit that most people have a self-control problem. These behavioral models are briefly described in the following.

Model of Self-Control

Thaler and Shefrin (1981) develop an economic model of self-control. The individual at a point in time is assumed to be both a farsighted planner and a myopic doer. In order to prevent the doer from consuming all of her lifetime income in the current period, the planner needs some psychic technology capable of affecting the doer's behavior. These technologies may be methods to alter incentives or methods to alter opportunities. Opportunities can be limited by the strategy of precommitment, or through the use of self-imposed rules of thumb, e.g., a prohibition on dissaving combined with limits on borrowing. Based on this model, retirement accounts and other savings, especially in illiquid forms, may be regarded as means of precommitment, or self-imposed constraint. The authors predict that people will rationally choose to impose constraints on their own behavior, and such precommitments will occur primarily for those goods whose benefits and costs occur at different dates.

Regarding to saving behavior, Thaler and Shefrin (1981) have characterized it primarily as a set of self-imposed rules of thumb and externally enforced saving plans. The best predictors of which individuals will adopt which strategies are probably related to family background, since the family is the most likely place for the individual to learn the rules and norms necessary to overcome the self-control problems.

According to the standard utility maximization model, consumers should have life cycle smoothing, borrowing or saving depending on expectations, interest rates, and their preferences. However, self-imposed borrowing constraints prevent the complete internal arbitrage from taking place. Therefore, based on the model of self-control, we would expect to observe behavior that implies a marginal rate of time preference greater than the interest rate, i.e., a preference to spend down assets and to borrow, and at the same time an unwillingness to engage in additional borrowing. Individual differences in marginal rate of time preference are anticipated, and Fisher (1930) believes that age, income, the shape of the income stream and the level of income, and marital status affect the rate of impatience. That the young behave impatiently can be partially interpreted as they have yet to master the techniques of self-control (Thaler & Shefrin, 1981).

Model of Mental Accounting

Thaler (1985, 1999) proposed a mental accounting theory of consumer behavior as a substitute to the standard economic theory of utility maximization. This alternative theory has three key features. First, the utility function U(x) is replaced with the value function v(.) from prospect theory (reference point). Second, a new concept of transaction utility is developed (coupling and decoupling). Third, the normative principle of fungibility is relaxed. Both the sources and uses of funds are labeled in mental accounting system.

Value function from prospect theory has the following properties (Tversky & Kahneman, 1991). First, the value function is reference dependent, which means that the carriers of value are gains and losses defined relative to a reference point. Second, it

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predicts loss aversion, since the function is steeper in the negative than in the positive domain, therefore, losses loom larger than corresponding gains. Third, the value function exhibits diminishing sensitivity, that is, the marginal value of both gains and losses decreases with their size. Diminishing sensitivity implies that the impact of a difference is attenuated when both options are remote from the reference point for the relevant dimension.

Thaler (1985, 1999) proposed that consumers get two kinds of utility from a purchase, acquisition utility and transaction utility. Acquisition utility is a measure of the value of the good purchased relative to its price, and the transaction utility is a measure of the perceived value of the 'deal', the difference between the amount paid and the 'reference price' for the good. The payment and consumption are always coupled. Through coupling, the pleasure from consumption is attenuated by the payment, while the pain of payment is buffered by consumption (Prelec & Loewenstein, 1998). The method of payment is an important determinant of coupling or decoupling. Prepayment and credit card payment create decoupling between payment and consumption. Credit card seems to be both a stimulus to spending and debt. Consumers can enjoy the benefits of acquisitions without much counteract by payment, because the physical payment is not made at the moment of purchase. However, when the payment is due one month later, consumers would feel as they are paying for nothing, since the pain of payment is buffered to a lesser extent by the consumption.

Another component of mental accounting is categorization or labeling. Thaler (1999) believes that money is commonly labeled at three levels: expenditures are grouped into budgets, such as food, housing, etc.; wealth is allocated into accounts, such as

checking, pension, 'rainy day', etc.; and income is divided into categories, such as regular

or windfall. Such system can facilitate making rational trade-offs between competing

uses for funds, and can act as a self-control device.

2.2 Empirical Studies on Credit Card Issues

2.2.1 Background Information on Credit Cards and Credit Card Users

In the credit card market, bank-issued cards, including MasterCard and Visa

credit cards account for the largest share of the aggregate charge volume on plastic in the

U.S., then followed by similar cards as Discover and Optima cards (Ausubel, 1991). The

above bank-type cards are most widely held by consumers. Other types of credit cards

include retail cards (e.g. department store cards and oil company cards), and travel and

entertainment cards (e.g. the American Express card and Dinners Club cards).

Credit card holders can be divided into credit card users and inactive holders.

Inactive credit card holders hold the credit cards, but do not currently use credit cards

either as a payment medium or as a financing medium, that is, they have zero balances

and no new charges on their accounts. Credit cards generally serve as a payment medium

and a financing medium for consumers. Therefore, credit card users can be divided into

convenience users, who are attracted by the convenience of using a credit card as a

payment instrument and who pay off the balance every month, and revolvers, who carry

over a balance and pay an interest charge each month (Ausubel, 1991; Lee & Kwon,

2002). For revolvers, credit card accounts provide a source of open-ended credit.

Previous studies have sought to identify different types of credit card users, however,

little is available in most recent literature to update the profile. Matthews and Slocum

(1969; 1972) find that revolvers have lower income and belong to lower social classes than convenience users. Adcock, Jr., Hirschman, and Goldstucker (1977) find that bank card users are more likely to have middle or upper-middle incomes, to be better educated, to be middle-aged or older, to be married, to be males, and to have more favorable attitudes toward the use of credit. Awh and Waters (1974) find that compared to inactive card holders, active bank card users have higher educational attainment, higher level of income, higher socio-economic standing, more favorable attitudes toward credit, are younger and are inclined to use two or more credit cards.

2.2.2 US Households' Access to Credit through Credit Cards

Over the last two decades, households have been using credit more than ever. The current total consumer debt is as high as 2109.6 billion, more than twice the amount in 1990 and almost six times the amount in 1980 (Federal Reserve Board, Table G19). Even though per capita income rose during last two decades, household borrowing grew at a faster rate. The aggregate debt outstanding relative to disposable personal income rose from 56% to 78% over the 1983-89 period (Canner, Kennickell, & Luckett, 1995). The rise in revolving debt – mainly credit card debts – is especial noticeable, and the share of revolving debt in total consumer debt increases (Stavins, 2000). In aggregate, U.S. consumers currently hold approximately $700 billion in credit card debt, and pay interest rates on credit card balances of 13% on average (Federal Reserve Report, 2004). Dividing this debt by 109 million U.S. households (U.S. Census Bureau, 2003), the average credit card debt is over $6,000 per household. This is partly due to the fact that US households have experienced easier access to credit, and the gap between desired and

actual borrowing have been reduced for consumers who are traditionally considered as being credit constrained, such as low-income and minority households in recent years (Lyons, 2003).

Financial industry, financial deregulation in the 1980s, and financial developments brought about by technological advances are all in favor of borrowers. Households now have easier access to both housing and consumer credit markets. They are offered additional and more affordable borrowing opportunities throughout the 1990s. Lyons (2003) examines the changes in the borrowing gap between 1983 and 1998, and finds that borrowing gap has narrowed over time for all households regardless of their permanent earnings, age, gender, or race. Black households and households with low permanent earnings, who are traditionally constrained by credit markets, have experienced the largest gap reductions. To a certain extent, the increase in credit have helped to improve the economic status of U.S. households throughout the 1990s by giving them the opportunity to better smooth their consumption and to maintain or improve their standard of living.

For the households with low income and low net worth, the additional borrowing opportunities are very likely to take the form of credit card debt, since it does not require collateral, and is easier to apply and to obtain than other forms of consumer credit. Many empirical studies have documented that credit card debt has increased disproportionately among poorer households. Bird, Hagstrom, and Wild (1997) examine the credit card debt of the poor, and find that from 1983 to 1995 the fraction of poor households with a credit card more than doubled, and the average balances held on these cards rise almost as rapidly as the balances of nonpoor households. The percentage of all households with

credit card debt-to-income ratio greater than 1 and 2 increased substantially for over the 1983-95 period, and the percentage increase is even more noticeable for poorer households. Among the poor, the increase in credit card debt is greater than the increase in consumer debt in general. Canner, Kennickell, and Luckett (1995) show that, from 1983 to 1992, the fraction of low-income households with credit card debt rises much more rapidly than the fraction of those with any consumer debt rises. Aizcorbe, Kennickell, and Moore (2003) also find that in 2001 credit card usage among demographic groups shifts noticeably. Usage rises for lower income families, renters, and Black and Hispanic and falls for their complementary sets of families. Black and Morgan (1999) compare cardholders in 1995 with those in 1989 to show that credit card holders become more risky customers over time, the 1995 cardholders are poorer, are more likely to be single and blue-collar and to rent rather than own their home, carry higher credit card balances, and have a higher debt-to income ratio.

2.2.3 Empirical Research on Credit Card Issues

The Stickiness of Credit Card Interest Rate in 1980s and the Current Trend

In 1980s, the most noticeable problem in the credit card market was the high and sticky interest rate of credit card debt.

The structure of credit card market is very close to the environment of perfect competition. There are more than 4,000 firms in the bank credit card market, and lack regulatory barriers in the 80s (Ausubel, 1991). However, Ausubel (1991) concludes that the major credit card issuers have persistently earned from three to five times the ordinary rate of return in banking during that period. The credit card industry has argued that the

high spread of interest rate is caused by an increase in the rate of bad loans. Ausubel (1991) doubt whether the high charge-off rate causes the high interest rate, or the high interest rate causes the high charge-off rate. This problem could be, first, due to the reasons that existing transaction costs or switch costs prevent consumers from choosing the best available interest rate in the market. Consumers may find it difficult to locate banks offering favorable terms; therefore, the high costs of information search discourage consumers to look for better price. Ausubel (1991) lists some other sources of costs: 1) The cost in time, effort, and emotional energy to fill out an application for a new card; 2) if the card charges fee on a annual base, then one forgoes some money if switches at a wrong time; 3) a better credit rating or a higher credit limit require longer holding of the same bank credit card; 4) the time lag between applying for a card and receiving one. Second, lenders face adverse selection in the market. Because of information asymmetry, they are reluctant to lower the interest rates. Ausubel (1991) posits some consumers do not intend to borrow on their credit card, but find themselves doing so. These consumers won't search for or response to a lower interest rate, since they intend to be convenience users. Some other consumers with limited sources of credit and higher credit risk intend to borrow on credit card, and they are likely to do comparison shopping on interest rate. If the banks lower their interest rates to compete, they are very likely to attract those less credit-worthy customers. Therefore, banks don't compete on the interest rate, but compete on other terms not facing adverse selection, e.g., lower annual fee, rebates on purchases. Stavins (1996) finds that delinquent credit card loans increase at a higher rate than credit card loans in general when APR falls. This gives empirical support for adverse selection. Third, the high sticky interest rate could be due to the reason that

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consumers do not make correct inference about their credit card use pattern. Ausubel (1991) lists some evidence of consumer irrationality by giving the fact that a much larger percentage of consumers actually carry balance than the percentage given by consumer survey. Some consumers may not understand how interest rates work and underestimate the consequences of borrowing. Credit card marketers find that consumers are much more sensitive to the increase in the annual fee than to commensurate increases in the interest rate (Ausubel, 1991). Consumer's irrationality also includes the behavior of impulsive purchases, which may cause cardholders to use more credit than expected. White and Munger (1971) find that consumers are insensitive to interest rate of new car loans, even if they are aware of lower interest rate nearby.

Calem and Mester (1995) test whether a cardholder's borrowing is correlated with the individual's propensity to engage in search, in order to answer the question why credit-card interest rates are stickiness. Based on Ausubel (1991)'s theoretical explanations for consumer's insensitivity to credit-card interest rates, Calem and Mester (1995) include variable measuring search effort in the empirical model. They find that searching for best rates on saving and borrowing products has a negative impact on bank card balances. They conclude that their results support the adverse selection assumption in credit card market.

Cargill and Wendel (1996) examine whether consumers are rational in the credit card market. Besides Ausubel (1991)'s argument of inefficient market for the stickiness of credit-card interest rates, Canner and Luckett (1992)'s market efficient hypothesis says that market forces and characteristics of credit card industry create the observed stickiness of bank-card interest rates. Cargill and Wendel (1996) include consumers'

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reported bankcard use pattern into their market-based model of demand for bankcard balance to test whether consumers are irrational. The estimated effects of consumer's awareness suggested that consumer credit card behavior is actually rational and consistent. Their results also suggest that consumers may rationally eschew search because low returns to search.

In the 1980s, firms kept high interest rates and compete to increase customers by issuing credit cards to less credit-worthy customers. In the 1990s, the competition focus on lowering interest rate. The average interest rate on credit card accounts is down from around 18% in 1980s to around 13% currently (Federal Reserve Board, Table G.19, 2004). Instead of a single interest rate, many of credit card issuers have offered a broad range of card plans with differentiated interest rates depending on consumers' credit rating and usage patterns. In addition, teaser rates have been introduced into this market (Lee & Hogarth, 2000). However, even though the interest rates of credit card accounts are lower now, compared to the interest rates in 1980s and early 1990s, the price of credit card debt is still expensive compared to other types of consumer loans (Federal Reserve Board, table G.19). Despite the perception that teaser interest rates that are zero or very low are prevailing in the market, not many credit card revolvers really take advantage of it. It could be that the targeted consumers offered these low rates are always convenience users, or revolvers do not switch to accounts with lower interest rates due to reasons discussed above.

Demand for Credit Card Debt

Previous studies have explored the factors that affect a household's credit card balance (Chien & DeVaney, 2001; Calem & Mester, 1995; Cargill & Wendel, 1996; Zhu

& Meeks, 1994). The literature consistently finds that favorable attitudes toward credit, younger age, higher educational attainment, larger household size, being married, and being Black increase the usage of credit cards, while active financial information search decreases the usage of credit cards for revolving. The effect of income on credit card usage is mixed among previous studies. Previous studies have found income to be negatively, nonlinearly, or insignificantly related to the credit card balance.

Chien and DeVaney (2001) focus on the effects of credit attitude, demographic, and economic factors on the sizes of credit card debt and installment debt with considering the possible correlation among the variables. Attitude theories in social psychology believe attitude and behavior are related, thus encouraging the inclusion of credit attitude variables, general attitude and specific credit attitudes for defined purposes, in the empirical model for predicting credit card balance. Life-cycle saving hypothesis and family resource management model suggest that demographic and economic variables would influence both credit attitude and credit practice. Therefore, demographic and socioeconomic variables are included in the empirical model with considering the possible correlation among these variables and credit attitude. Chien and DeVaney (2001) find that favorable specific credit attitude is positively related to credit card balances, while favorable general attitude toward using credit is positively related to the balance of installment debt. Other factors that have positive effects on credit card balance include professional or managerial occupation, education, household size, and being married. Total annual income has a negative effect on credit card balance.

Cargill and Wendel (1996) show that the attitude towards installment credit, the number of bankcards, and being non-White have positive impacts on bankcard balances,

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while age and information search have negative impacts on bankcard balances. Income has non-linear effect on bankcard balance. The bankcard balances increase with income at first and then decrease. This might be due to the fact that alternative and less expensive forms of consumer credit become more accessible as income increases.

Zhu and Meeks (1994) examine general consumer credit and focused on the effect of low-income families' ability and willingness to use credit on outstanding credit balances. Using the 1983-86 SCF panel data, they show that younger or full-time employed low-income consumers are more likely to have large credit balances. The interaction effect of higher educational attainment and favorable specific attitude towards credit contribute to more consumer credit outstanding, while the interaction effect of higher credit balance in 1983 and a more favorable specific attitude contribute to less consumer credit outstanding in 1986. The authors suggest that well-educated households may know more about credit and made better use of credit.

Credit Card Debt and Payment Difficulties

At the same time when consumer debts increase, the increase in personal delinquency rate and bankruptcy rate is substantial. The personal bankruptcy filings in the United States are almost four times the number in 1980s. ABI (American Bankruptcy Institute) data shows that except for 1999 and 2000, annual personal bankruptcy filings have increased every year since 1996. Personal bankruptcies now account for 97.8 percent of all bankruptcies filed in federal courts in 2003, up from 85% of the total in 1986.

The rise in consumer debt, especially credit card debt, and the concurrent rising in personal bankruptcy make many researchers and policy makers doubt whether high level of debt caused the high rate of delinquency and bankruptcy.

Several empirical studies have examined whether high debt balances contribute to high rates of payment delinquency and personal bankruptcy and have identified the characteristics of consumers who are more likely to have payment difficulties. Households who have filed for bankruptcy in the past are found to carry higher unpaid credit card balances and have significantly higher ratios of credit card debt to income than those who had not filed for bankruptcy before (Stavins, 2000). In that study, Stavins (2000) examined the relationship among credit card borrowing, delinquency, and personal bankruptcy. Higher unpaid balances on credit cards statistically increase the probability of being behind on payments, but the amount is not economically significant. The strongest factors increasing the probability of delinquency are having filed for bankruptcy in the past and having been unemployed at any time during the previous 12 months. In terms of bankruptcy, having higher credit card balances and other debt balances both increase the probability of filing bankruptcy in the past, however, the effect of credit card debt is larger than that of other debts.

In their study of the credit card debt among the poor, though, Bird, Hagstrom, and Wild (1997) do not find direct evidence that the heavy participation in credit card debt of the poorer households leads to the increasing delinquency rate, they argue that the rising debt of poor households is a new development of the bankruptcy crisis, and poor households who have already exhausted their access to credit are much more vulnerable

to an economic downturn and much more likely to become dependent on the social assistance system.

Canner and Luckett (1991) look at the payment of household debts and identify the characteristics of consumers with payment problems from 1990-91 Surveys of Consumer Attitudes. Other types of non-credit-card installment debt and credit card debt have the highest incidence of consumers who report falling more than thirty days or sixty days behind in their payments. Missed payment problems are most strongly related with higher debt-service burdens, lower educational attainment, more children under 18 in the household, separated or divorced. Main reasons indicated by respondents for payment difficulties are that they become overextended by taking on too much debt (55%) or they have experienced an unforeseen change in their employment or health status. To solve the problem of payment difficulties, most consumers pay back when they are able, cut back on other types of spending, take second jobs, worked longer hours, sell various items to raise funds, or borrow or receive gifts from relatives or friends.

Domowitz and Sartain (1999) find that the most important contributor to bankruptcy is credit card debt, followed by medical debt. Homeownership reduces the likelihood of bankruptcy.

2.2.4 Studies of Simultaneous Borrowing and Saving

Little research has examined the behavior of simultaneously holding credit card debt and accumulating liquid assets. Spencer and Fan (2002) explore the behavior of simultaneously holding non-mortgage debt and financial assets, using a framework of saving motives. They use broad measures of debt and financial assets. They include

credit card debt, installment debt, other debt, lines of credit, and home equity loans in their measure of debt, and measure all financial assets excluding checking accounts and retirement savings. They find that having a precautionary saving motive, an investment motive, an independence motive, a bequest motive, or a down payment motive increase the likelihood of being a simultaneous debtor and saver, while having a life cycle saving motive decreases the household's likelihood of being a simultaneous debtor and saver.

Laibson, Repetto, and Tobacman (2000) use a hyperbolic discounting model to explain the phenomenon of consumers simultaneously borrowing actively in the revolving credit card market and accumulating relatively large stocks of illiquid wealth. Hyperbolic consumers act as if they have endogenous time preferences, acting like exponential consumers with a high discount rate over short horizons, but acting patiently when accumulating illiquid wealth over long horizons. However, this model cannot explain the frequency of borrowing in the credit card market and the magnitude of liquid asset accumulation.

Using an individual account specified dataset provided by credit card issuers from 1995 through 1998, Gross and Souleles (2002) also find a "portfolio puzzle" – large amounts of asset holdings among bankcard borrowers, though this is not the focus of their study. Conditional on borrowing on bankcards, 95% of households have positive net worth and even one third of the borrowers hold liquid assets more than one month's income. The proportion of borrowers with positive assets is not small, and this pattern holds across different demographic groups.

Hurst and Willen (2004) document the pattern of simultaneously holding both credit card debt and social security wealth as the social security contributions are

mandatory in the current system. They consider a life-cycle model with optimizing and

"rule-of-thumb" households, and analyze two policy experiments, one to allow

households to use social security wealth to pay off credit card debt, and another to

exempt young households from social security contributions. Their simulations suggest

that paying off debt first leads to increases in saving, reductions in debt and substantial

increases in lifetime certain equivalent consumption for both types of households.

2.3 Empirical Studies on Precautionary Saving

Chang, Hanna, and Fan (1997) applied the life cycle approach to study optimal

emergency fund holdings and developed a three-period model of consumption, instead of

modeling optimal savings in the context of an infinite time horizon. The uncertainty

about future income growth was also incorporated. The optimal amount to save depended

on the expected income growth rate and the probability that income growth will occur.

They assumed that the only purpose for holding monetary assets is to provide a cushion

for income decreases. As the expected income growth rate increases, the percent of

income that should be saved decreases. In particular, if income is expected to remain the

same, the household is rational not to hold many monetary assets. As the probability of

an income drop increases, the percent of income that should be saved increases

accordingly. Their empirical results of the mean probability of meeting the guideline

from 1983 and 1986 SCF panel data are quite consistent with the theoretical analysis.

In most previous research, the liquidity ratio, which refers to the ratio of monetary

assets to monthly expenditures, is the most commonly used ratio in previous research on

emergency funds. Monetary assets, also known as liquid assets, include cash and near-

cash items that can be readily converted to cash (DeVaney, 1997). There is no universal consensus on the components that should be included in the numerator when using the liquidity ratio to assess the adequacy of emergency funds. Johnson and Widdows (1985) classified three measures of emergency funds based on their degree of liquidity:

1. Quick emergency fund: assets held in saving, checking and money market accounts.

2. Intermediate emergency fund: quick assets plus CD's and saving certificates.

3. Comprehensive emergency fund: intermediate assets plus the value of stocks and bonds.

In previous empirical research on emergency funds, different measures of emergency funds based on the three definitions were used. For example, Chang and Huston (1995) used a measure of intermediate emergency funds; Chang (1995), DeVaney (1995), and Hanna and Wang (1995) used a measure of comprehensive emergency funds; Hanna et al. (1993) used liquid assets, including the amount in checking accounts, brokerage accounts, savings accounts, savings and loans, credit unions, amount in stocks, bonds, mutual funds, and amount in US savings bonds. Johnson and Widdows (1985), and Huston and Chang (1997) used all three measures of emergency funds. Ding and DeVaney (2000) measured emergency funds at two levels: liquid assets and comprehensive assets. They used the Survey of Consumer Finances' definition of liquid assets including assets held in checking, saving, brokerage accounts, and money market funds (Kennickell, 2003). Comprehensive emergency funds included liquid assets plus assets held in certificates of deposit, mutual funds, stocks, and bonds. Chen and DeVaney (2001) used these same definitions.

Another problem in the empirical research on liquidity ratios and emergency fund holdings is the choice of denominator, or the indicator of the amount of emergency funds that are needed. Ideally, monthly expense is the denominator in the equation. However, difficulty exists in obtaining information on both assets and monthly expenses in the existing secondary U.S. household datasets. In most of the previous studies, the SCF was used and gross household income was used as a proxy for expenditure (e.g. Chang & Huston, 1995; Chang, 1995; DeVaney, 1995; Johnson & Widdows, 1985).

In terms of the adequacy of emergency funds, there is no universal consensus on this either. The liquidity ratio reveals the number of months that the family's or individual's living expenses can be covered given today's current monetary assets. So this is a good indication of how long the household can sustain itself if any emergency happens and the inflow of income is suspended. In practice, financial planners and counselors recommend the ratio value range from two to six, that is, two to six months of expenses in the form of monetary assets. In previous empirical studies, different guidelines were used, or they were used simultaneously to make a comparison. For example, Johnson and Widdows (1985) used both two months and six months gross household income guidelines. Most researchers chose three months gross household income as adequate emergency funds (Chang & Huston, 1995; Chang, 1995; DeVaney, 1995; Huston & Chang, 1997; Chen & DeVaney, 2001; Bi & Montalto, 2004).

In previous research, Chang, et al. (1997) found households with a higher probability of experiencing an income decrease were more likely to hold adequate emergency funds and the probability of meeting the recommended emergency funds guideline increased as the expected income decrease increased. Chang and Huston (1995)

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found that age, education, and home equity were positively associated with adequacy of intermediate emergency funds. Black householders were less likely to have enough intermediate emergency funds. Household size negatively affected the probability of meeting emergency guidelines. Effect of income was not significant. Huston and Chang (1997) found the same effect of age, education and race on the probability of holding adequate emergency funds at all three levels. Income significantly increased the probability of holding enough comprehensive emergency funds, however, the magnitude was negligible. Saving motives for emergencies and willingness to accept at least some financial risk increase the likelihood of holding adequate emergency funds. Interestingly, they didn't find income certainty to be statistically significant. This might due to the measure of this variable not indicating any direction associated with income for the next year, as suggested by the authors. Chen and DeVaney (2001) also found a positive association of education, race (White), homeownership, and saving motives with adequacy of quick and comprehensive emergency funds. Income again was significant only for the comprehensive measure of emergency funds. Bi and Montalto (2004) examine both the actual level of emergency funds held by households and the subjective level of emergency funds mentioned by households, and the results suggest that the actual emergency fund level held by households is more closely related to the ability to save than to the need for emergency funds.

CHAPTER 3

THEORETICAL FRAMEWORK

The theoretical model that provides the investigation of the saving behavior of credit card revolvers is presented in this chapter. A precautionary saving model incorporating uncertainty and liquidity constraints is used. First, theoretical extensions of the standard intertemporal utility maximization model that have been employed in research on precautionary saving are presented and the appropriateness of applying these extensions to explain the saving behavior of credit card revolvers is discussed. Then theoretical explanations for the effects of uncertainty, liquidity constraints, and the interaction between them on precautionary saving are given. Finally, research hypotheses are presented.

3.1 Model of Precautionary Saving with Uncertainty and Liquidity Constraints

Two major extensions of the standard intertemporal utility maximization model have been widely used in research on consumption and saving in the last decade. One is to incorporate uncertainty into the standard model, and the other is to incorporate liquidity constraints into the standard model.

The buffer stock theory of saving is an extension of the standard intertemporal utility maximization model, in which uncertainty about future income plays an important

role. Buffer stock theory posits that consumers hold assets mainly to shield their consumption against unpredictable fluctuations in income (Carroll, Hall, & Zeldes, 1992). Buffer-stock saving behavior can emerge from the standard dynamic optimization framework when consumers facing important income uncertainty are both impatient and prudent. Impatience makes consumers want to spend down their assets, or even borrow against future income to finance current consumption, if income is certain. On the other hand, prudent consumers have a precautionary saving motive and are reluctant to draw down assets too far. This tension will imply the existence of a target wealth stock. If wealth is below the target, prudence will dominate impatience and the consumer will try to save; while if wealth is above the target, impatience will dominate, and consumers will plan to dissave. When consumers' uncertainty about future income increases, their target buffer-stock increases, and they increase their saving to build up wealth toward the new target.

Credit card revolvers are more likely to be impatient than convenience users, because they are actively borrowing, and, furthermore, they are borrowing at high interest rates. If those revolvers are also prudent, they would save at the same time to reach a target level at which they feel financially secure, at the cost of paying interest charges to credit card companies. For those who also consider available credit as a form of buffer stock, their target saving level may be adjusted according to their available credit line. Uncertainty would create or increase prudence among credit card users, and therefore, revolvers facing uncertainty about future income or other factors that would cause variation in future consumption may want to save more than other revolvers facing little uncertainty.

Deaton's saving model with liquidity constraints adds a borrowing restriction to the standard intertemporal model (Deaton, 1991). Liquidity constraints mean that borrowing is not allowed or at least cannot exceed some fixed limit. A weak notion of liquidity constraints includes the situation where consumers can borrow only at high interest rates (Browning & Lusardi, 1996).

Deaton assumes (1) consumers are prudent and have a precautionary demand for saving, and (2) the rate of time preference is larger than the real interest rate, which means consumers are impatient. Precautionary motives interact with liquidity constraints because the inability to borrow when times are bad provides an additional motive for accumulating assets when times are good, even for impatient consumers.

Based on Deaton's definition and the weak notion of liquidity constraints, it may be more appropriate to refer to the liquidity constraints as credit constraints, since the inability of the consumer to borrow or to borrow over a certain amount is emphasized. Also, if the interest rate for borrowing is much higher than the interest rate for saving, it may reduce the consumers' willingness to borrow. Credit constraints are very relevant for impatient consumers who are willing to borrow (Browning & Lusardi, 1996). Therefore, liquidity constraints should be a relevant factor to consider for credit card revolvers.

The conclusions from both the buffer-stock model and the model with liquidity constraints for multiperiod utility are drawn from simulations. With the presence of uncertainty or/and liquidity constraints, impatient consumers would restrict their borrowing and save more than the optimal amount suggested by the certainty equivalent model. Carroll and Kimball (2001) present a theoretical explanation for why the existence of uncertainty or liquidity constraints or both would cause consumers' to save

more than the amount that the standard model suggests. Furthermore, they show the important effect of future uncertainty or future liquidity constraints on current saving decisions.

Intuitively, prudence makes consumers under uncertainty save more to reduce the risk of a consumption drop. Constrained consumers have less flexibility in responding to shocks than unconstrained consumers, because the effects of the shocks cannot be spread out over time. Therefore, risk has a bigger negative effect on expected utility for constrained consumers than for unconstrained consumers. So the precautionary saving motive is increased by the desire to reduce the probability that the constraints will bind in the event of shocks. Both current liquidity constraints and future liquidity constraints increase the precautionary saving motive, because additional saving can reduce the probability that the constraints will bind in the future.

Theoretically, concavity of the consumption function causes prudence, which makes consumers have precautionary saving motives and save more than the amount suggested by a standard consumption model without uncertainty or liquidity constraints. Concavity of the consumption function can be induced or intensified by uncertainty or liquidity constraints.

3.1.1 The Effect of Uncertainty on Precautionary Saving

A two-period model is used to demonstrate the effect of uncertainty on precautionary saving (Carroll & Kimball, 2001). The multiperiod case can be derived when the second period utility function is interpreted as the value function arising from optimal behavior from time t+1 forward.

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Consumers start with initial wealth, w_t, and anticipate uncertain future income y_{t+1}. This consumer solves the optimization problem without liquidity constraints.

$$\max_{\{c_t\}} u(c_t) + E_t\left[V_{t+1}(w_t - c_t + \tilde{y}_{t+1})\right], \tag{1}$$

The first-order condition for this problem is:

$$u'(c_t) = E_t\left[V'_{t+1}(w_t - c_t + \tilde{y}_{t+1})\right] \tag{2}$$

where c_t = consumption in period t

$\quad\quad w_t$ = initial wealth in period t

$\quad\quad \tilde{y}_{t+1}$ = uncertain future income in period t+1

By substituting c_t with (w_t - s_t), equation (1) and (2) can be equivalently expressed as equation (3) and (4):

$$\max_{\{s_t\}} u(w_t - s_t) + E_t\left[V_{t+1}(s_t + \tilde{y}_{t+1})\right] \tag{3}$$

$$u'(w_t - s_t) = E_t\left[V'_{t+1}(s_t + \tilde{y}_{t+1})\right] \tag{4}$$

where s_t = saving in period t

Assume both u and V_{t+1} are Constant Relative Risk Aversion (CRRA) utility functions. Figure 1 illustrates the solution of this problem. The horizontal axis represents the choice of how much the consumer saves in period t, and the vertical axis represents the marginal utility of consumption corresponding to each level of savings in period t. $u'(w_t - s_t)$ is the period-t marginal utility of the consumption (w_t - s_t) associated with that choice of saving. It is upward-sloping curve because the more the consumer saves in period t, the less is available for consumption in this period and thus the higher the marginal utility of consumption in period t. The downward-sloping curve $V'_{t+1}[s_t + \mu(y)]$

reflects the marginal value the consumer would experience in period t+1 as a function of saving s_t in the previous period if she were perfectly certain to receive income $\mu(y) = E_t$ $(\tilde{y}_{t+1})$ in period t+1. The curve is downward-sloping because the more the consumer saves in period t, the more is available for consumption in period t+1 and thus the lower the marginal utility of consumption. The intersection of curve $u'(w_t - s_t)$ and curve $V'_{t+1}[s_t + \mu(y)]$, where the first-period marginal utility of consumption is equated to the second-period marginal utility of consumption, represents the utility-maximizing level of saving in the perfect-certainty case.

The downward-sloping curve $E_t [V'_{t+1}(s_t + \tilde{y}_{t+1})]$ as a function of s_t is the expectation of the second-period marginal value function in the case where period t+1 income is uncertain. The expectation is a convex combination of the marginal values associated with each possible outcome of $\tilde{y}_{t+1}$, where the weights on each outcome are given by the probability of that outcome. For any given level of s_t, where $S_t < \infty$, E_t $[V'_{t+1}(s_t + \tilde{y}_{t+1})]$ is larger than $V'_{t+1}[s_t + \mu(y)]$, and consequently the intersection with $u'(w_t - s_t)$ will occur at a higher value of first period saving. That the curve of $E_t [V'_{t+1}(s_t + \tilde{y}_{t+1})]$ is above the curve of $V'_{t+1}[s_t + \mu(y)]$ can be illustrated by Figure 2.

Under uncertainty, the utility-maximizing solution is at the intersection of the first-period marginal utility and the expectation of the second-period marginal value function, which is S* in Figure 1. The magnitude of precautionary saving is the amount by which saving rises from risk-free case ($\overline{S}$) to the risky case (S*).
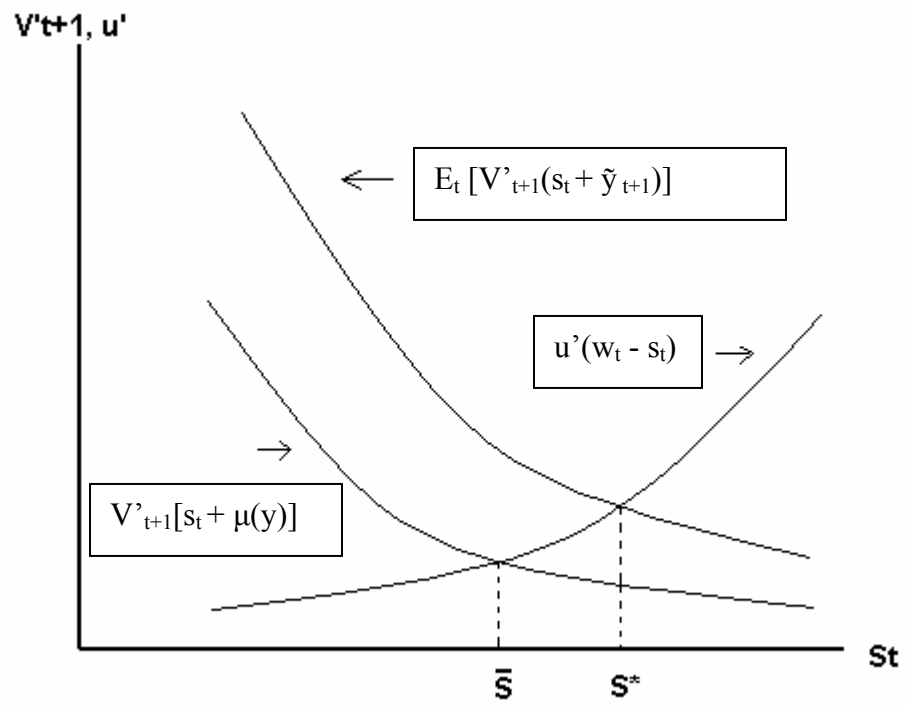
Figure 3.1 Determining Saving in the Two Period Case Given Initial Wealth w_t, with and without Uncertainty

V't+1

$\leftarrow E_t[V'_{t+1}(S_t+\tilde{Y}_{t+1})]$

$V'_{t+1}[\mu(s)+\mu(y)-\eta]$

$0.5\,V'_{t+1}[\mu(s)+\mu(y)-\eta]$
$+ 0.5V'_{t+1}[\mu(s)+\mu(y)+\eta]$

Y

$V'_{t+1}[S_t+\mu(Y)] \rightarrow$

$V'_{t+1}[\mu(s)+\mu(y)+\eta]$

St

$\bar{S}$
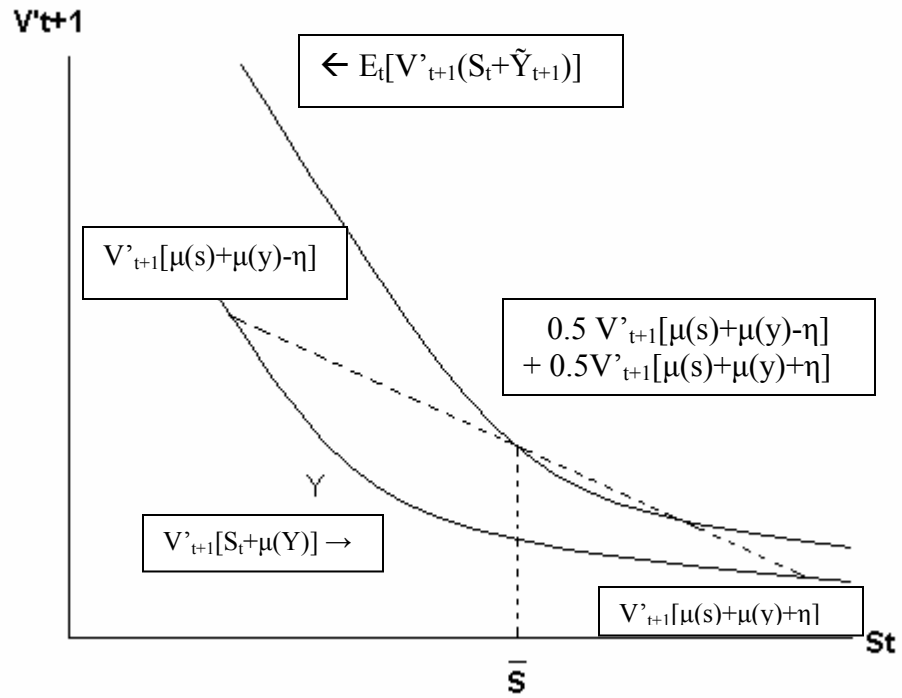
Figure 3.2 Construction of expected marginal utility of consumption under uncertainty $(E_t[V'_{t+1}])$
Source: Carroll and Kimball (2001)

The magnitude of precautionary saving is related to the degree of convexity of the marginal value function. Kimball (1990) shows that the prudence of the value function, which is defined as $-V'''(w)/V''(w)$, measures the convexity of the marginal value function at w and therefore the intensity of the precautionary saving motive at that point. The greater "the prudence of the value function", the greater rightward shift of E[V'(w)] caused by the addition of uncertainty, therefore, the greater the magnitude of precautionary saving.

3.1.2 The Effect of Liquidity Constraints on Precautionary Saving

When a liquidity constraint is added to the standard consumption problem, the liquidity constraint concavifies the consumption function by introducing a "kink" in the marginal value function at the level of wealth where the constraint binds, and the resulting value function exhibits increased prudence around that point. Therefore, prudence in the consumption function with liquidity constraints is greater than in the consumption function without liquidity constraints. The "concavity-boost-prudence" result holds for quadratic utility functions and for any utility function in the Hyperbolic Absolute Risk Aversion (HARA) class, which includes Constant Relative Risk Aversion, Constant Absolute Risk Aversion, and most other commonly used forms.

The logical explanation for the "kink" introduced by liquidity constraints is as follows. At any level of wealth below the point at which the constraint begins to bind, all incremental wealth is devoted to extra current consumption. However, when wealth is above the level where the constraint begins to bind, an increment to wealth can be spread between the present and the future, and the decline in total marginal value is therefore strictly less than when all of the extra wealth had to be consumed in the present. As a result, there is a kink at the point where the liquidity constraint binds.

Once the concavity is induced by either uncertainty or liquidity constraints, it will be propagated to all prior periods. Therefore uncertainty or liquidity constraints in future periods will affect consumers' saving behavior in the current period as well.

The simultaneous presence of uncertainty and liquidity constraints raises the prudence of the value function, which implies that consumption and saving react more

strongly to the uncertainty, and liquidity constraints and uncertainty have a bigger
negative effect on consumption.

3.1.3 Summary

According to the above theoretical explanations, uncertainty and liquidity
constraints are the main additional factors that induce precautionary saving motives, and
hence precautionary saving, which is the amount in excess of the saving level predicted
in a standard model without uncertainty and liquidity constraints. Precautionary saving
motives induced by either uncertainty or liquidity constraints, or both, are likely to be the
reason why some financially sufficient credit card users do not pay off their credit card
balance but instead accumulate assets in a very liquid form. The model of precautionary
saving with uncertainty and liquidity constraints may also work better quantitatively for
credit card revolvers than for convenience users or a pooled population, because, first,
impatient credit card revolvers hold assets mainly for precautionary purposes, according
to buffer-stock theory. Second, liquidity constraints are likely to be of interest only for
consumers who want to borrow (Browning & Lusardi, 1996), and credit card revolvers
are more likely to satisfy the assumption of being more impatient than convenience users.
Previous research found people who perceive the need to save are not always able to save
(e.g., Bi & Montalto, 2004). By focusing on credit card revolvers, the variation in the
ability to save would be smaller than that by using a sample of the whole population.
Furthermore, households who save more are relatively wealthier in terms of financial
resources. Wealthy households are less likely to save in order to protect against future
income or consumption fluctuation (i.e., precautionary saving) and more likely to save

for other purposes, such as investment, improvement, or bequest motives (Browning &

Lusardi, 1996). Including these households in the sample may bound the possible

quantitative importance of a precautionary motives. Therefore, using the sample of credit

card revolvers may provide a better test of the economic model predicting who should

have more precautionary savings.

3.2 Hypotheses

Based on the theoretical discussion of the precautionary saving model with

uncertainty and liquidity constraints presented in the previous section and the empirical

findings of previous related research, the following hypotheses are proposed in two parts,

each of which addresses a research question presented in the previous chapters. First,

hypotheses related to the likelihood of a financially sufficient credit card user being a

revolver are presented. Second, the hypotheses related to factors affecting the level of

liquid assets held by credit card revolvers are presented.

3.2.1 Hypotheses Related to the Likelihood of Being Financially Sufficient Revolvers

Precautionary Saving, Uncertainty, and Liquidity Constraints

Based on the saving model with uncertainty and/or liquidity constraints,

precautionary saving motives increase the optimal level of saving. The buffer-stock

saving model suggests that impatient consumers save for prudence. In addition, money is

no longer fungible because of prudence, i.e., the money is saved for precautionary

considerations and is not used for other purposes. Therefore, credit card revolvers may

want to reserve extra money due to income uncertainty and the fear of being credit

constraints in the future, instead of using the money to pay their credit card balance. In other words, the hypothesized main reason for revolvers to hold liquid assets is that they save for precautionary purposes. Therefore, explicit precautionary saving motives and factors related to uncertainty and borrowing constraints, which could induce or intensify precautionary saving, are expected to be related to the likelihood of being financially sufficient revolvers.

H1.1: Holding other things constant, having precautionary saving motives is positively related to the likelihood of being financially sufficient revolvers.

H1.2: Holding other things constant, being uncertain about future household income is positively related to the likelihood of being financially sufficient revolvers.

H1.3: Holding other things constant, expecting future household income to decline is positively related to the likelihood of being financially sufficient revolvers.

Mental Accounting

Besides the main reason, there may be other possible explanations for the behavior of simultaneous borrowing and saving among revolvers. The behavior of holding large amounts of liquid assets by revolvers looks puzzling under standard economic models partly because of the principle of fungibility, which implies that money is not labeled. Thaler's model of mental accounting (1985, 1999) relaxes this assumption. Thaler believes that money is commonly labeled and not fungible. Therefore, money in one account is not a perfect substitute for money in another account. People may run out of money for one purpose, but have money in other accounts for other uses. So in terms of credit card users, if they open several liquid accounts at the same time, this may

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suggest that they assign different purposes to money in different accounts. If they have other saving goals or debt obligations, it may be less surprising to observe them as simultaneous credit card debtors and savers. For example, closed-end loans have fixed repayment schedules and the periodic repayments are monitored by institutions, while credit card companies only require consumers to pay a minimum amount, which is a relatively small monthly amount. Therefore, consumers may have a tendency to put less priority on paying off credit card debt. Also, if the revolvers expect major expenditures in the near future, such as education expenses, they may save for these goals first. Or they may reserve money in their liquid accounts and wait for good investment opportunities. Therefore, the following hypotheses are proposed.

H1.4: Holding other things constant, having more liquid accounts is positively related to the likelihood of being financially sufficient revolvers.

H1.5: Holding other things constant, having other payment obligations is positively related to the likelihood of being financially sufficient revolvers.

H1.6: Holding other things constant, having saving motives for children's education and also having college age children in the household is positively related to the likelihood of being financially sufficient revolvers.

H1.7: Holding other things constant, having saving motives for investment is positively related to the likelihood of being financially sufficient revolvers.

Other Explanations

Additional explanations for the simultaneous saving and borrowing behavior include: (1) A financial planner concerned about the client's overall situation should

recommend paying off high interest credit card debt. Therefore, revolvers using financial planners may be less likely to hold credit card debt and saving at the same time. (2) The possibility of default or declaring bankruptcy for credit card debt may provide an incentive for consumers to carry credit card debt. By filing for bankruptcy under Chapter 7, the debtor surrenders nonexempt property rights and wealth to the court, and retains property legally classified as exempt from bankruptcy proceedings. There is no limit on the amount of debt that can be discharged and the household need not be insolvent or unable to pay the bills. However, Chapter 7 debtors cannot refile bankruptcy for six years. Credit card debt makes up a substantial portion of debts being discharged by bankruptcy (Sullivan, Warren, & Westbrook, 1989, P.188). Domowitz and Sartain (1999) find credit card debt is the largest single contributor to bankruptcy on the margin. Households having filed for bankruptcy in the past may be inclined to hold unsecured consumer debt, especially credit card debt, since they are familiar with the rules and procedure. However, on the other hand, bankruptcy history may result in difficulty in getting new loans and credit or higher interest rates on loans and credit in the future. Therefore, credit card users may be restrained from filing for bankruptcy. (3) Instead of a single decision maker, the decision to carry a credit card balance and the decision to hold liquid assets may be made by two different "actors" in the household, such as wife and husband. (4) Since interest is charged by the month, the monthly interest charge may not be large enough, especially to wealthier consumers. Therefore, some revolvers may not perceive revolving as costly. The psychic cost of paying off the balance may be perceived as higher than the interest charge, so the consumers will choose not to pay off the balance. The interest rate as the cost of credit card debt will affect the credit card user's

borrowing decision, and it may also interact with other factors. For instance, revolvers having filed for bankruptcy in the past may have higher interest rates on their credit cards, compared to those without bankruptcy history. (5) Some people might need to take costly actions as a self-control strategy to reduce their "impulse" spending (Gross & Souleles, 2002). Therefore, the following control factors are included in the model and the a priori hypotheses are as follows.

The use of financial planners. It is expected that, holding other things constant, using financial planners for saving advice is negatively related to the likelihood of being financial sufficient revolvers.

Bankruptcy history of the credit card user. Holding other things constant, the effect of filing for bankruptcy in the past may be an effect on the likelihood of being financially sufficient revolvers.

Credit attitude. Previous studies show that a favorable attitude towards credit has a positive effect on credit card balances (Chien & DeVaney, 2001; Calem & Mester, 1995). Holding other things constant, it is expected that positive credit attitudes are positively related to the likelihood of being financial sufficient revolvers.

Interest rate on credit cards. The interest rate, as the price of credit card debt, theoretically affects the credit card user's decision about carrying the balance or not. It is expected that the interest rate is negatively related to the likelihood of being financial sufficient revolvers.

Household financial characteristics. Based on the saving model with uncertainty and liquidity constraints introduced in Chapter 3, as the levels of financial assets and income increase, uncertainty and liquidity constraints become less important for the

household. Credit card users may make the repayment decision based on their overall financial ability. Therefore, the level of financial assets and the level of household annual income are controlled in order to test the hypotheses. The levels of financial assets and income are expected to have nonlinear effects on the likelihood of being financially sufficient revolvers, because when the amounts of financial assets and income are large enough, uncertainty and liquidity constraints become irrelevant.

Household demographic characteristics. Family life cycle variables, including age of the head, household type, and number of small children in the household, and other demographic variables such as education and race/ethnicity are controlled in order to test the hypotheses above. Age is an important variable that affect the level of saving in the standard life cycle saving model. Household type and number of small children may affect household's needs to save money for other life cycle motives. Education and race/ethnicity may affect household's financial management behavior because of financial knowledge or cultural background. Therefore, these variables are controlled in this model.

3.2.2 Hypotheses Related to the Level of Precautionary Saving

Based on the theory, the presence of uncertainty or/and liquidity constraints not only induces precautionary saving, but also affects the amount of precautionary saving.

Hypothesis Related to Precautionary Saving

For revolvers, their liquid saving is highly likely to be their precautionary savings, based on the assumption that they save for precautionary purposes. The baseline saving

without uncertainty and liquidity constraints for these credit card revolvers is expected to be close to zero or even negative under a standard saving model. Since precautionary saving is defined as the difference between optimal saving under uncertainty and liquidity constraints, and the baseline saving without uncertainty and liquidity constraints, the amount of observed saving of revolvers would be their precautionary saving. The observed amount of liquid assets held by credit card revolvers represents their accumulated precautionary saving, and reflects saving behavior of the household in the past. Therefore, the following hypotheses are proposed.

H2.1: Holding other things constant, having precautionary saving motives is positively related to the level of liquid assets held by credit card revolvers.

Hypotheses Related to Uncertainty

Based on the theory, uncertainty will induce precautionary saving. Major uncertainties (risks) that can produce precautionary saving motives include uncertainty associated with future exogenous variables, e.g., future income risk, and uncertainty about future health status (Browning & Lusardi, 1996). Therefore, hypotheses related to income uncertainty are proposed as:

H2.2: Holding other things constant, being uncertain about future household income is positively related to the level of liquid assets held by credit card revolvers.

H2.3: Holding other things constant, expecting future household income to decline is positively related to the level of liquid assets held by credit card revolvers.

Compared to households with members in good health, households that are aware of existing health problems among household members may perceive higher risk in terms

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of future declines in productivity that may reduce or stop income, or higher future risk in terms of increased spending related to medical care. Therefore, the following hypothesis is proposed.

H2.4: Holding other things constant, having household member(s) with fair or poor health in the household is positively related to the level of liquid assets held by credit card revolvers.

Household's expectation about the future economy also affects the household's perceptions about future financial risk. If the household believes the economy is getting worse, the fear of unemployment or an income decrease is likely to rise. Therefore, the following hypothesis is proposed.

H2.5: Holding other things constant, expecting the future economy to be worse is positively related to the level of liquid assets held by credit card revolvers.

Hypotheses Related to Borrowing Constraints

Borrowing constraints are another set of factors that could induce precautionary saving. Based on the theory, both current and future borrowing constraints may intensify precautionary saving. Current borrowing constraints could take the form of a household being unable to borrow or unable to borrow beyond a certain amount (Deaton, 1991). A weak notion of borrowing constraints is that households can borrow only at high interest rates (Browning & Lusardi, 1996). High interest rates for borrowing could discourage consumers from borrowing the desired amount. Based on this notion, credit card revolvers are sometimes regarded as being borrowing constrained (Gross & Souleles, 2002). The fear of being borrowing constrained in the future could induce credit card

revolvers to act more prudently in the current period. Therefore, the following hypotheses are proposed.

H2.6: Holding other things constant, having experienced borrowing constraints in the past is positively related to the level of liquid assets held by credit card revolvers.

If the household has been turned down in the past when they applied for credit or they didn't apply for credit because they thought they would be turned down, they are likely to feel that they are borrowing constrained or may be concerned about being borrowing constrained in the future.

H2.7: Holding other things constant, the credit card utilization ratio, measured as credit card debt divided by the total credit line, is positively related to the level of liquid assets held by credit card revolvers.

Credit card revolvers with high utilization ratios have less flexibility in borrowing if their consumption needs increase, so they can be viewed as being liquidity constrained. Gross and Souleles (2002) use the credit card utilization ratio as an indicator of liquidity constraints.

H2.8: Holding other things constant, the interest rate on credit card balances affects the level of liquid assets held by credit card revolvers.

Based on the weak notion of borrowing constraints, the higher the interest rate, the higher the degree of constraints consumers may feel, and this would increase the level of accumulated precautionary saving. On the other hand, according to cost-benefit analysis, the higher the credit card interest rate, the lower the level of accumulated precautionary saving credit card revolvers should keep due to the high cost of saving. Therefore, the direction of the effect of the interest rates is uncertain.

Hypotheses Related to Buffers for Consumption Shocks

Uncertainty induces or intensifies prudence, hence increasing precautionary saving. Factors that reduce the shock of uncertainty are expected to reduce the amount of precautionary saving as well. For example, insurance can reduce the perceived risks due to variations in income and consumption. If the household has more than one earner, the probability of income dropping to zero would be largely reduced, since the additional earner can provide potential income insurance inside the household to buffer consumption if another earner's income drops or even stops. Buffers for consumption shocks including the level of wealth will affect the level of liquid assets held by credit card revolvers. Therefore, the following hypotheses are proposed.

H2.9: Holding other things constant, health insurance coverage is negatively related to the level of liquid assets held by credit card revolvers.

H2.10: Holding other things constant, the amount of life insurance is negatively related to the level of liquid assets held by credit card revolvers.

H2.11: Holding other things constant, having a working spouse or partner in the household is negatively related to the level of liquid assets held by credit card revolvers.

Control Factors

Other financial assets. Precautionary saving can also be affected by the level of "cash-on-hand", which is assets plus current income (Browning & Lusardi, 1996). Low levels of cash-on-hand (assets plus current income) induce a stronger precautionary saving motive in order to protect against future fluctuations in consumption. High wealth can make income uncertainty and liquidity constraints less important or totally irrelevant

for consumers (Carroll & Kimball, 2001). In addition, the higher the income, the higher the marginal tax rate, and therefore, the lower the after-tax return on liquid assets. So, all other things equal, wealthier households are less motivated to hold liquid assets together with credit card debt. Therefore, the amount of financial assets other than liquid assets is controlled. Holding other things constant, the amount of other assets, which include investment assets and retirement assets, is expected to be negatively related to the level of liquid assets held by credit card revolvers.

The use of financial planners and household demographic characteristics and are expected to affect the level of liquid asset holdings.

Use of financial planners. Households using financial planners are expected to have their assets and credits managed wisely and efficiently. However, these households may be more aware of emergency fund guidelines, compared to those not seeking advice from financial planners. Emergency fund guidelines given by financial planners in practice usually suggest holding liquid assets equal to two and a half to three months of living expenses (Greninger, et al., 1996). These guidelines do not consider the position of household debt. On the other hand, most financial planners are paid as commission based. According to a survey by the Financial Planning Association (FPA) for the first quarter of 2000, more than two-thirds of FPA's members are compensated by commissions and nearly one-fifth are compensated solely by commissions. This compensation approach may create a conflict of interest, because financial planners have the incentive to recommend their clients to build up assets without considering their debt repayment, in order to sell financial products that might not be in the best interest of the client. According to FPA, another common compensation approach is to charge fees for assets

under management. This arrangement can also encourage the planner to keep as much money in saving accounts as possible, even when some of that money is needed to pay down debts. Therefore, using financial planners for saving or investment advice is expected to have some effect on the level of liquid assets held by credit card revolvers, but the direction is uncertain.

Age. Previous research indicates that age is positively related to the adequacy of emergency fund levels (Bi & Montalto, 2004; Chen & DeVaney, 2001; Huston & Chang, 1997; Chang & Huston, 1995). Age plays an important role in the life cycle saving model. Under the life cycle savings theory, people at younger ages are at the stage of dissaving, so it is expected that household's accumulated liquid saving would be lower at early life cycle stages. In addition, as people age, they are likely to learn from past experience, therefore, older people are likely to be more prudent and value precautionary saving more, compared to younger people. Therefore, holding other things constant, age of the householder is expected to be positively related to the level of liquid assets held by credit card revolvers.

Education. Empirical studies have found that more educated people tend to have higher future income and more employment security. An expectation of income growth and less income uncertainty theoretically results in a lower optimal amount of precautionary saving. When expectation of future income and income uncertainty are controlled, education should have no effect on the level of precautionary saving. However, more educated people may have a better understanding of the importance of precautionary saving and hear about the guidelines for emergency funds, and therefore be more prepared in advance. After controlling for income change patterns, education was

found to be positively associated with the level of precautionary saving in previous

empirical studies (Bi & Montalto, 2004; Chen & DeVaney, 2001; Huston & Chang,

1997; Chang & Huston, 1995). On the other hand, more educated people may have a

better understanding of the cost of simultaneously borrowing on credit cards and

accumulating liquid assets. Therefore, they are likely to either avoid credit card debt or

reduce credit card debt using their available financial assets. Based on the above

discussion, the effect of education on the level of liquid assets held by credit card

revolvers is uncertain.

Race. Race might affect the level of liquid assets held by credit card revolvers due

to racial differences in income growth patterns, the probability of income changes, and

the level of other financial resources available that may substitute for precautionary

saving. However, after controlling for these variables, race might still matter due to

differences in social and cultural background. Social and cultural factors may produce

racial differences in perceptions of precautionary saving and the cost of credit card debt,

and these differences in perceptions result in different saving and spending behaviors.

Previous empirical studies suggest that Black householders are less likely than White

householders to have adequate emergency funds (Chang & Huston, 1995; Huston &

Chang, 1997; Chen & DeVaney, 2001; Bi & Montalto, 2004).

Risk tolerance. Theoretically "prudence" refers to the propensity to prepare

oneself in the face of uncertainty, that is, the intensity of the precautionary saving motive.

On the other hand, the theoretical term "risk aversion" refers to the degree that one

dislikes uncertainty and would avoid uncertainty if possible (Kimball, 1990). As

discussed in Chapter 2, the possible relationship between prudence and risk aversion can

bias the estimated effect of the precautionary motive (Browning & Lusardi, 1996). Therefore, risk aversion should be controlled for in the precautionary saving model. Empirically, there is no consensus on the best empirical measure of risk aversion. The study by Hanna and Lindamood (2004) suggested a significant positive correlation between relative risk aversion and risk tolerance as measured in the Survey of Consumer Finances. Therefore, risk tolerance is included as a control variable in the empirical model.

Eligibility for Medicaid. Medicaid is a means-tested program based on income and assets. The means-test may produce an incentive for households to hold only a low level of financial assets, in order to qualify for the program. Therefore, eligibility for Medicaid is controlled in this model.

Saving behavior. Bi and Montalto (2004) found that the households' actual holdings of emergency funds are likely to be constrained by the difference of their income and how much they choose to spend. Bi and Montalto (2004) estimated the likelihood of meeting the three-month expenditure guideline based on measures of objective and subjective emergency funds. Results for subjective emergency funds were more consistent with theoretical hypotheses, compared to the results for actual emergency fund holdings. The authors concluded that the actual level of emergency funds may be constrained by the household's financial situations. For example, some households may hold less financial assets than they perceive they need because they need or choose to spend most of their income. Therefore, the empirical effects on the accumulated precautionary saving of some variables that are closely related to the household's economic status are likely to be different for households who save and households who

do not save. Given these considerations, the following interaction terms are included in the empirical model.

Interactions between Health Conditions and Saving Behavior

Poor health conditions of household members increase income uncertainty and the possibility of unexpected extra expenses. Based on the theoretical framework, households with members in poor health should hold more precautionary savings. However, the household's current level of liquid assets may reflect not only the household's expectation about future events, but also the results of past events. Households with members in poor health may have incurred more medical expenses, making them less likely to save, even if they believe they should save more. Given these considerations, interaction terms are expected to differentiate the effect of health conditions on the current level of accumulated precautionary saving between households who saved in the past year and households who did not save.

Interactions between Borrowing Constraints and Saving Behavior

Households perceiving borrowing constraints are expected to hold more precautionary savings, in order to reduce the possibility of being liquidity constrained in the future. However, borrowing constrained households are also likely to be the households that only have small amount of money, if there is any, available for saving. Therefore, the effects of borrowing constraint experience and utilization ratios on the level of accumulated precautionary saving are expected to differ between households who saved in the past year and households who did not save.

Interactions between Insurance Coverage and Saving Behavior

Based on the theoretical framework, health insurance coverage and life insurance coverage are expected to be negatively related with levels of precautionary saving. Previous research about the effect of health insurance coverage on precautionary saving found a positive effect (Starr-McCluer, 1996). Starr-McCluer explained that the positive relationship between private health insurance coverage and saving might be due to the unmeasured differences in income between insured and uninsured households. A job providing health insurance is more likely to have higher total remuneration and more other benefits, compared to a job without coverage. Therefore, the insured households might be expected to have higher savings, other things being equal. Insurance coverage is expected to be negatively related to the level of precautionary saving for households who saved in the past, but it might be positively related to the level of precautionary saving for households who did not save.

Interactions between Risk Tolerance and Saving Behavior

Due to the availability of variables in the dataset, the measure of risk tolerance is based on a question about investment behavior. Investment decisions are likely to come after households' saving decisions. Households with no or little savings may be less likely than households with substantial levels of savings to think about investments. Therefore, households who save may interpret and respond to the SCF risk tolerance question differently than households who do not save. For example, if a respondent who did not save indicated he/she was not willing to take any financial risk when investing, it may reflect the fact that the respondent didn't make investment decisions since he/she didn't save, and may not measure the respondent's real risk tolerance. Given these

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considerations, the measure of risk tolerance based on the SCF question is likely to be more accurate for households who saved than for households who did not save. Adding interaction terms helps to differentiate the effect of risk tolerance on the level of accumulated precautionary saving, between households who saved and households who did not save.

CHAPTER 4

DATA AND METHODOLOGY

The data and sample used for empirical analysis are described in this chapter. The development of the empirical model including model specification, variable identification, measurement issues, and statistical methods are also described.

4.1 Data and Sample

<u>Data</u>

Data from the 2001 Survey of Consumer Finances (SCF) are used in this study. SCF is a triennial survey of U.S. households sponsored by the Federal Reserve Board with the cooperation of the U.S. Department of Treasury (Aizcorbe, Kennickell & Moore, 2003), and 2001 SCF was conducted by National Opinion Research Center at the University of Chicago. The data were collected using computer-assisted personal interviewing. The 2001 SCF public-use data contains information on 4,442 U.S. households. This survey asks a series of credit card related questions and also provides very comprehensive and detailed information about financial assets, socioeconomic information, demographic characteristics, and attitudes regarding financial issues, all of which are important to this study.

Sample Design in 2001 SCF

The SCF uses a dual-frame sample design. Sixty-five percent of the final sample were from a standard multi-stage area-probability design. This part of the sample is intended to provide good information on characteristics that are broadly distributed in the population. The other 35% of the final sample came from a list sample based on individual tax data, designed to disproportionately select wealthy families.

Sample Weights in the 2001 SCF

The SCF sample is not an equal-probability design, and the wealthy families are over sampled. Therefore, weights play a critical role in interpreting the survey data. Nonresponse-adjusted sampling weights are used to compensate for unequal probabilities of selection in the original design and also for unit nonresponse. The weight is constructed at the Federal Reserve using original selection probabilities and frame information along with aggregate control totals estimated from the Current Population Survey (Board of Governors of the Federal Reserve System, 2003).

All descriptive analyses in this study are weighted using the SCF final nonresponse-adjusted sampling weights to produce point estimates that are nationally representable.

Multiple Imputation in the 2001 SCF

The Federal Reserve Board employs multiple imputation techniques to deal with the problem of missing responses. Most of the variables that originally contained missing values have been imputed five times by drawing repeatedly from an estimate of the

conditional distribution of the data. As a result, the 2001 SCF consists of five complete implicates (Kennickell, 2003). Thus, the number of observations in the full data set is five times the actual number of respondents. All five implicates are used for this study.

<u>Sample</u>

Since credit card revolvers are paying interest rates much higher than the typical interest rates paid on monetary accounts, intuitively, they should try to pay off or pay down their credit card balance using their holdings in monetary accounts. Given this and the fact that many credit card revolvers save many liquid assets (Laibson, Repetto, & Tobacman, 2000; Gross & Souleles, 2002), the saving behavior of credit card revolvers is of particular interest. The empirical analyses consist of two parts, and the samples for these two parts are different.

For the first part, the focus is to explore the factors that are associated with the likelihood of being financial sufficient revolvers instead of being financially sufficient convenience users, therefore, the empirical analysis focuses on financially sufficient credit card users. The sample for testing the hypotheses is limited to active users of major credit cards who also have liquid assets in excess of one month's income. Since anyone with a zero interest rate on her credit card would be rational to revolve, households with zero interest rates are excluded from the analyses. A preliminary check of the credit card interest rates suggests that a small portion (3%) of the credit card users have non-zero interest rates less than 5%. The after-tax interest rates on liquid accounts are very likely to be less than the low interest rates on credit card accounts, and the low interest rates are usually introductory rates and usually expire in a several months. Therefore, these credit

card users with low interest rates are included. As a result, 1,579 financially sufficient credit card users, including 928 convenience users and 651 revolvers, are used for analysis.

For the second part, the purpose is to examine the relationship between credit card revolver's liquid saving and uncertainty and liquidity constraints, so the sample for the multivariate analysis is limited to credit card revolvers. Because anyone with a zero interest rate on her credit card would be rational to revolve and accumulate liquid assets, households with zero interest rates are excluded from the analyses. As a result, there are 1,723 credit card revolvers in the sample. The households in the sample represent about 58% of active bank card users, and about 39% of all American households.

4.2 Empirical Specification

Chapter 3 lays out the factors that are hypothesized to affect the likelihood of being financially sufficient revolvers and to affect the level of precautionary saving among revolvers, based on the model of precautionary saving with uncertainty and liquidity constraints. This section presents two empirical models separately to test the factors affecting the likelihood that a financially sufficient credit card user is a revolver, and to test the effects of uncertainty and liquidity constraints on the level of precautionary saving among revolvers.

4.2.1 The Likelihood of Being Financially Sufficient Revolvers

4.2.1.1 Empirical Model

Logistic regression is used to determine the factors affecting the likelihood that a financially sufficient credit card user is a revolver. Logistic regression is appropriate given that the dependent variable is dichotomous. Rubin's (1987) repeated-imputation inference (RII) techniques are used for more valid inference (Montalto & Yuh, 1998).

4.2.1.2 Variable Identification

1) Dependent Variable

Financial assets are usually categorized in three ways in the studies of precautionary saving (e.g., Johnson & Widdows, 1985; Huston & Chang, 1997): 1) liquid (monetary) assets, including checking, saving, and money market accounts and call accounts; 2) comprehensive assets, including liquid assets plus CDs, non-money market funds, stocks, and bonds; and 3) general financial assets, including comprehensive assets plus retirement accounts, saving bonds, cash value of life insurance, and some other managed assets and financial assets.

Holding certain types of financial assets while also revolving credit card debt may be considered rational under some circumstances. For example, restrictions on withdrawals from retirement accounts, or tax benefits for retirement saving may result in households having both high retirement saving levels and credit card debt. Households may also hold stocks and bonds simultaneously with credit card debt if the rate of return on the investments exceeds the interest rate charge on the credit card balance. Even if the

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rate of return does not exceed the interest charge, investors may be reluctant to sell

investments due to loss aversion (Thaler, 1999). Individuals may also hold some level of

liquid assets for cash transactions. However, it seems puzzling for credit card revolvers to

hold large amounts of liquid assets. One month's income is considered more than

typically needed for monthly cash transactions (Gross & Souleles, 2002). Given the

above considerations, for purposes of the primary empirical work, this study focuses on

credit card revolvers' liquid assets and defines financially sufficient revolvers as

revolvers with liquid assets in excess of one month's income.

The dependent variable is a dichotomous variable, and is coded as 1 if the credit

card user has liquid assets in excess of one month's income and carries a balance on

credit cards (financially sufficient revolvers), and 0 if the credit card user has liquid

assets in excess of one month's income and carries zero balance on credit cards

(financially sufficient convenience users).

2) Explanatory Variables

Variables Related to Precautionary Saving Motives

Directly Indicated Precautionary Saving Motives

In SCF, each household provided up to six reasons for savings, even though they

might not be saving all the time. In some previous research, only the first answer to this

question is used to indicate the household's primary saving motive (Huston & Chang,

1997; Chen & DeVaney, 2001). However, it is plausible that several saving motives exist

at the same time. The SCF question asks about the most important reasons for saving and

records the answers in the order reported by respondents. Thus, it is hard to say which

motive is the most important and primary one. Therefore, information from all their

answers is included to create the saving motives variable. If the respondent's answers included "Reserves in case of unemployment", "In case of illness", "Emergencies/other unexpected needs", and "Liquidity", then the variable is coded as 1, else coded as 0.

Ability to Borrow from Friends/Relatives

A dichotomous variable equals 1 if the household can borrow $3000 or more from friends or relatives, and 0 otherwise. If the households can borrow $3000 or more, they may worry less about saving for emergencies.

Subjective Emergency Funds

A continuous variable is used to capture the amount of self-reported subjective emergency funds.

Expectation of Future Income

Expectation of future income is measured with four dichotomous variables created from two questions in the SCF. One question asked "Over the next year, do you expect your total income to go up more than prices, less than prices, or about the same as prices?" The other question asked "At this time, do you have a good idea of what your income for next year will be?" Among the households that said they had a good idea of next year's income, if they expected their total income to go up about the same as prices, then they are coded as "constant, sure"; if they expected their total income to go up more than prices, then they are coded as "growth, sure"; if they expected their total income to go up less than prices, then they are coded as "decline, sure". All the others were not sure about their next year's income and are coded as "not sure".

Variables Related to Mental Accounting

Number of liquid accounts

A continuous variable measures the total number of checking accounts, saving accounts, and money market accounts.

Saving motives for commitments

A dichotomous variable indicates whether the household has saving motives for contractual commitments or bills.

Saving motives for children's education

Three dichotomous variables are used to indicate: a saving motive for children's education and having children ages 17-22; a saving motive for children's education but not having children ages 17-22; and not having a saving motive for children's education. When households have children reaching or at the age of attending college, it's reasonable to keep more liquid assets for education expenses.

Saving motives for investment

A dichotomous variable equals 1 if the respondent indicates saving motives for investment reasons, and 0 otherwise.

Ownership of mortgage

A dichotomous variable equals 1 if the respondent has a mortgage, and 0 otherwise.

Ownership of other consumer loans

A dichotomous variable equals 1 if the respondent has car loans, education loans, or other consumer installment loans, and 0 otherwise.

Control Variables

Use of financial planners for credit advice

The respondent was asked, "How do you make decisions about credit or borrowing?" All of the information sources reported by the respondent were recorded. If financial planner was mentioned, the value of the dichotomous variable equals 1, and 0 otherwise.

Use of financial planners for saving advice

A parallel question was asked, "How do you make decisions about savings and investments?" All of the information sources reported by the respondent were recorded. If financial planner was mentioned, the value of the dichotomous variable equals 1, and 0 otherwise.

Credit attitude

Three dichotomous variables are used to capture the respondent's credit attitude: If the respondent thinks credit in general is a good idea, good equals 1, 0 otherwise; If respondent thinks credit is good in some ways and bad in others, neutral equals 1, 0 otherwise; If the respondent thinks credit in general is a bad idea, bad equals 1, 0 otherwise.

Bankruptcy history

A dichotomous variable equals 1 if the household has filed for bankruptcy before, and 0 otherwise.

Household annual income

Household annual income is measured by before-tax income in 2000 and grouped into five categories representing the quintiles of the income distribution for the total

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sample, in order to capture any nonlinear effects. As income tax further reduces the after-tax return on liquid assets, and the marginal tax bracket varies progressively according to the level of taxable income, we may expect that income has a nonlinear effect on the likelihood of being financially sufficient revolvers. The five dichotomous variables are:

< = $13,000	=1 if yes, =0 otherwise
$13,001 ~ $25,000	=1 if yes, =0 otherwise
$25,001 ~ $42,000	=1 if yes, =0 otherwise
$42,001 ~ $67,000	=1 if yes, =0 otherwise
> $67,000	=1 if yes, =0 otherwise

General financial assets

General financial assets include all the financial assets defined in the SCF held by the household, that is, liquid (monetary) assets, including checking, saving, money market accounts, and call accounts, plus CDs, non-money market funds, stocks, bonds, retirement accounts, saving bonds, cash value of life insurance, and some other managed assets and financial assets.

The amount of general financial assets are grouped into five categories representing the quintiles of the general financial assets distribution for the total sample, in order to capture any nonlinear effects. The five dichotomous variables are:

< = $20,000	=1 if yes, =0 otherwise
$20,001 ~ $60,000	=1 if yes, =0 otherwise
$60,001 ~ $150,000	=1 if yes, =0 otherwise
$150,001 ~ $370,000	=1 if yes, =0 otherwise
> $370,000	=1 if yes, =0 otherwise

Age

Age of the head is measured with five dichotomous variables: under 35 years old,
35 to 44 years old, 45 to 54 years old, 55 to 64 years old, and 65 years old and over. One
advantage of treating age as a categorical variable is that it is easier to detect nonlinear
effects if any, compared with treating age as a continuous variable.

Household type

Household type is measured with three dichotomous variables defined as follows:

Legally married couple

$\qquad$ 1=current legal marital status is married $\quad$ 0=otherwise

Male head, not legally married

$\qquad$ 1= yes $\qquad$ 0=otherwise

Female head, not legally married

$\qquad$ 1=yes $\qquad$ 0=otherwise

Number of children under age 16

A continuous variable measures the number of children age 16 or under in the
household.

Educational attainment

Educational attainment of the head is measured with five dichotomous variables:
less than high school, high school graduate, some college, bachelor's degree, and
graduate school.

Race/ethnicity

Race/ethnicity of the respondent is measured with four dichotomous variables:
White, Black, Hispanic, and Other. The *other* category includes Asian, American Indian,

Alaska Native, Native Hawaiian, and others. The majority of households in the *other* category are most likely Asians.

4.2.2 Level of Precautionary Saving

4.2.2.1 Empirical Model

OLS regression is used to test the effects of uncertainty and liquidity constraints on the level of precautionary saving held by households. Rubin's (1987) repeated-imputation inference (RII) techniques are used for more valid inference (Montalto & Yuh, 1998).

4.2.2.2 Variable Identification

1) Dependent Variable

The dependent variable is the log of the ratio of liquid (monetary) assets to household monthly income.

There is no universal agreement on the appropriate measure of wealth to be considered as precautionary saving. Theoretically, precautionary saving is the amount in excess of the optimal saving level under the standard model of saving without uncertainty and liquidity constraints (Carroll & Kimball, 2001). Liquid assets may correspond most closely to precautionary saving, as they are most readily and risklessly converted to cash (Starr-McCluer, 1996; Bi & Montalto, 2004).

In this study, the level of accumulated liquid assets is more of interest than the saving behavior in the current period. Even if the credit card revolver is dissaving in the current period, the fact that she is still holding a large amount of liquid assets and does

not dissave enough to further reduce her credit card debt remains puzzling. In addition, the level of accumulated liquid assets reflects the saving behavior in the past, so it is consistent with the theory introduced in the previous section. Furthermore, empirically, no measurement of the current period level of saving is available in the SCF dataset. The indicator variable in the SCF of whether the household is currently saving or not has limitations for this study, since current saving may include saving for other important purposes, such as retirement, in addition to the precautionary saving which is the interest of this study.

The ratio of liquid (monetary) assets to household monthly income is used as a measure of the level of liquid saving. This ratio is similar to the liquidity ratio which is defined as liquid assets divided by monthly expenditure. In empirical studies of emergency funds, this ratio of liquid assets to household monthly income is commonly used as a proxy for the liquidity ratio to indicate the adequacy of household emergency fund holdings. A ratio, instead of the absolute amount of liquid assets, is chosen to measure the level of accumulated liquid assets. The ratio measurement gives a relative evaluation of the level of liquid saving, since it relates the household's liquid financial assets to the household's spending, as income is commonly used as a proxy for expenditure in emergency funds research. The absolute amount of liquid assets itself may not fully reflect the saving relative to needs.

If the monthly income of credit card users is below the household poverty threshold, the household's poverty threshold is used to replace monthly income to calculate the ratio. The dependent variable attempts to measure the accumulated precautionary saving relative to needs. For households with very low income the income

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level is likely to underestimate need, and therefore the household poverty threshold is used to indicate a minimum level of need. Some credit card users may have zero liquid assets, and this will make the ratio equal to zero, which might cause a bias if OLS is used. A preliminary examination of the data suggests the proportion of households with zero liquid assets is relatively small, only 2.7% of revolvers and 0.92% of convenience users. Give the small portion of zero values, this will not cause a serious problem for OLS. Therefore, the revolvers with zero liquid assets are included in this study.

The distribution of the ratio of liquid assets to monthly income is clustered at small values with relatively large values more sparsely distributed. This violates the assumption of OLS that the distribution of the error term is an independent identical normal distribution. A logarithmic transformation of the ratio will stretch out the difference between small values of the ratio clustered at the lower tail of the distribution, and compress the values at the upper tail (Cohen, et al., 2003). After transforming the ratio into the logarithmic form, the distribution of the error terms is more likely to satisfy the assumption. In order to validate the logarithmic transformation, the amount of liquid assets is assigned to 1 if the household reported zero liquid assets.

Twenty-three revolvers (weighted) had liquidity ratio equal to or larger than 30. Table 4.1 presents some preliminary descriptive statistics for these revolvers, compared to all the other revolvers. Almost half of these 23 revolvers were elderly and most of them (99%) had income higher than poverty threshold. These revolvers had a much larger amount of liquid and other financial assets than other revolvers. Therefore, the large ratios of liquid assets to monthly income for these 23 revolvers are reasonable

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considering their age, income, and financial assets. So, these 23 revolvers are included in this study.

Variables	Ratio >= 30	Ratio <30
N		
Unweighted	25	1399
Weighted	23	1700
Age		
Under 35	2.03%	25.98%
35 to 44	6.70%	27.96%
45 to 54	25.00%	24.33%
55 to 64	20.23%	12.30%
65 and over	46.04%	9.43%
Mean	64.0	44.5
Median	64	43
Years of education		
Less than high school	5.70%	9.10%
High school graduate	39.38%	33.94%
Some college	27.22%	29.26%
Bachelor's degree	3.21%	18.43%
Graduate school	24.50%	9.27%
Mean	13.6	13.5
Median	14	13
Liquid assets ($)		
Mean	260,219	9,615
Median	136,400	2,750
Other financial assets ($)		
Mean	339,289	66,880
Median	83,000	8,700
Normal income ($)		
Mean	43,837	59,128
Median	31,000	46,000
% with normal income < poverty threshold	1.05%	5.49%

Table 4.1 Descriptive statistics for revolvers by liquidity ratio.

2) Explanatory Variables

Precautionary saving motives

The precautionary saving motive variable is measured as described in section

4.2.1.2.

Expectation of future income

Expectation of future income is measured as described in section 4.2.1.2.

Health condition of household members

Health condition is measured with four dichotomous variables created to indicate whether the respondent or his/her spouse or partner's health condition was excellent, good, fair, or poor. If a spouse/partner is present, the worse health condition between the respondent and the spouse/partner is used to assign the household into one of the four categories. That is, if either the respondent or the spouse/partner reported a poor health condition, the dichotomous variable *poor* is coded as 1, and 0 otherwise. If one reported his/her health condition as excellent, good, or fair, and the other reported his/her health condition as fair, the dichotomous variable *fair* is coded as 1, and 0 otherwise. If one reported his/her health condition as excellent or good, and the other reported his/her health condition as good, the dichotomous variable *good* is coded as 1, and 0 otherwise. If both of the respondent and the spouse/partner reported an excellent health condition, the dichotomous variable *excellent* is coded as 1, and 0 otherwise.

Expectation of future economy

The SCF question about the respondent's expectation for the future asks

"Over the next five years, do you expect the U.S. economy as a whole to perform better, worse, or about the same as it has over the past five years?"

Three dichotomous variables are created correspondingly:

Better   1= expect the economy to perform better   0=otherwise

Same   1= expect the economy to perform about the same   0=otherwise

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Worse   1= expect the economy to perform worse   0=otherwise

Variables Associated with Borrowing Constraints

Borrowing constraint experience

The SCF contains two questions related to the household's perception of being

credit constrained: (1) whether or not the household has ever been turned down for a

credit request, or not given as much credit as requested in the past five years, and (2)

whether or not members of the household thought of applying for credit but changed their

minds because they thought they might be turned down. Households that answered 'yes'

to the second question were regarded as 'discouraged borrowers' by Jappelli (1990), and

he believed that these households should be treated as being credit-constrained as well. A

dichotomous variable is created and coded as 1 if the household responded to either of

the questions with a 'yes', and 0 otherwise.

Credit card utilization ratio

Utilization ratio is defined as the balance owed on major credit card accounts

divided by the total credit limit from these accounts. Three indicator variables are created

for households with utilization ratios of at least 0.90, households with utilization ratio

below 0.50, and households with utilization ratios between 0.50 and 0.90. Households

with utilization ratios of at least 0.90 are more likely to be credit constrained than those

with the ratios below 0.50. Gross and Souleles (2002) use this as a measure of credit

constraint.

Utilization ratio1 $1 =$ utilization ratio < 0.5 $0 =$ otherwise

Utilization ratio2 $1 = 0.5 \leq$ utilization ratio < 0.9 $0 =$ otherwise

Utilization ratio3   1 = utilization ratio ≥ 0.9 0 = otherwise

Interest rate on the credit card balance

The interest rate on the credit card balance is a continuous variable measured from the SCF question that asks about the interest rate that the household pays on the credit card carrying the largest balance. Though it is not the exact interest rate applied to the total balance, it provides a reasonably good estimate.

Variables Associated with Buffers for Consumption Shocks

Health insurance coverage

Health insurance coverage is an indicator variable. Questions in the SCF ask whether members in the household are covered by government health insurance, or by private health insurance. If all the members in the household are covered by either government health insurance or private health insurance, the dichotomous variable equals 1 and 0 otherwise.

Life insurance coverage

Life insurance coverage is an indicator variable. The SCF includes questions about two kinds of life insurance, term insurance and cash-value insurance. Term insurance will pay only in the event of death, while cash-value insurance can also build up a value that can be borrowed against. Therefore, cash-value insurance may be perceived as a type of buffer for consumption or income fluctuations. The variable is coded as 1 if the household has cash-value insurance that they can borrow on, and 0 otherwise.

Working status of the spouse/partner

Working status of the spouse/partner is measured with five dichotomous variables coded as spouse/partner working full-time, spouse/partner working part-time, spouse/partner not working, and finally indicators of single male headed household and single male headed household for households with no spouse/partner. Given the consideration that gender difference may have an effect on the level of precautionary saving held by credit card revolvers, single male and female headed households are separated.

Amount of other financial assets

Other financial assets include investment assets defined as directly held stocks, bonds, mutual funds, and assets in retirement accounts. The amount of other financial assets is a continuous variable. A logarithmic transformation is used, which is a common treatment for money-based variables in economics studies (Cohen, et al., 2003, P.221). The transformed variable has two advantages over the original variable. First, a logarithmic transformation simplifies the relationship between the explanatory variable and the dependent variable, resulting in a more linear relationship. A logarithm transformation also reduces possible heteroskedasticity. The transformation stretches out the lower tail and compresses the upper tail of the distribution. Second, the logarithmic form better reflects the utility of money. It is likely that the proportionate changes in the amount of other financial assets are associated with additive changes in the dependent variable.

<u>Control Variables</u>

Age

Age of the head is a continuous variable, and square of age will be entered into the model to allow for a possible nonlinear effect of age on the dependent variable.

Education

The level of educational attainment of the head is measured with five dichotomous variables: less than high school, high school graduate, some college, bachelor's degree, and graduate school.

Race/ethnicity

Race/ethnicity is measured as described in section 4.2.1.2.

Use of financial planners for credit advice

Use of financial planners for credit advice is measured as described in section 4.2.1.2.

Use of financial planners for saving advice

Use of financial planners for saving advice is measured as described in section 4.2.1.2.

Eligibility for Medicaid

In the SCF, the respondent was asked whether anyone in the household was eligible for Medicaid. An indicator called Medicaid equals 1 if the respondent or anyone in the household was eligible for this program, and equals 0 otherwise.

Risk tolerance

Risk tolerance is measured with four dichotomous variables based on responses to the SCF question. The four variables are high risk tolerance, if the respondent indicated

they were willing to "take substantial financial risks expecting to earn substantial returns"; above average risk tolerance, if willing to "take above average financial risks expecting to earn above average returns"; average risk tolerance, if willing to "take average financial risks expecting to earn average returns; and low risk tolerance, if "not willing to take any financial risks".

Saving behavior

The respondents were asked whether they have saved in the past year. If the spending in 2000, excluding spending for durable goods such as a home or automobile and spending for any investments, was less than the household's income, then this household is classified as a saver. The indicator variable "Saver" equals 1 if the household is a saver, and 0 otherwise.

Interactions

As discussed in Chapter 3, the actual level of precautionary saving may be constrained by the difference of their income and how much they need or choose to spend. For example, some households may hold less financial assets than they perceive they need because of the limited amount that can be saved given their income and expenditure. Therefore, the empirical effects on the accumulated precautionary saving of some variables that are closely related to the household's expenditure needs and economic status are likely to be different for households who save and households who do not save. Given these considerations, the following interaction variables are created and included in the empirical model.

Interactions between health conditions and saving behavior

Each health condition category is interacted with saving behavior. They are constructed as follows:

Interaction between excellent health and saver = excellent × saver;

Interaction between good health and saver = good × saver;

Interaction between fair health and saver = fair × saver;

Interaction between poor health and saver = poor × saver.

Interactions between borrowing constraint variables and saving behavior

Interaction between borrowing constraint experience and saving behavior = turned down × saver;

Interactions between credit card utilization ratios and saving behavior include:

Utilization ratio 1 (<0.5) × saver;

Utilization ratio 2 (0.5 – 0.9) × saver;

Utilization ratio 3 (>0.9) × saver.

Interactions between insurance coverage and saving behavior

Interaction between health insurance coverage and saving behavior = health insurance coverage × saver;

Interaction between life insurance coverage and saving behavior = life insurance coverage × saver.

Interactions between risk tolerance and saving behavior

Four interactions are created:

High risk tolerance × saver;

Above average risk tolerance × saver;

Average risk tolerance × saver;

No risk tolerance × saver.

4.2.2.3 Endogeneity

The indicator of whether the household saved or not in the past year is likely to be

endogenous with the liquidity ratio. Households' saving behavior is likely to affect the

amount of accumulated liquid assets held by the households, and hence the liquidity ratio.

On the other hand, households may make their saving decisions based on the level of

their accumulated liquid assets. As a consequence of endogenous variables, the OLS

estimator is biased (Kennedy, 2003, p180). Two-stage OLS regression is a common

treatment for endogeneity, where an instrument variable of whether the household saved

or not is estimated and the predicted value is used in the OLS regression. However, in

this study, the indicator of whether the household saved or not in the past year is based on

the respondent's subjective answer, which is likely subject to large measurement error.

Therefore, estimating the indicator has little value in itself. An alternative strategy will be

used to access whether the potential endogeneity may cause a problem in this model.

Two models will be estimated, one model including the indicator of whether the

household saved or not in the past year and the interaction terms with this indicator, and

one without the indicator and interaction terms. If the estimated coefficients from these

two models have the same signs and similar magnitudes, the potential bias introduced by

possible endogenous variables is negligible. Otherwise, further considerations regarding the endogenous variables will be needed.

4.2.2.4 Alternative Dependent Variable Based on the Subjective Measure of Precautionary Saving

Since whether the households save and how much they can save may mask the true effects of some variables on the dependent variables, an alternative model with a subjective measure of the accumulated precautionary saving is estimated and compared to the original model. The subjective measure of the accumulated precautionary saving uses the amount of emergency funds that the households think they need for emergencies, in place of the level of liquid assets the households actually hold. The indicator of saving behavior and all the interactions with this variable are excluded from this alternative model. The subjective measure is not expected to be affected by the controlled or uncontrolled factors that are associated with whether the households choose to save. Therefore, the estimated effects of variables related to liquidity constraints and insurance coverage are expected to be more consistent with the hypotheses. Bi and Montalto (2004) estimated models of the likelihood of meeting emergency fund guidelines and compared objective and subjective measures of emergency funds. The model using a subjective measure of emergency funds was more consistent with the hypotheses based on economic theories.

CHAPTER 5

RESULTS AND DISCUSSION

Results from the empirical analysis are presented and discussed in this chapter. The first section provides an overview of credit card borrowing and asset holding among U.S. households. The second section presents descriptive results for financially sufficient credit card users and logistic regression results for the likelihood of being financially sufficient revolvers. In the third section, the descriptive statistics for all revolvers and all convenience users, and the OLS regression results for the level of precautionary saving are presented. Some model-comparisons are also discussed in this section. Finally, a discussion of the results is presented in the fourth section.

5.1 Overview of Credit Card Borrowing and Asset Holding

About 40% of all US households (including all credit card holders and non-holders) are borrowing on major credit cards. The average balance held by all revolvers is $3,866 and the average interest rate charged is 14.5%. Though teaser interest rates, featuring zero or very low interest charges, are popular in the credit card market, few revolvers actually report having a very low interest rate. The majority of credit card revolvers (72%) are paying interest rates of 10% or more, and 13% of the revolvers pay interest rates higher than 20%. Regardless of the high price, borrowing on credit cards is

common across a wide range of demographic groups, even among high-income and wealthy households. Among credit card holders with financial assets above the median level of holdings, more than 38% are revolving.

Many of the revolvers are actually capable of paying down their credit card debt using their accumulated financial assets, even if only the liquid assets are considered. Table 5.1 examines the borrowing patterns among households with major credit cards and the asset holding patterns among revolvers. Across three measures of financial assets, the patterns of simultaneous-borrowing-and-saving behavior are similar.

Among all active credit card holders, 58% are revolving on their accounts. The percent revolving is higher among households with younger heads or with lower income. The percent revolving noticeably declines when the head has at least a college degree. However, the percent revolving is above 30% even for households with older heads (65 years old and over), with highly educated heads (beyond a Bachelor's Degree), and for households with income of at least $100,000. Among revolvers, 97% have liquid assets, and 38% still have positive liquid assets after subtracting one month's before-tax income. The proportion of financially sufficient revolvers, who had liquid assets greater than one month's income, increases as age increases, from 29% among the youngest revolvers to over 63% among the oldest revolvers. The change in proportion of revolvers by educational attainment is nonlinear. Compared to revolvers with less than a high school education, the percent having liquid assets more than one month's income is lower among revolvers finishing high school or some college, while the percentage is higher among revolvers obtaining at least a Bachelor's degree. At least one-third of revolvers in any income group are considered financially sufficient. As expected, the percentage of

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revolvers having positive assets is higher when comprehensive assets or general assets

are considered.

	All credit card holders (N= 2987)	Revolvers (N= 1,733)					
		% with assets greater than zero or one month's income					
	% who revolve	Liquid Assets[a]		Comprehensive Assets[b]		General Assets[c]	
		(1)[d]	(2)[e]	(1)[d]	(2)[e]	(1)[d]	(2)[e]
All	57.70	97.30	37.90	97.57	50.52	98.24	75.20
Age							
Under 35	73.05	97.23	29.16	97.73	42.18	98.57	64.88
35 to 44	65.84	98.09	33.54	98.32	47.57	98.95	78.25
45 to 54	59.97	96.43	37.43	96.74	50.47	97.50	79.14
55 to 64	51.17	96.88	45.41	96.88	58.28	97.71	78.65
65 and over	31.70	97.91	63.39	97.91	70.71	97.91	79.44
Education							
Less than HS	67.56	88.72	36.95	88.72	39.13	89.90	57.30
High School	67.30	98.06	32.23	98.22	43.87	98.98	71.09
Some college	65.42	97.38	33.81	98.12	46.01	98.62	73.90
Bachelor's degree	46.14	98.59	44.73	98.59	62.70	99.50	85.62
Graduate school	37.64	100	57.60	100	75.74	100	91.07
Income							
Less than $25,000	67.57	91.84	37.18	92.18	40.98	93.85	58.26
$25,000 to $49,999	65.47	97.34	34.48	97.93	46.21	98.87	69.82
$50,000 to $ 74,999	58.87	99.83	39.56	99.83	51.94	99.83	83.24
$75,000 to $99,999	55.22	100	44.71	100	60.52	100	89.65
$100,000 or more	36.52	100	38.53	100	67.68	100	92.89

Sources: 2001 Survey of Consumer Finances. Statistics derived from weighted analyses of data pooled from all five implicates.
[a] Liquid assets: assets held in saving, checking and money market accounts;
[b] Comprehensive assets: liquid assets plus CD's and saving certificates;
[c] General assets: comprehensive assets plus the value of stocks and bonds;
[d] Specified financial assets > 0;
[e] Specified financial assets > one month's income.

Table 5.1 Percent of credit card holders who revolve a balance on their credit card; Percent of revolvers with assets greater than zero or one month's income (row percents)

Table 5.2 presents descriptive statistics for all revolvers by quartile distribution of their liquid asset holdings. The percentage of financially sufficient households increases quite significantly as their holdings of liquid assets increase. Revolving balances also increase and interest rates decrease as the levels of liquid assets increase. The average balance in any group is not small, ranging from $3,353 to $4,482. Simplified estimates of annual interest charges on these accounts are more than $500 on average. Since these estimates assume that the balance will not increase and assume a simple interest rate, the actual interest charges are likely to be higher than these estimates. If the household carries this balance year after year, interest will repeatedly be paid on this balance. Therefore, paying down credit card balances would make these financially sufficient households better off. Interestingly, the percentage of self-identified regular savers was high among revolvers. Based on SCF questions, self-identified regular savers are households who report to save income of one family member, to save income other than regular income, or to save regularly by putting money aside each month.

Liquid assets ($)	< 1400	1400~4900	4901~16800	> 16800
Bank card balance($)	3,353	3,962	4,200	4,482
Bank card interest rate(%)	15.65	13.97	13.12	12.6
Annual interest charge [a]($)	510	566	520	585
% Financially sufficient revolvers [b]	4.03	27.32	72.76	97.34
Self-identified regular savers (%)	28.26	48.49	68.49	71.37

Sources: 2001 Survey of Consumer Finances. Statistics derived from weighted analyses of data pooled from all five implicates.
a Calculated using simplified assumptions of constant balance and constant simple interest rate for each household throughout the year.
b % Having positive liquid assets after subtracting one month's income.

Table 5.2 Descriptive statistics by quartile distribution of liquid assets for credit card revolvers: N=1733 (mean value)

Focusing on financially sufficient revolvers, Table 5.3 reports the estimated annual simple interest charge, annual compound interest charge, five-year compound interest charge, and percentage of self-reported regular savers. Compound interest rates are more realistic for revolvers, compared to simple interest rates. If the revolvers carry over the balance for five years and do not increase the total balance, the average interest charge was estimated to be $3,232. Surprisingly, financially sufficient revolvers age 65 and over pay the highest interest charge compared to revolvers in any other age group, and this is due to both large average balances and high average interest rates. The interest charges for revolvers with a Bachelor's degree and above, and revolvers with income above $50,000 are well above the overall average.

The above statistics show that financially sufficient revolvers exist across various age, education and income groups and many of them are, in fact, regular savers. Given the large scale of the puzzling behavior and the high costs generated, financially sufficient revolvers are worth our attention.

	Annual interest charge (simple)	Annual interest charge (compound)	5-year interest charge (compound)	Bank card balance	Bank card interest rate	Regular savers
All	$430	$464	$3,232	$3,348	13.32%	63.22%
Age						
Under 35	437	474	3,364	3,094	13.88	68.23
35 to 44	383	410	2,780	3,433	12.81	63.47
45 to 54	453	489	3,449	3,405	13.21	69.43
55 to 64	374	402	2,772	3,289	12.43	65.64
65 and over	507	548	3,839	3,498	14.34	45.75
Education						
Less than HS	168	182	1,285	1,225	13.62	44.36
High school	337	363	2,515	2,628	13.70	58.11
Some college	396	427	2,963	3,365	13.10	70.64
Bachelor's degree	634	686	4,813	4,581	13.61	67.05
Advanced degree	532	574	3,990	4,225	12.32	65.88
Income						
Less than $25,000	284	308	2,186	2,050	14.41	44.71
$25,000 to $49,999	325	351	2,464	2,648	13.68	61.15
$50,000 to $ 74,999	469	507	3,566	3,207	12.33	75.72
$75,000 to $99,999	525	562	3,783	4,198	12.99	67.52
$100,000 or more	767	827	5,732	5,893	12.69	73.23

Note: Interest charge is computed for each revolver, and then the mean is calculated for each group in this table.

Sources: 2001 Survey of Consumer Finances. Statistics derived from weighted analyses of data pooled from all five implicates.

[a] Revolvers having liquid assets greater than one month's income.

Table 5.3 Bank card balances, interest rates, and estimated interest charge for financially sufficient revolvers [a] (N=651)

5.2 The Likelihood of Being Financially Sufficient Revolvers

5.2.1 Descriptive Statistics for Financially Sufficient Credit Card Users

Table 5.4 presents the descriptive statistics for financially sufficient convenience users and financially sufficient revolvers. A higher proportion of financially sufficient revolvers have precautionary saving motives compared to convenience users. However, the average amount of emergency funds the households think they need is much higher among convenience users than among revolvers ($52,558 vs. $18,697). Compared to financially sufficient revolvers, a higher percentage of convenience users believe that they can borrow $3000 or more from friends or relatives not living with them. About 28% of revolvers and 22% of convenience users are not sure about their income in the next year, respectively. Five percent of convenience users, while only 3% of revolvers, have saving motives for contractual commitments such as debt repayments, insurance, taxes, and bill payments. However, a higher percentage of revolvers than convenience users have other types of debts. Over half of revolvers have other consumer loans, compared to only a quarter of convenience users. Approximately 11% of both convenience users and revolvers indicate saving motives for children's education, and the proportion having the motive and children ages 17-22 is slightly higher among revolvers than among convenience users (1.81% vs. 0.85%). Few households in either group indicate saving motives for investment, 1.53% of revolvers and only 0.85% of convenience users. On average, households have a little more than three liquid accounts. Although the differences are not statistically significant, in this sample, a higher percentage of revolvers use financial planners for saving/investment advice or for credit/borrowing advice compared to convenience users. One third of convenience users

think credit is a bad idea, compared to only 24% of revolvers. As expected, the percent favoring the idea of credit or favoring it in some ways is higher among revolvers than among convenience users. Relatively more revolvers have previously filed for bankruptcy compared to convenience users (6.14% vs. 2.92%). On average, revolvers are younger, have more children of age 16 and under, and have lower annual income and less financial assets, compared to convenience users. A higher percentage of revolvers are unmarried females and are Black compared to convenience users. A higher percentage of convenience users have a Bachelor's degree or above compared to revolvers.

5.2.2 Results of Logistic Regression

Table 5.5 presents the logistic regression results of the likelihood of being a financially sufficient revolver. After controlling for family life cycle factors, other socioeconomic and demographic variables, precautionary saving motives, having other debt, number of liquid accounts, using financial planners for saving/investment advice, and credit attitude are statistically significant in the model.

As expected, for these credit card users, directly indicating precautionary saving motives is positively related and the ability to borrow at least $3000 from friends or relatives is negatively related to being revolvers, after controlling for all other factors in the model. Contrary to the hypothesis, the level of subjective emergency funds has a negative effect on the likelihood of being a revolver, however, a $1,000 increase in the level of the subjective precautionary saving has a very small impact on the likelihood of revolving. The marginal effect of subjective emergency funds is very small, though. The effect of having other consumer loans is statistically significant and large in magnitude.

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Credit card users having other consumer loans have 2.6 times the odds as those not having not having other consumer loans to revolve credit card balances. Having a mortgage has a positive effect as well, but the magnitude is smaller. The hypothesis about the number of liquid account is supported, and having one more liquid account increases the likelihood of being a revolver. Interestingly, households seeking help from financial planners for saving/investment advice are more likely to be revolvers, compared to those who do not use financial planners. However, whether or not the household uses a financial planner for credit/borrowing advice does not have a significant effect. Not surprising, compared to those who think credit is a bad idea, credit card users who think credit is a good idea are more likely to revolve.

Among all the demographic and economic variables, race is a strong predictor. Households with a Black respondent are much more likely to be financially sufficient revolvers than households with a White respondent. Households with a Hispanic respondent are more likely as well, but to a less extent. Compared to households with annual income of $45,000 to $64,999, households with income of $100,000 or more are less likely to carry a balance on their credit card, and all the other income categories are not significant. Compared to households with financial assets of $60,000 to $149,999, households having financial assets less than $20,000 are more likely and households having financial assets of $370,000 or more are less likely to be revolvers.

Explanatory Variables	Convenience Users (N=928)	Revolvers (N=651)
Precautionary saving motives		
Directly indicated motives *	22.07%	26.30%
Subjective emergency funds ($) ***	52,558 (101,713)	18,697 (30,187)
Ability to borrow from friends/relatives ***	85.68%	78.10%
Expectation of future income		
Constant, sure	39.36%	36.19%
Growth, sure	15.76%	15.14%
Decline, sure	23.11%	21.06%
Not sure	21.78%	27.60%
Other obligations		
Saving motives for commitments *	4.96%	2.82%
Have mortgage ***	49.55%	58.89%
Have other consumer loans ***	26.84%	57.48%
Saving motives for children's education		
Have motive and children of age 17-22	0.85%	1.81%
Have motive but no child of age 17-22	10.75%	8.78%
No such saving motive	88.40%	89.41%
Saving motives for investment	0.82%	1.53%
Number of liquid accounts	3.33 (0.68)	3.38 (0.81)
Use of financial planners		
For saving/investment advice	23.14%	25.31%
For credit/borrowing advice	11.98%	14.62%
Credit attitude		
Good	23.69%	31.62%
Neutral	42.98%	45.23%
Bad	33.33%	23.15%
Bankruptcy	2.92%	6.14%
Family life cycle variables		
Age (Mean) ***	55.42 (6.06)	48.34 (7.20)
Age ***		
Under 35	10.42%	19.79%
35 to 44	18.94%	24.55%
45 to 54	20.37%	24.10%
55 to 64	16.65%	14.91%
65 and over	33.62%	16.65%

<div align="right">Continued</div>

Table 5.4 Descriptive statistics for financially sufficient convenience users and revolvers. (Mean (Standard Error) for continuous variables; column percents for categorical variables)

Table 5.4 continued

Explanatory Variables	Convenience Users (N=928)	Revolvers (N=651)
Household type **		
Legally married couple	66.49%	59.27%
Male head, not legally married	15.15%	17.03%
Female head, not legally married	18.36%	23.70%
Number of children of age 16 and under ***	0.46 (0.33)	0.54 (0.44)
Other socioeconomic and demographic variables		
Gross Annual Income (Mean, $) ***	112,692 (149,510)	60,233 (32,679)
Gross Annual Income ***		
< = $13,000	14.74%	21.47%
$13,001 ~ $25,000	25.84%	30.48%
$25,001 ~ $42,000	20.14%	22.29%
$42,001 ~ $67,000	11.67%	13.35%
> $67,000	27.60%	12.42%
General financial assets (Mean, $) ***	514,493 (687,592)	156,812 (367,101)
General financial assets ***		
< = $20,000	10.42%	32.67%
$20,001 ~ $60,000	16.86%	24.34%
$60,001 ~ $150,000	20.95%	19.65%
$150,001 ~ $370,000	23.37%	15.02%
> $370,000	28.40%	8.31%
Education ***		
Less than high school	6.43%	8.85%
High school graduate	21.60%	29.00%
Some college	22.19%	26.14%
Bachelor's degree	28.46%	21.56%
Graduate school	21.32%	14.44%
Race/Ethnicity ***		
White	92.56%	78.68%
Black	1.93%	13.72%
Hispanic	2.02%	5.13%
Other	3.50%	2.46%

Sources: 2001 Survey of Consumer Finances. Statistics derived from weighted analyses of data pooled from all five implicates.
* Significant at $p \leq 0.05$; ** Significant at $p \leq 0.01$; *** Significant at $p \leq 0.001$
Note: Chi-square test is used for categorical variables, and t-test is used for continuous variables.

Explanatory Variables	Point Estimates	P-value	Odds Ratio
Precautionary Saving Motives			
Directly indicated motives	**0.2649**	0.0500	1.300
Subjective emergency funds (in $1,000)	**-0.0008**	0.0231	0.999
Ability to borrow from friends/relatives	**-0.3914**	0.0332	0.676
Expectation of future income (Reference Group = Constant, sure)			
Growth, sure	0.1214	0.5237	1.128
Decline, sure	-0.010	0.9622	0.990
Not sure	0.0791	0.6592	1.083
Other obligations			
Saving motives for commitments	-0.5771	0.1562	0.566
Have mortgage	**0.5416**	0.0002	1.713
Have other consumer loans	**0.9728**	<0.0001	2.638
Saving motives for children's education (Reference Group = No Such Saving Motive)			
Have motive and children of age 17-22	0.4551	0.3627	1.568
Have motive but no child of age 17-22	-0.2401	0.3060	0.789
Saving motives for investment	0.7090	0.1565	2.027
Number of liquid accounts	**0.0917**	0.0099	1.095
Use of financial planners			
For saving/investment advice	**0.4232**	0.0138	1.522
For credit/borrowing advice	-0.0523	0.8009	0.950
Credit attitude (Reference Group = Bad)			
Good	**0.5901**	0.0007	1.803
Neutral	0.2728	0.0793	1.313
Bankruptcy	0.3632	0.2426	1.437
Family life cycle variables			
Age (Reference Group = 45 to 54)			
Under 35	-0.0537	0.8303	0.948
35 to 44	0.0165	0.9328	1.015
55 to 64	-0.1789	0.4263	0.836
65 and over	-0.4221	0.0597	0.655
Household type (Reference Group = Legally married couple)			
Male head, not legally married	-0.0957	0.6325	0.909
Female head, not legally married	-0.0470	0.8201	0.953
Number of small children	-0.0963	0.2551	0.908

Other socioeconomic and demographic variables

Table 5.5 Logistic regression of the likelihood of being financially sufficient revolvers.

Table 5.5 continued

Explanatory Variables	Point Estimates	P-value	Odds Ratio
Gross Annual Income (Reference Group = $45,000 ~ $64,999)			
< $25,000	0.1003	0.7645	1.103
$25,000 ~ $44,999	0.1077	0.6988	1.109
$65,000 ~ $99,999	-0.0195	0.9490	0.978
>=$100,000	**-0.7536**	0.0018	0.470
General financial assets (Reference Group = $60,000 ~ $149,999)			
< $20,000	**1.2160**	<0.0001	3.344
$20,000 ~ $59,999	0.3131	0.1988	1.362
$150,000 ~ $369,999	-0.2597	0.2830	0.771
>= $370,000	**-0.7355**	0.0012	0.479
Education (Reference Group = High School Graduate)			
Less than high school	0.0434	0.8869	1.045
Some college	0.1386	0.4803	1.148
Bachelor's degree	-0.1035	0.6143	0.902
Graduate school	-0.2134	0.3373	0.808
Race/Ethnicity (Reference Group = White)			
Black	**1.8651**	<0.0001	6.447
Hispanic	**1.2103**	0.0037	3.371
Other	0.0469	0.8979	1.050

Note: Bolded estimated coefficients are significant at an alpha level of 0.05.
Source: 2001 Survey of Consumer Finances. Statistics derived from an unweighted analysis of data pooled from all five implicates with RII techniques.

5.3 Level of Precautionary Saving

In this section, descriptive statistics of the sample characteristics and the variables used in the analysis of the level of precautionary saving are presented first, followed by the multivariate analyses.

5.3.1 Descriptive Statistics of the Sample Characteristics

Table 5.6 presents the characteristics of 1,723 revolvers who were paying non-zero interest rates on their credit card balance in 2001. The characteristics of active convenience users are also presented in Table 5.6 for comparison. On average, revolvers held $13,015 in liquid assets. As introduced in Chapter 4, liquid assets include checking, saving, and money market accounts and call accounts. The amount of liquid assets held by revolvers varied a lot, since the standard deviation was $42,180. The average liquidity ratio was 2.72. The amount of subjective precautionary saving and the subjective liquidity ratio, $14,175 and 3.86 respectively, were slightly higher than the actual holdings of liquid assets and the actual liquidity ratio. On average, convenience users held significantly larger amount of liquid assets, $68,746, and indicated a larger amount of precautionary saving need in case of emergency, $47,914, compared to revolvers. The variations for both actual holdings of liquid assets and subjective levels of precautionary savings were large.

Precautionary Saving Motives

Over one third (35%) of revolvers directly indicated that they had precautionary saving motives. A slightly lower proportion of convenience users (33%) directly

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indicated that they had precautionary saving motives, however, the difference was not statistically significant.

Variables Related to Uncertainty

About one third (34%) of revolvers expected their next year's household income would remain the same as the current household income, and around another one third (31%) were not sure about their household income next year. Compared to revolvers, a higher percent of convenience users were sure about next year's income with 39% expecting income to be similar and a lower percent of convenience users (22%) expecting income to decline. Almost 20% of revolvers were expecting their household income in the next year to decline. The majority of revolvers (41%) expected the economy in the next year to be the same as in 2001, and 31% of revolvers expected the economy to be worse in the coming year. The expectations of future economy were similar among revolvers and convenience users. About 23% of revolvers claimed that both themselves and their spouse or partner, if present, were in excellent health condition. About half of revolvers claimed both themselves and their spouse or partner, if present, in good health condition, or one of them in good health, and another one in excellent health. Another 21% reported fair health for themselves and their spouse or partner, if present, or fair health as the worse condition between themselves and their spouse or partner. Only 5.51% reported poor health as the worse condition between themselves and their spouse or partner, if present. Compared to revolvers, a higher percentage of convenience users

identified themselves and/or their spouse or partner in excellent health condition, and a lower percentage of them reported fair or poor health.

Variables Related to Liquidity Constraints

The proportion of revolvers who had been turned down or not been given as much credit as requested was 35%, much higher than the comparable statistic for convenience users (10%). About 70% of revolvers had a utilization ratio less than 0.5, which means the balance on all bank cards was less than half of the total credit line on all these bank cards. About 23% of revolvers had used between 50% to 90% of their credit lines, and almost 8% had used at least 90% of their total credit lines. The average interest rate paid on the credit card balance was 14% with a standard deviation of 3% among revolvers, while the average interest rate carried by convenience users was slightly higher, 15%, but with a smaller standard deviation of 2%. This is reasonable, since convenience users are less likely to search for a lower interest rate since they do not carry a balance on their credit cards. For revolvers, the interest rate is an important term to consider when choosing credit cards. As a result, revolvers with good credit scores are likely to select the lowest rate they can get, but revolvers with low credit scores are likely to get offers of high interest rates only, resulting in the large standard deviation.

Variables Related to Buffers for Consumption Shock

The majority of revolvers (83%) had government or private health insurance coverage for each member in the household, and the coverage rate among convenience

users was higher (94%). Cash-value life insurance coverage is less common compared to health insurance. The coverage rates were 32% among revolvers and 35% among convenience users. If the respondent has a working spouse or partner, the risk of a complete interruption of household income are likely to be reduced. Among revolvers, 39% had a spouse or partner working full time, another 8% had a spouse or partner working part time, and 17% had a spouse or partner not working. The rest, which represented 36% of all the revolvers, had no spouse or partner. Single-headed male households represented 12% of all revolvers, and single-headed female households represented 23% of all revolvers. Compared to revolvers, the composition among convenience users was significantly different. A larger proportion of convenience users (29%) were households with a non-working spouse or partner, and a smaller proportion of convenience users were single-headed female households (17%).

Other Characteristics of Credit Card Revolvers and Convenience Users

The average amount of household financial assets other than liquid assets was $70,576 for revolvers and $352,635 for convenience users, and the variances was very large for both groups. As mentioned in Chapter 4, financial assets other than liquid assets include investment assets defined as directly held stocks, bonds, mutual funds, and assets in retirement accounts. About 6% of revolvers were eligible for Medicaid, which means these revolvers had low income and assets, and passed the means test for Medicaid. Fewer convenience users were eligible for means-tested Medicaid (3%). A noticeably smaller proportion of revolvers identified themselves as savers in the preceding year,

which means they reported spending less than their household's annual income, 58% for revolvers versus 78% for convenience users.

The percent of revolvers was significantly lower than the percent of convenience users using financial planners for saving or investment advice, 20% and 23% respectively. The percentages using financial planners for credit or borrowing advice were lower for both groups compared to the percentages seeking help for saving or investment advice. About 10% of revolvers and 12% of convenience users used financial planner for credit or borrowing purposes. The distribution of risk tolerance was different between revolvers and convenience users. A noticeably higher percentage (34%) of revolvers were not willing to take any risk when making investment decisions, compared to convenience users. On the other hand, a lower percentage (25%) of revolvers were willing to take above average or high risk when making investment decision, compared to convenience users (31%).

Demographic characteristics, including age, educational attainment, and race/ethnicity, are significantly different between revolvers and convenience users. Revolvers were significantly younger than convenience users on average. The average age of revolvers was 44.8 years, and the average age of convenience users was 53.7 years. A much higher percent of convenience users (50%) had at least a bachelor's degree compared to revolvers (28%). The educational attainment of revolvers was concentrated on high school degree or some college education, 34% and 29% respectively. About three quarters of revolvers identified themselves as White, while over 91% of convenience users identified themselves as White. The proportions of Black and Hispanic were

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relatively large among revolvers (15% and 7% respectively), compared to those

proportions among convenience users (3% and 2% respectively).

Variables	Revolvers (N=1723)	Convenience Users (N=1263)
Liquidity ratio ***	2.72 (6.43)	9.67 (6.94)
Liquid assets ($) ***	13,015 (42,180)	68,746 (141,407)
Subjective liquidity ratio ***	3.86 (9.35)	6.76 (8.96)
Subjective precautionary saving ($) ***	14,175 (32,190)	47,914 (103,044)
Precautionary saving motives	35.43%	32.83%
Variables related to uncertainty		
Expectation of future income ***		
Constant, sure	33.78%	38.53%
Growth, sure	15.63%	16.57%
Decline, sure	19.55%	22.42%
Not sure	31.04%	22.47%
Expectation of future economy		
Better economy	28.26%	27.60%
Same economy	41.15%	41.66%
Worse economy	30.59%	30.74%
Health conditions ***		
Excellent health	22.61%	28.39%
Good health	50.77%	50.21%
Fair health	21.12%	17.18%
Poor health	5.51%	4.21%
Variables related to liquidity constraints		
Being turned down before ***	34.68%	9.64%
Line of credit utilization ratio		
Utilization ratio < 0.5	69.38%	---
Utilization ratio 0.5-0.9	22.83%	---
Utilization ratio ≥ 0.9	7.80%	---
Interest rate on balance (%) ***	14.27 (2.72)	14.63 (1.67)
Variables related to buffers for consumption shock		
Complete health insurance coverage ***	83.21%	93.58%
Having cash value life insurance	31.58%	34.73%

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Table 5.6 Descriptive statistics for credit card revolvers and convenience users. (Mean (Standard Error) for continuous variables; column percents)

Table 5.6 continued

Variables	Revolvers (N=1723)	Convenience Users (N=1263)
Working status of spouse/partner ***		
Spouse/Partner working full time	39.01%	29.25%
Spouse/Partner working part time	8.14%	12.53%
Spouse/Partner not working	17.09%	29.03%
Single male headed household	12.32%	11.93%
Single female headed household	23.45%	17.27%
Other control variables		
Other financial assets ($) ***	70,576 (186,632)	352,635 (555,796)
Eligible for Medicaid ***	5.98%	2.71%
Saver ***	58.36%	77.63%
Use of financial planners		
For saving advice *	19.85%	23.23%
For credit advice	9.88%	11.96%
Risk tolerance ***		
High risk tolerance	4.70%	5.16%
Above average risk tolerance	20.53%	26.18%
Average risk tolerance	41.24%	45.56%
Not willing to take risk	33.53%	23.10%
Age ***	44.8 (6.9)	53.7 (6.0)
Education ***		
Less than high school	9.05%	5.93%
High school	34.02%	22.55%
Some college	29.23%	21.08%
Bachelor's degree	18.22%	29.02%
Advanced degree	9.48%	21.42%
Race/Ethnicity ***		
White	75.51%	91.31%
Black	14.81%	3.12%
Hispanic	7.38%	2.52%
Other	2.29%	3.05%

Sources: 2001 Survey of Consumer Finances. Statistics derived from weighted analyses of data pooled from all five implicates.
* Significant at $p \leq 0.05$; ** Significant at $p \leq 0.01$; *** Significant at $p \leq 0.001$
Note: Chi-square test is used for categorical variables, and t-test is used for continuous variables.

5.3.2 Results of OLS Regression for the Level of Precautionary Saving

An OLS regression model was used to test the hypotheses about the effects of uncertainty and liquidity constraints on the level of precautionary saving on the sample of credit card revolvers. In addition to the main model, Model 1 in Table 5.7, a similar model, Model 2 in Table 5.7, was run excluding the indicator variable for saving behavior and the corresponding interaction terms, in order to assess the potential problems caused by endogenous variables. The dependent variable for Model 1 and Model 2 is the logarithm of the liquidity ratio. Model 3 tests the effects of uncertainty and liquidity constraints on the subjective level of precautionary saving. The dependent variable for Model 3 is the logarithm of the subjective liquidity ratio, which is defined as the subjective level of precautionary saving indicated by the respondents divided by monthly household normal income, as mentioned in Chapter 4.

Table 5.7 presents the coefficient estimates from the OLS regression for the three models mentioned above. Table 5.8 shows how to compute the effect of dichotomous explanatory variables on the logarithm of the liquidity ratio for savers and non-savers, accounting for the interaction variable. Table 5.9 presents the effects on the logarithm of the liquidity ratio. In Table 5.10, the effects on the liquidity ratio are presented for savers and non-savers respectively. Appendix C describes how these effects are calculated for each variable.

The F-test for Model 1 has a p-value less than 0.0001, which suggests the model is significant. The adjusted R^2 is 0.289. Since the SCF is a cross-sectional data set, such an adjusted R^2 suggests that the model fits pretty well. The following explanatory

variables have significant effects at a significance level of 0.05 or less on revolvers' level of accumulated precautionary saving: directly indicated precautionary saving motives, health condition, being turned down for credit before, credit card utilization ratio, health insurance coverage, cash value life insurance coverage, the level of other financial assets, eligibility for Medicaid, using financial planners for saving or investment advice, being a saver, age of the respondent, being Black, and the interactions between utilization ratio no less than 0.9 and saving behavior, between cash value life insurance coverage and saving behavior, and between not willing to take risk and saving behavior.

Precautionary Saving Motives

As expected, having directly indicated precautionary saving motives had a positive effect on the level of precautionary saving. When the coefficient of precautionary saving motives, 0.205 (Table 5.7) is translated into the effect on the liquidity ratio (Table 5.10), it suggests that a household with precautionary saving motives has a liquidity ratio 1.23 times the ratio for a household without precautionary saving motives.

Variables Related to Uncertainty

Among the variables related to uncertainty, only the effects of health conditions were significant. The estimated coefficient for expecting the economy to be worse in the future was positive, however, it was not significant at an alpha level of 0.05, compared to expecting the economy to be better. The effect of uncertainty about future household

income was not significant either. Compared to expecting future income to remain unchanged, being sure that future income would increase had a negative effect on the level of precautionary saving, which is expected, however, the effect was not statistically significant. The effect of being sure that future income would decline was weak and non-significant on the level of precautionary saving.

Health condition variables were interacted with the saving indicator variable. Compared to households with a spouse or partner present and both the respondent and spouse in excellent health, the main effects of health conditions for households with either the respondents and/or their spouse or partner in good, fair or poor health conditions reduced the level of precautionary saving. These are not as expected. However, the effects of health conditions less than excellent and being a saver at the same time were positive on the level of precautionary saving, and the magnitude of the effect of poor health was large, though not statistically significant. After considering the interactions with saving behavior, the estimated effects for health condition variables increased for revolvers who saved in the last year. For example, the effect of poor health on the logarithm of the liquidity ratio was –0.694 for non-savers, and the corresponding coefficient of poor health was –0.273 for savers. Translated into the original scale of the liquidity ratio, the effect of poor health was 0.761 for savers and 0.50 for non-savers, that is, the liquidity ratio was 24% lower for households with member(s) in poor health conditions than for households with member(s) in excellent health conditions among revolvers who saved, and the liquidity ratio was 50% lower for households with member(s) in poor health than for households with member(s) in excellent health among

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revolvers who did not save. Though the effect of poor health was still negative even if saving behavior was considered, the magnitude was greatly reduced and the effect moved toward the direction of the hypothesized overall effect of health conditions for savers.

Variables Related to Liquidity Constraints

Contrary to expectations, variables related to liquidity constraints all had negative effects on the level of precautionary saving. The past experience of borrowing constraints and credit card utilization ratios were both interacted with saving behavior. If a household had experienced difficulties when applying for credit, or had been discouraged from applying for credit because they thought they would be turned down, the liquidity ratio would be 27% lower than the liquidity ratio for a household who had not experienced such difficulties or discouragement among revolvers who saved in the preceding year, and the liquidity ratio for such households would be 35% lower among revolvers who did not save in the preceding year.

Credit card utilization ratio, defined as total credit card balance divided by credit line from all credit cards, was used as another indicator of the degree of liquidity constraints that the revolvers might perceive. Utilization ratios of 0.9 and above had negative effects on the level of precautionary saving, compared to a low utilization ratio less than 0.5. In addition, the negative main effect and the significance level of the effects increased a lot when the utilization ratio moved from the middle group with a value from 0.5 to 0.9 to the more liquidity-constrained group with a value of 0.9 and above. For example, the coefficient for the main effect of utilization ratio between 0.5 and 0.9 was –

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0.313, while the corresponding coefficient for utilization ratio of 0.9 and above was –

.387. The effect of the interaction between extreme utilization ratio (0.9 and above) and

saving behavior was positive and both economically and statistically significant.

Therefore, among revolvers who saved in the preceding year, and had used 90% or more

of their credit lines the liquidity ratio was only 42% of the liquidity ratio for revolvers

who had used no more than 50% of their credit lines; while among revolvers who did not

save in the preceding year, the liquidity ratio for revolvers having used 90% or more of

their credit lines was 25% of the liquidity ratio for revolvers having used no more than

50% of their credit lines.

The interest rate on the credit card balance was hypothesized to have an effect on

the level of precautionary saving, however, the direction was uncertain. A higher interest

rate itself would increase the cost of holding credit card debt and precautionary saving at

the same time, however, the interest rate might also imply a higher degree of liquidity

constraints. The effect of the interest rate on the liquidity ratio turned out to be weak and

not statistically significant on the level of precautionary saving.

Variables Related to Buffers for Consumption Shock

Health insurance coverage for every household member, cash value life insurance

coverage, and the working status of a spouse or partner are included in this model as

buffers for consumption or income shocks. Having any of these buffers was hypothesized

to reduce the level of precautionary saving for revolvers. However, the results did not

support these hypotheses. As discussed in Chapter 3, the true effects of insurance

coverage may be masked by the household's financial situations, i.e., difference of their income and how much they need or choose to spend.

The main effect of having health insurance coverage for every household member was positive, but the interaction effect for having the coverage and being a saver at the same time was negative. As a result, among revolvers who saved in the preceding year, the overall effect of having health insurance coverage was 1.25, which means the liquidity ratio for savers having health insurance for all household members was 25% higher than the ratio for savers not having health insurance for every member in the household. Among revolvers who did not save in the preceding year, the overall effect was 1.49, which means the liquidity ratio for non-savers having health insurance for all household members was 49% higher than the ratio for non-savers not having health insurance for every member in the household.

Similarly for cash value life insurance coverage, the interaction with being a saver moved the effect on the level of the liquidity ratio in the expected direction, that is, it reduced the positive effect. Among savers, having cash value life insurance increased the liquidity ratio by only 0.3%, compared to the ratio for those without cash value life insurance coverage. However, among non-savers, having cash value life insurance increased the liquidity ratio by 52%, compared to the ratio for those without the coverage.

A positive association was hypothesized between the level of precautionary saving and not having a full-time working spouse or partner in the household. However, the corresponding variables were not significant.

<u>Other Control Variables</u>

The amount of other financial assets. This continuous variable was transformed into logarithm with base 10, and it had a positive effect on the level of precautionary saving. Transformed back to its original scale, the marginal effect can be interpreted as for every 10 fold increase in the amount of other financial assets, the liquidity ratio increases by 15%.

Eligibility for Medicaid. As expected, this variable had a negative effect. The liquidity ratio for revolvers who were eligible for means-tested Medicaid was 60% of the liquidity ratio for those who were not eligible for this government health insurance. This is reasonable, since only households with low income and low financial assets will be qualified for Medicaid, and this could give households the incentive to keep their liquid assets low.

Saving behavior. As expected, there was a positive relationship between the level of precautionary saving and the fact that the household saved in the preceding year. Being a saver increases the liquidity ratio by 63%, compared to the liquidity ratio of a non-saver.

Use of financial planners. Using a financial planner for saving and investment advice had a positive effect on the level of precautionary saving. A revolver seeking saving or investment advice from financial planners would have a liquidity ratio 38.0% higher than the ratio for someone not using financial planners for saving or investment purposes. The causality is unclear, though. The result could be due to the fact that revolvers with more liquid assets are more likely to use financial planners, or it could be

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due to the fact that financial planners focus more on building up liquid assets for their clients than on considering the overall saving and borrowing practice of their clients. The effect of using financial planners for credit or borrowing advice was not statistically significant.

Risk tolerance. Risk tolerance was controlled in this model, since the possible relationship between prudence and risk aversion might bias the estimated effect of the precautionary motive. The effects of risk tolerance were not statistically significant. The insignificant result could be due to the fact that the measure of risk tolerance was derived from the question in the SCF asking about investment behavior, which was not a precise measure of general risk tolerance for everyone. However, the effects of the interaction between high risk tolerance and saving behavior and the interaction between no willingness to take risk and saving behavior were significant at an alpha level of 0.05, and the signs were opposite to the main effects. Among credit card revolvers who saved in the preceding year, those willing to take substantial financial risk had a lower liquidity ratio, while those not willing to take any financial risk had a higher liquidity ratio, compared to those only willing to take average financial risk. Therefore, the effects of risk tolerance were consistent with the hypotheses that revolvers with higher risk tolerance would save less, while revolvers with lower risk tolerance would save more for precautionary purposes.

Age. Age had a nonlinear effect on the level of precautionary saving. The liquidity ratio reaches the lowest level at age 32. However, age had a relatively flat effect

on the level of precautionary saving before age 40, and then had a more noticeable

positive effect after 40 years old.
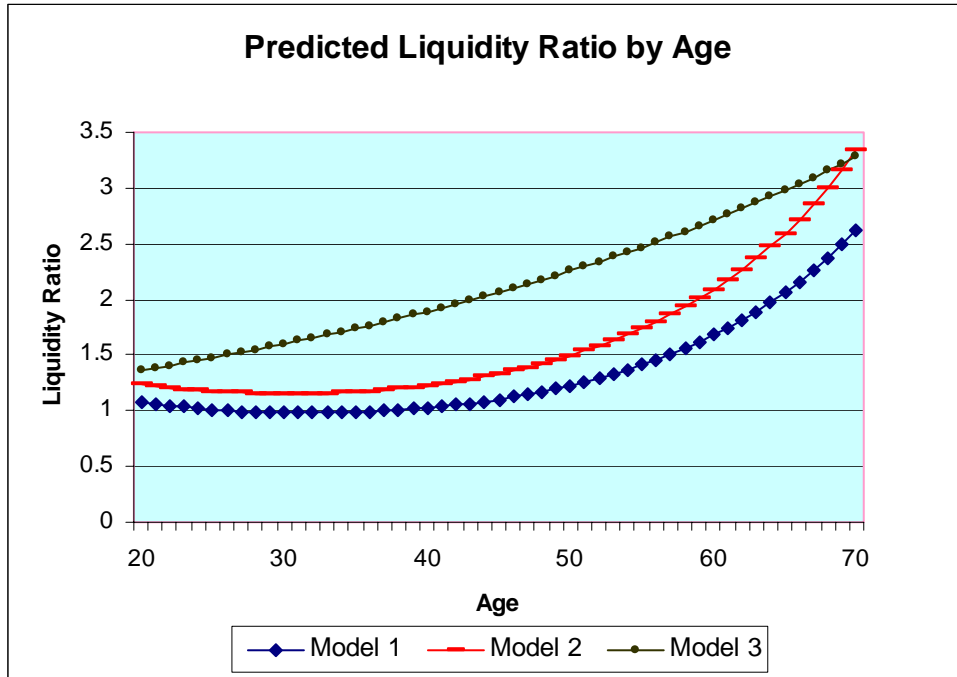
Note: To calculate the predicted liquidity ratio by age, all categorical variables are set
equal to the reference group, and continuous variable (other financial assets) are set equal
to the sample mean values.

Figure 5.1 Predicted Liquidity Ratio by Age

Education. The effect of an advanced degree was largest, compared to the effects

of other levels of educational attainment; however, the effect of education was not

statistically significant.

Race/Ethnicity. Compared to revolvers with the respondent being White,

revolvers with the respondent being Black had significantly lower levels of precautionary

saving. The effects of respondents being Hispanic or in other racial or ethnicity groups were not significant.

5.3.3 Model Comparison

5.3.3.1 Model 1 versus Model 2

An indicator of saving behavior (being a saver or not in the preceding year) was included as an explanatory variable in Model 1 for the purpose of adding interactions with some variables potentially related to saving behavior. As mentioned in Chapter 4, saving behavior is likely to be endogenous with the dependent variable, level of precautionary saving. If dependent and independent variables are in fact endogenous, the OLS estimates may be biased (Kennedy, 2003, p180). In order to check to what degree the potential endogenous variables might bias the estimated coefficients, Model 2 without the indicator variable for saving behavior and the interactions was run and compared with Model 1.

Table 5.7 provides a side-by-side comparison between Model 1 and Model 2. The results from Model 1 and Model 2 are similar, in terms of the signs, the magnitude, and the significance levels of the estimated coefficients. All the signs of estimated coefficients remain the same in Model 2 as in Model 1. With the exception of the variables *good health*, *fair health*, *Utilization ratio ≥ 0.9*, *cash value life insurance coverage, high risk tolerance*, and *no risk tolerance*, where the estimated coefficients changed over 0.1 in magnitude, the other estimated coefficients from Model 2 stayed close to those from Model 1. The variables mentioned above are, in fact, variables that

were interacted with the savings indicator in Model 1, and the estimated coefficients

being compared are main effects of these variables. Therefore, the relatively large change

in the estimated coefficients could be due to the effect of the separation of savers and

non-savers in Model 1.

The p-values for some variables in Model 1 were much larger than the

corresponding p-values in Model 2. These relevant variables include *fair health*, *poor

health*, *being turned down before*, and *utilization ratio 0.5 – 0.9*, *eligible for Medicaid*,

and *use of financial planners for saving/investment advice*. However, if the significance

level were set at 0.05 or less, which is a standard criterion in social science, the

conclusions drawn from both models would remain the same, with the exception of the

effect of cash value life insurance. The larger p-values in Model 1 compared to Model 2

might suggest a potential problem of multicollinearity, and this will be discussed in detail

in section 5.4.

Based on the above comparison between Model 1 and Model 2, and given that

this study focuses mainly on hypotheses testing, it is concluded that the endogeneity does

not cause a substantial problem for the results, as the signs of coefficients and the inferred

significant effects remain the same for Model 1 and Model 2.

5.3.3.2 Model 1 versus Model 3

Table 5.7 includes the estimated coefficients, p-values, and adjusted R^2 for Model

3. The main difference between Model 1 and Model 3 is the measure of the dependent

variable. The dependent variable in Model 1 is the actual level of precautionary saving

held by revolvers. The dependent variable in Model 3 is the level of precautionary saving respondents indicated they needed to hold. Model 1 and Model 3 are referred to as the objective model and subjective model, respectively, in the discussion of the results.

Though it is of interest in itself, an important reason for including the subjective model in this study is to further examine whether some uncontrolled factors what related to the difference of household income and how much they need or choose to spend masks the true effects of some variables in explaining the level of precautionary saving. The dependent variable in the subjective model is the level of precautionary saving the revolvers think they would need in the event of an emergency, instead of the actual holdings of precautionary saving. The subjective measure of precautionary saving reflects the saving plan, instead of actual saving; hence, it is not affected by whether the household's expenditure needs prevent them from saving as much as they want. Therefore, the subjective model does not include the indicator of saving behavior and the corresponding interaction terms, as the concern about the potential bias that may be caused by saving behavior in the objective model will not be a problem here. The adjusted R^2 dropped to 0.083 for the subjective model. However, some variables that had unexpected directions of effects in the objective model turned out to have signs consistent with the hypothesized effects.

In the subjective model for the revolvers, the variables that had significant effects on the level of subjective precautionary saving were *directly indicated precautionary saving motives*, *poor health*, *health insurance coverage*, *spouse/partner not working*, *single male headed household*, and *single female headed household*. Noticeable

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differences between the objective and subjective models lie in the estimated coefficients of variables *poor health* and *health insurance coverage*, where the signs of the estimates changed and supported the corresponding hypotheses. Other noticeable changes are the estimated coefficients of variables covering revolvers not having a working spouse or partner in the household, i.e., *spouse/partner not working*, *single male headed household*, and *single female headed household*, where the magnitude of the estimates increased and became statistically significant.

Precautionary saving motives. The magnitude of the effect of directly indicated precautionary saving motives was larger and more precisely estimated in the subjective model compared to the objective model.

Poor health. The variable poor health had the largest estimated effect on the level of precautionary saving among all the variables included in the subjective model. Consistent with the hypothesis, having household member(s) in poor health conditions increased the level of subjective precautionary saving. However, in the objective model, this effect was negative.

Health insurance coverage. The effect of health insurance coverage for every household member was negative on the level of precautionary saving in the subjective model. Again this was different from the result in the objective model but consistent with the hypothesis. The effect is theoretically correct that having health insurance coverage for every household member reduces the risk of a consumption shock, and hence reduces the need for precautionary saving.

Working status of spouse or partner. In the objective model, the effects of not having a working spouse or partner were not significant. However, in the subjective model, the effects were positive and significant, as hypothesized. Compared to revolvers with a spouse or partner working full time, the level of subjective precautionary saving was higher for revolvers without a working spouse or partner, including revolvers with spouse or partner not working, unmarried or unpartnered revolvers, and unmarried or unpartnered female revolvers.

Only the variables mentioned above were significant in the subjective model. The effects of the control variables such as other financial assets and demographic characteristics (age, education, and race/ethnicity) were not significant. In the objective model, use of financial planners for saving and/or investment advice had a significant and positive effect on the level of precautionary saving, while in the subjective model, the estimated coefficient for this variable was still positive, but not statistically significant (p= 0.1002).

The comparison of the objective model and the subjective model provides further empirical support that uncontrolled factors related to how much they need or choose to spend can bias the estimated effects of variables closely related to revolver's economic status, if revolvers who save and who save little or do not save are mixed together. The actual amount of accumulated liquid assets is a combined result of both financial planning for the future and consequences of past and current consumption needs, while a subjective amount of precautionary saving that the households believe they need in case

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of emergencies reflects solely the planning side and is not affected by the households'

past or current consumption needs.

Variables	Model 1[a]		Model 2[b]		Model 3[c]	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Intercept	-0.323	0.5709	-0.007	0.9992	-0.643	0.1596
Precautionary saving motives	**0.205**	0.0478	**0.251**	0.0167	**0.317**	0.0001
Variables related to uncertainty						
Expectation of future income (Reference group = Constant, sure)						
Growth, sure	-0.159	0.2616	-0.160	0.2689	-0.017	0.8889
Decline, sure	-0.041	0.7735	-0.048	0.7435	0.146	0.2222
Not sure	-0.159	0.1788	-0.184	0.1264	0.061	0.5388
Expectation of future economy (Reference group = Better economy)						
Same economy	0.106	0.567	0.082	0.4839	-0.112	0.2547
Worse economy	0.194	0.1136	0.156	0.2091	-0.113	0.2747
Health condition (Reference group = Excellent health)						
Good health	**-0.507**	0.0104	**-0.261**	0.0275	-0.117	0.2365
Fair health	**-0.499**	0.0333	**-0.396**	0.0081	0.065	0.6010
Poor health	**-0.694**	0.0382	**-0.637**	0.0109	**0.456**	0.0279
Variables related to liquidity constraints						
Being turned down before	**-0.429**	0.0122	**-0.393**	0.0007	-0.112	0.2392
Utilization ratio (Reference group = Utilization ratio < 0.5)						
Utilization ratio 0.5-0.9	-0.313	0.1281	**-0.338**	0.0007	-0.158	0.1884
Utilization ratio ≥ 0.9	**-1.387**	<0.0001	**-1.279**	<0.0001	-0.138	0.4021
Interest rate on balance	-0.009	0.3468	-0.016	0.1075	-0.002	0.8129
Variables related to buffers for consumption shock						
Health insurance coverage	**0.399**	0.0456	**0.326**	0.0262	**-0.249**	0.0304
Cash value life insurance	**0.416**	0.0221	0.146	0.2092	0.157	0.1156
Working status of spouse/partner (Reference group = Spouse/Partner working full time)						
Working part time	0.241	0.1891	0.172	0.3522	0.087	0.5685
Not working	0.013	0.9298	0.006	0.9668	**0.299**	0.0130
Single male headed household	0.126	0.4156	0.116	0.4616	**0.354**	0.0068
Single female headed household	0.043	0.7511	-0.023	0.8674	**0.270**	0.0177
Other control variables						
Other financial assets (log)	**0.137**	<0.0001	**0.157**	<0.0001	0.003	0.9024
Eligible for Medicaid	**-0.519**	0.0185	**-0.608**	0.0062	0.057	0.7533
Saver	**0.486**	0.0151				
Use of financial planners						
For saving/investment	**0.320**	0.0182	**0.376**	0.0058	0.186	0.1002
For credit/borrowing	0.148	0.3934	0.106	0.5475	-0.016	0.9145
Risk tolerance (Reference group = Average risk tolerance)						
High risk	0.406	0.2819	0.117	0.6067	0.051	0.7958
Above average risk	-0.095	0.6782	-0.161	0.2063	0.114	0.2922
No risk	-0.203	0.2574	-0.065	0.5880	0.102	0.3063

Table 5.7 OLS regression on the level of precautionary saving for credit card revolvers

Table 5.7 continued

	Model 1[a]		Model 2[b]		Model 3[c]	
Variables	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Age	**-0.043**	0.0351	**-0.041**	0.0411	0.014	0.4354
Age_SQ	**6.760E– 4**	0.0010	**6.760E– 4**	0.0010	3.920E– 5	0.8281
Education (Reference group = High school)						
Less than high school	-0.157	0.4258	-0.276	0.1640	-0.058	0.7243
Some college	0.093	0.4495	0.104	0.4030	0.093	0.3723
Bachelor's degree	0.149	0.2860	0.141	0.3198	0.157	0.1974
Advanced degree	0.291	0.1177	0.217	0.1960	-0.003	0.9829
Race/Ethnicity (Reference group = White)						
Black	**-0.305**	0.0341	-0.260	0.0742	-0.006	0.9608
Hispanic	-0.312	0.1372	-0.240	0.2450	0.071	0.6637
Other	-0.228	0.4996	-0.209	0.5396	-0.245	0.4018
Interaction terms						
Good health_Saved	0.430	0.0772				
Fair health_Saved	0.188	0.5207				
Poor health_Saved	0.421	0.4026				
Turned down_Saved	0.109	0.5206				
Utilization ratio2_Saved	-0.016	0.9572				
Utilization ratio3_Saved	**0.514**	0.0190				
Health insurance_Saved	-0.178	0.4923				
Life insurance _Saved	**-0.413**	0.0500				
High risk _Saved	**-0.509**	0.0269				
Above average risk_Saved	-0.180	0.5048				
No risk_Saved	**0.350**	0.0151				
Adjusted R^2	0.289		0.259		0.083	

Note: Bolded estimated coefficients are significant at an alpha level of 0.05.
[a] Model 1 is the original OLS regression with the dependent variable as Log(liquid assets/normal monthly income) and with interaction terms.
[b] Model 2 is the OLS regression without interaction terms to assess the influence of potential endogeneity.
[c] Model 3 is the OLS regression with the dependent variable as Log(subjective level of emergency funds/normal monthly income).

	Saver = 1	Saver = 0	Marginal effect of being a saver
$X_i = 1$	$b_i + b_s + b_{int}$	b_i	$b_s + b_{int}$
$X_i = 0$	b_s	0	b_s
Marginal effect of X_i	$b_i + b_{int}$	b_i	

Table 5.8 Compute marginal effect of X_i on Log (ratio).

Variables	Marginal effect of X_i on Log (ratio)	
	Saver (Saver = 1)	Non-saver (Saver = 0)
Health condition (Reference group: excellent health)		
Good health	-0.077	-0.507
Fair health	-0.311	-0.499
Poor health	-0.273	-0.694
Being turned down before	-0.320	-0.429
Utilization ratio (Reference group: utilization ratio < 0.5)		
Utilization ratio 0.5-0.9	-0.329	-0.313
Utilization ratio > 0.9	-0.873	-1.387
Complete health insurance coverage	0.221	0.399
Having cash value life insurance	0.003	0.416
Risk tolerance (Reference group: average risk)		
High risk	-0.103	0.406
Above average risk	-0.275	-0.095
No risk	0.147	-0.203

Table 5.9 Marginal effects on Log (liquidity ratio) for variables with interaction terms with being a saver

Variables	Marginal effect as percentage of the liquidity ratio for reference group		
		Savers	Non-Savers
Precautionary saving motives	1.228		
Variables related to uncertainty			
Expectation of future income (Reference group = Constant, sure)			
Growth, sure	0.853		
Decline, sure	0.960		
Not sure	0.853		
Expectation of future economy (Reference group = Better economy)			
Same economy	1.112		
Worse economy	1.214		
Health condition (Reference group = Excellent health)			
Good health		0.926	0.602
Fair health		0.733	0.607
Poor health		0.761	0.500
Variables related to liquidity constraints			
Being turned down before		0.726	0.651
Utilization ratio (Reference group = Utilization ratio < 0.5)			
Utilization ratio 0.5-0.9		0.719	0.731
Utilization ratio > 0.9		0.418	0.250
Interest rate on balance	0.991		
Variables related to buffers for consumption shock			
Health insurance coverage		1.247	1.490
Cash value life insurance		1.003	1.516
Working status of spouse/partner (Reference group = Spouse/Partner working full time)			
Spouse/Partner working part time	1.273		
Spouse/Partner not working	1.013		
Single male headed household	1.134		
Single female headed household	1.044		
Other control variables			
Other financial assets (log)	1.147		
Eligible for Medicaid	0.595		
Saver	1.626		

Continued

Table 5.10 Marginal effects of explanatory variables on liquidity ratio for savers and non-savers (Based on Model 1)

Table 5.10 continued

Variables	Marginal effect as percentage of the liquidity ratio for reference group		
		Savers	Non-Savers
Use of financial planner			
For credit/borrowing	1.160		
For saving/investment	1.377		
Risk tolerance (Reference group = Average risk tolerance)			
High risk		0.902	1.501
Above average risk		0.760	0.909
No risk		1.158	0.816
Age	0.958		
Age_SQ	1.001		
Education (Reference group = High school)			
Less than high school	0.855		
Some college	1.097		
Bachelor's degree	1.161		
Advanced degree	1.338		
Race/Ethnicity (Reference group = White)			
Black	0.737		
Hispanic	0.732		
Other	0.796		

Note: When interaction terms are used, marginal effects are derived separately for revolvers who save and revolvers who don't save.

For the calculation of marginal effects, see Appendix C.

5.4 Discussion of Results

5.4.1 Factors Associated with the Likelihood of Being Financially Sufficient Revolvers

Table 5.11 summarizes the hypotheses and the empirical results. Having directly indicated precautionary motives increases the likelihood of being financially sufficient revolvers. The level of subjective emergency funds shows a small negative impact which was contrary to the hypothesis. As the level of emergency funds that the household thinks they need increases, the households are less likely to revolve on their credit card accounts. An explanation for this result could be that as the household thinks they need more emergency funds, they act more cautiously about borrowing on credit cards. If the households can borrow from their friends or relatives, it's reasonable for them to save less for emergencies, therefore, they are more likely to pay off their credit card balance using their extra liquid assets. This is supported in the model. With the exception of saving motives for commitments, which is not significant in the model, the other two objective measures of other obligations have the hypothesized effects. Having other consumer loans, including car loans, education loans, and other consumer installment loans, has a positive relationship with the likelihood of revolving. Having a mortgage is also positively related with the likelihood of revolving. This supports the hypothesis that households would put a higher priority on other contractual debt payments, and take advantage of the flexibility of credit card debt. Having more liquid accounts has a positive effect as expected as well. This supports the hypothesis from mental accounting, which implies that money is not completely fungible, but labeled. Households may keep

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money for different purposes in different accounts, which could also be a means for self-control. Even though they have money in other accounts, this money may not be perceived as available for paying off their credit card debts.

The hypotheses about expectations of future income are not supported. The effects of expecting future income to decline or being uncertain about future income are not statistically significant. This could be due to the reason that the expectation of future income is not a perfect measure of income uncertainty. For example, household expecting income to decline may expect a huge income drop, which encourages the household to be more prudence, or may just expect a slight drop, which may has little effect. More discussions regarding the expectations of future income are presented in section 5.4.2.

Interestingly, using financial planners for saving advice increases the likelihood of revolving. An explanation for this result could be that households followed the financial planner's advice on reserving three months income as emergency funds, which is a standard guideline. Another plausible explanation for this result could be that households experiencing difficulty managing their portfolio of assets and debts, including credit card debt and other debts, seek help from financial planners for saving or investment advice in an attempt to improve their financial situation. Or it could be that financial planners focus more on helping their clients to build up financial assets, regardless of whether their priority should be to pay off credit card debt, since many of the financial planners are paid as commission-based.

Race/ethnicity turns out to be a relatively strong predictor in the model even after controlling for many other factors. The explanation could be that some other factors, such

as financial knowledge, the understanding of the cost of credit card debt, or the way they feel about paying off credit card debt using their accumulated financial assets, may be correlated with race or ethnicity. Since direct measures of these factors are not included in the current model, the race/ethnicity variable picks up the effect. Apparently, a higher fraction of households with a Black householder are borrowing on credit cards even though they have extra liquid assets, compared to households with a White householder.

Family life cycle variables, including age (with the exception of age 65 and over), household type, and number of children under age 17, do not have significant effects on the likelihood of revolving. Educational attainment of the householder is not a significant predictor either. Compared to households with financial assets at the middle of the distribution, households with low levels of financial assets (less than $20,000) are more likely to revolve, even though they have extra liquid assets, while households with high levels of financial assets ($370,000 and above) are more likely to be convenience users. Only households with very high annual income ($100,000 and above) would be less likely to revolve, compared to households with income at the middle of the distribution ($45,000 to $64,999). These results are consistent with the descriptive statistics of credit card borrowing presented in the third section, and support the argument that the likelihood of being financially sufficient revolvers are less affected by life cycle factors, compared to factors related to precautionary saving and mental accounting.

Hypotheses	Expected Effect	Results
H1.1 Precautionary Saving Motives		
Directly indicated motives	+	+
Subjective emergency funds	+	−
Ability to borrow from friends/relatives	−	−
H1.2 Uncertain about future income	+	N/S
H1.3 Future income expected to decline	+	N/S
H1.4 Total number of liquid accounts	+	+
H1.5 Other payment obligations		
Saving motives for commitments	+	N/S
Have mortgage	+	+
Have other consumer loans	+	+
H1.6 Saving for children's education and having children of age 17-22	+	N/S
H1.7 Saving motives for investment	+	N/S

Table 5.11 Hypothesized effects of variables on the likelihood of being financially sufficient revolvers and empirical results.

5.4.2 Factors Associated with the Level of Precautionary Saving

This is the first study to find that precautionary saving concerns are important to explain the behavior of holding credit card debt and large amounts of liquid assets at the same time. Therefore, it is plausible that the liquid assets held by credit card revolvers are held as precautionary saving. As a next step, the factors associated with the level of precautionary saving are explored. Table 5.12 summarizes the hypothesized effects of explanatory variables and the empirical results.

Directly Mentioned Precautionary Saving Motives and Precautionary Saving

Revolvers who explicitly mention precautionary saving motives as a reason for saving tend to have higher levels of accumulated precautionary saving, as measured by liquid assets. This association is as expected, and the result supports the hypothesis that

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having directly indicated precautionary saving motives not only affects the likelihood of being financially sufficient revolvers, but also affects the amount of precautionary saving held by all the revolvers.

Uncertainty and Precautionary Saving

Expectation about future income, expectation about future economy, and health conditions of household members were hypothesized to be associated with uncertainty about income or consumption needs. In the empirical work, the effects of expectation variables are not statistically significant. This could be due to limitations associated with the dataset. First, part of the interviews in the 2001 SCF were conducted after September 11, 2001 (SCF codebook, 2001), and expectations about income and the future economy are likely to have changed dramatically and instantly in response to this crisis. However, the accumulated liquid assets are less likely to change in a short period of time accordingly. This may contribute to the inconsistent empirical result between expectations about uncertainty in the future and the level precautionary saving. Second, the measures of expectations about future income and future economy based on answers to subjective questions are proxies for uncertainty about income and economy, and these cannot be perfect measures of uncertainty as defined in the theory. As discussed in Chapter two, different measures of uncertainty have been used in previous empirical research and they all have pros and cons. For example, even if respondent expected the household income to decrease in the next year, income will not necessarily sharply drop or completely stop, which is the main focus of uncertainty in the model of precautionary

saving. The question about the future economy is about expectations over the next five years. Therefore, this may not immediately affect the household's precautionary saving. In addition, though subjective measures of uncertainty is an attractive approach, the accuracy depends on the answers to questions that respondents may not fully understand as the researchers expect, or they may not have the incentive to answer accurately.

Instead of the hypothesized positive effects, fair or poor health conditions have negative effects on the level of precautionary saving. However, the interactions between health conditions and saving behavior have positive effects, though they are not significant, and the estimated coefficients are especially large for good health and poor health, with excellent health as the reference group. The large standard errors of the estimated coefficients could be due to the potential problem of multicollinearity among explanatory variables, and this will be discussed later. The positive coefficients on the interaction terms support the hypothesis that uncontrolled factors related to whether the revolvers save can bias the estimated effects of worse health conditions if revolvers who save and who save little or do not save are mixed together. Poor health exposes households to higher uncertainty in terms of income and consumption shocks, and according to the precautionary saving theory, these household should plan ahead to save more in order to buffer the possible future consumption shocks. On the other hand, poor health is likely to increase the actual expenditure in the current period. The actual amount of accumulated liquid assets is a combined result of both financial planning and consequences of past and current consumption needs, while a subjective amount of precautionary saving that the households believe they need in case of emergencies

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reflects solely the planning side and is not affected by the households' consumption

needs. In fact, poor health has a strong positive effect in the subjective precautionary

saving model. This further supports the hypothesis about the constraints posed by the

revolvers' consumption needs relative to their income. As a result of differentiating

savers from non-savers, the overall negative marginal effects on precautionary saving of

less than excellent health conditions are reduced for savers, though still negative. The

possible explanations for the fact that the marginal effect of poor health is still negative

could be due to two reasons. First, due to the measurement available in the SCF, only the

indicator of whether the revolver saved or not in the preceding year is controlled and

interacted with health conditions, and how much the revolvers saved is still unknown.

The amount of accumulated precautionary saving is a results of how much a household

saved in previous years. Second, the indicator of being a saver or not can be affected by

several factors, such as the capability to save, the need to save, the willingness to save,

and simply the life cycle effects. For example, households with low income and/or with

large consumption needs relative to their income may have very limited amount of

money left for saving, therefore, they may not be able to save much. Some households

may make the decision not to save because they expect low income uncertainty and/or

income increases in the future. Or some households may decide not to save in the

preceding year because the accumulated liquid assets from previous years already

exceeds their targeted amount. However, compared to other alternative measurement, the

indicator of saving behavior is the best available in the SCF.

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Liquidity Constraints and Precautionary Saving

Variables measuring liquidity constraints do not have the expected effects on level of precautionary saving. Being turned down or not given enough credit in the past and having a high credit card utilization ratio (>0.9) both have negative effects on the level of precautionary saving. A possible explanation could be due to the fact that the dataset used is cross-sectional, instead of longitudinal. Current liquidity constraints imply that the constrained households may not be able to get any or enough credit to cover their needs, therefore, theoretically, these households plan ahead to save more compared to their current level of saving in order to smooth their consumption. The estimated effects on precautionary saving from a longitudinal dataset would reflect the pure effects of liquidity constraints. However, the estimated effects of liquidity constraints from a cross-sectional dataset could be affected by other characteristics among households that are not controlled in the model. In fact, the interaction between high utilization ratio and being a saver has a positive effect on the level of precautionary saving. Though the marginal effect of high utilization ratio for savers is still negative, the magnitude is largely reduced by including the interaction term. Interacting with saving behavior partially separates the potential confounding effect of some uncontrolled factors, i.e., the amount revolvers can save given their income and consumption needs. However, an indicator of being a saver does not provide information about how much they save, and this may explain the fact that high utilization ratio for savers has a reduced negative marginal effect on the level of precautionary saving, compared to non-savers. Since no satisfactory longitudinal dataset

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is available for this study, the SCF is the best national representative cross-sectional dataset that provides the desired variables.

Buffers for Consumption or Income Shocks and Precautionary Saving

Health insurance coverage, cash value life insurance coverage, and having a working spouse or partner are regarded as buffers for consumption or income shock. Contrary to the hypothesis, having health insurance coverage has a positive effect on the level of precautionary saving, and this is consistent with results from previous research (e.g., Starr-McCluer, 1996). However, having health insurance coverage has a negative effect on the level of subjective precautioanry saving.

If the revolvers do not have a working spouse or partner (including having non-working spouse, single male headed household, and single female headed household), they are expected to hold larger amounts of precautioanry saving, compared to others with a working spouse of partner. In the subjective model, not having a working spouse or partner has a positive effect on the level of precautioanry saving, however, the effect is not significant in the objective model.

These results imply that household's subjective plan for precautionary saving is consistent with utility-maximizing theory, however, the actual financial practice could be different from their plan. The difference between subjective and objective precautionary saving could be due to the facts such as households' overall available financial resources and actual needs for expenditure.

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Use of Financial Planners and Precautionary Saving

Revolvers using financial planners for saving or investment advice have higher levels of precautionary saving. One possible explanation could be that revolvers with more money in hand are more likely to use the services from financial planners. The explanation could go the other direction as well. Financial planners may advise the revolvers to prepare precautionary saving as much as two to six months' income, regardless of their costly debt on credit cards. Or financial planners may be more interested in helping their clients to build up financial assets, instead of helping them to pay off their credit card debt, because many of the financial planners are commission-based.

Age and Precautionary Saving

In the objective model, age has a positive effect on the level of precautionary saving, however, age does not have a significant effect in the subjective precautionary saving model. These results are reasonable and suggest that household's understanding of precautionary saving is less affected by age, but the amount they actually save for precautionary purposes is associated with age. According to the life cycle saving theory, the amount the household should save is directly related to age. Younger householders either dissave or save small amount, compared to older householders.

<u>Multicollinearity</u>

The potential problem of multicollinearity among independent variables is a concern for the hypothesis tests. If there is correlation among the independent variables, the variance of these variables will be inflated, thus the estimated effects of these variables may turn out to be statistically insignificant. In addition, the estimated coefficients of these variables would be unstable, that is, if a few observations are removed from the sample, the estimated coefficients could change a lot (Maddala, 1992, p274-276). In the precautionary saving model, directly mentioned precautionary saving motives may be correlated with some variables related to uncertainty, liquidity constraints, and buffers for consumption shock. In addition, the inclusion of interaction terms may introduce additional correlation among explanatory variables. Diagnostic checks for multicollinearity were run, and the variance-inflation factors (VIF) suggest that the problem of multicollinearity should not be a big concern in this model. The rule-of-thumb indicator for serious multicollinearity problems is the VIF of independent variables larger than 10. The variables with VIF larger than 10 in the objective precautionary saving model with interaction terms are age and the indicator of saving behavior (VIFs for each explanatory variables are reported in Appendix D). The estimated coefficients for these variables are significant, so it is not necessary to worry about the problem.

Hypotheses	Expected Effect	Results
H2.1 Precautionary saving motive	+	+
H2.2 Uncertain about future income	+	N/S
H2.3 Expecting future income to decline	+	N/S
H2.4 Fair or poor health condition	+	−
H2.5 Expecting future economy to be worse	+	N/S
H2.6 Being turned down before	+	−
H2.7 Credit card utilization ratio	+	−
H2.8 Interest rate on credit card	+ or −	N/S
H2.9 Health insurance coverage	−	+
H2.10 Life insurance coverage	−	+
H2.11 Not having a working spouse/partner	+	N/S
Interaction between fair or poor health and being a saver	+	N/S
Interaction between being turned down before and being a saver	+	N/S
Interaction between high utilization ratio and being a saver	+	+
Interaction between health insurance coverage and being a saver	−	N/S
Interaction between life insurance coverage and being a saver	−	−
Interaction between high risk tolerance and being a saver	−	−
Interaction between low risk tolerance and being a saver	+	+

[a] Model 1 is the objective model with the dependent variable as Log(liquid assets/normal monthly income) and with interaction terms.

Table 5.12 Hypothesized effects of variables on the level of precautionary saving among credit card revolvers and empirical results (Based on Model 1[a])

Hypotheses	Expected Effect	Results	
H2.1 Precautionary saving motive	+	+	
H2.2 Uncertain about future income	+	N/S	
H2.3 Expecting future income to decline	+	N/S	
H2.4 Fair or poor health condition	+	+	
H2.5 Expecting future economy to be worse	+	N/S	
H2.6 Being turned down before	+	N/S	
H2.7 Credit card utilization ratio	+	N/S	
H2.8 Interest rate on credit card	+ or −	N/S	
H2.9 Health insurance coverage	−	−	
H2.10 Life insurance coverage	−	N/S	
H2.11 Not have a working spouse/partner	+	+	

[a] Model 3 is the subjective model with the dependent variable as Log(subjective level of precautionary saving/normal monthly income).

Table 5.13 Hypothesized effects of variables on the level of precautionary saving among credit card revolvers and empirical results (Based on Model 3[a])

CHAPTER 6

SUMMARY, IMPLICATIONS, AND CONCLUSIONS

The first section of this chapter summarizes the procedures and major findings of this study, which includes a model for the likelihood of being financially sufficient revolvers and a model for the level of precautionary saving of credit card revolvers. The implications of this study are discussed in section two. Limitations of this study and suggestions for future research are discussed in section three.

6.1 Summary

The behavior of simultaneously holding liquid assets and credit card debt looks puzzling because the cost of borrowing is higher than the return of saving. No previous study has carefully analyzed such behavior. The traditional utility maximization model cannot satisfactorily explain this behavior. A review of the modern models of saving and consumption introducing uncertainty and liquidity constraints into the process of utility maximization suggests that a precautionary saving model may explain the saving behavior of credit card revolvers.

The main purpose of this dissertation was to explore the credit card revolver's behavior of holding substantial levels of liquid assets. This research includes two stages. In the first stage, a sample of financially sufficient credit card users (credit card revolvers

and convenience users holding liquid assets more than one month's income) is selected, and factors associated with the likelihood of being financially sufficient revolvers are investigated. Results from this step support precautionary saving motives as explanations for the behavior of simultaneously saving and borrowing. Therefore, based on a precautionary saving model, the second stage further explores how factors related to uncertainty and liquidity constraints affect the level of liquid assets held by credit card revolvers, using a sample of all revolvers. In addition, an objective precautionary saving model is compared with a subjective precautionary saving model.

The data used for the analyses were obtained from the 2001 Survey of Consumer Finances. The sample used for the first step of this research contains 1,579 financially sufficient credit card users, of which 928 are convenience users and 651 are revolvers. These credit card users have accumulated liquid assets in excess of one month's income. Liquid assets are measured as the amount in checking, saving, and money market accounts and call accounts. The sample used for the second step contains 1,723 credit card revolvers, which represent 58% of active bank card users.

In the first step, a logistic regression is used to estimate the likelihood of being financially sufficient revolvers, compared to being financially sufficient convenience users. Three models are compared in the second step. An OLS regression with interactions between saving behavior and selected variables is used to study the relationship between precautionary saving and factors measuring uncertainty and liquidity constraints. Interaction terms are included because of the concern that households' actual precautionary saving could be affected by uncontrolled factors related

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to the difference of revolvers' income and how much they need or choose to spend. In order to assess the possible endogenous relationship between saving behavior and accumulated precautionary saving, an OLS regression without interactions is run as well. Finally, an OLS regression with subjective precautionary saving as the dependent variable is examined. An advantage of modeling the subjective precautionary saving is that the estimated effects of variables of interest will not be masked by the households' actual financial situations.

Empirical results in the first step suggest that precautionary saving concerns can explain the behavior of simultaneously saving and borrowing. Having direct precautionary saving motives increases the likelihood of being financially sufficient revolvers, while being able to borrow $3,000 or more from friends or relatives decreases the likelihood of being financially sufficient revolvers. Having other debt obligations, such as mortgage or other consumer loans, also increases the likelihood of being financially sufficient revolvers, which supports the argument that money is not fungible but labeled.

Empirical results in the second step suggest that having direct precautionary saving motives also increase the level of liquid assets. The hypothesized effects of expectation about future income and health conditions are not supported in the objective model, but are supported in the subjective model. The hypotheses about liquidity constraints are not supported. The effects of variables measuring liquidity constraints are negative, instead of positive, in the objective model, and are not significant in the subjective model. This may be due to the fact that the SCF is a cross-sectional dataset,

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therefore, it may not be a good source to test the effects of liquidity constraints. It is desirable to compare the household's current level of precautionary saving to their previous level when liquidity constraints are added. However, cross-sectional data cannot detect the change of precautionary saving over time due to the change in perceived liquidity constraints for the same household.

The hypotheses about the effects of variables measuring buffers for consumption or income shock are not supported in the objective model, but are partially supported in the subjective model. In the objective model, health insurance coverage and life insurance coverage have positive effects on the level of precautionary saving among revolvers, and not having a working spouse or partner does not have a significant effect. In the subjective model, however, health insurance coverage has a negative effect and not having a working spouse or partner has a positive effect on the level of precautionary saving as expected.

Interestingly, using financial planners for saving or investment advices increases the likelihood of being financial sufficient revolvers and is positively related with the level of precautionary saving. The reason is undetermined with the information available. It could simply be that revolvers with more financial assets are more likely to use services from financial planners. However, it is also possible that financial planners advise the revolvers to prepare precautionary saving as much as two to six months' income, regardless of the cost of revolving on credit cards. Or it could be that instead of a comprehensive consideration of the household's overall financial situation, financial

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planners are more interested in helping their clients to build up financial assets, since the pay for many financial planners are commission-based.

In conclusion, there is a positive relationship between precautionary saving motives and the behavior of accumulating liquid assets among credit card revolvers. This research suggests that revolvers save for precautionary purposes, though this may not be an optimal financial management decision. According to the precautionary saving model, revolvers facing higher uncertainty should prepare more precautionary savings in order to buffer the possible future consumption shock. However, the actual amount of accumulated liquid assets is a combined result of both financial planning and consequences of past and current consumption needs. This study shows that expenditure needs relative to household income, which determine the amount of money the household can save, largely affect revolver's actual holding of precautionary saving, regardless of their subjective level of precautionary saving. Therefore, estimated coefficients of uncertainty and liquidity constraints may not be consistent with what the normative economic theory predicts. This may explain why the empirical effects of some variables, such as health condition and health insurance coverage, have an effect opposite to hypothesized effect in this study and previous studies.

6.2 Implications

The results of this study contribute to the literature in several ways. First, this is the first study to carefully examine credit card revolver's behavior of accumulating liquid assets. This study is also among a few to empirically test the saving model with

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uncertainty and liquidity constraints, an extension of the standard life cycle saving model. Empirical results support the claim that revolvers save for precautionary purposes. Second, the findings suggest that consumers' financial plans may be different from their actual financial behavior. Modeling consumers' actual saving without considering their expenditure needs relative to their household income may lead to biased coefficient estimates for key variables based on normative economic models. Third, the use of financial planners is found to be positively related to the likelihood of being financially sufficient revolvers and to the level of precautionary saving. This finding is worth the attention of consumer researchers and educators. The results of this study have important implications for financial planning, consumer education, and public policy, and also provide suggestions for future research.

6.2.1 Implications for Financial Advisors and Educators

This study helps us better understand consumers' behavior related to managing credit card debt and financial assets. Before evaluating financial practices and providing advice, it is important to understand the factors influencing current financial behaviors. Once the motivation is better understood, financial advisers or educators may provide tailored advice and family financial management plans for specific consumers. Blacks and Hispanics may benefit from specially targeted financial education programs.

Households using financial planners for saving/investment advice are more likely to engage in the less economically efficient practice of borrowing at a high price and investing at a low rate of return relative to risk. If these households are influenced by the

advice for emergency funds, it might suggest considering lines of credit when making recommendations for emergency funds. Given the prevalence and ease of using credit nowadays, especially through credit cards, lines of credit could be an efficient buffer stock. However, not many households really consider this as a component of their emergency funds (Bi & Montalto, 2004). Some education regarding alternative forms of emergency funds, such as line of credit from credit cards and home equity line of credit, may be beneficial to many revolvers. In addition, financial planners or advisors should be encouraged to evaluate their clients' financial situation comprehensively and to provide advice accordingly. Financial planners or advisors may evaluate whether the households should pay off their credit card debt first or should consider precautionary saving first case by case. For financially sufficient revolvers, they could be better off by retiring their credit card debt using their available liquid assets or other assets, and using that credit line again in case of emergencies.

Household financial planning and financial practice may not be consistent partly due to the fact that some households do not save the optimal amount or do not save at all given their expenditure relative to their household income. Some households may choose not to repay credit card debt using their accumulated liquid assets because they are afraid that they will never have enough saving for other purposes once they use their saving for credit card debt, since a credit card account without a balance may encourage impulsive buying for some card holders. Therefore, it is important to help households set up some feasible saving disciplines and plans. For example, financial educators can show households the calculation of accumulated money by saving a small amount everyday,

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and illustrate the cost of revolving. Also, financial educators can help households reduce impulsive buying behavior.

6.2.2 Implications for Public Policy

Interest charged for credit card debt is substantially large compared to the interest earned on liquid assets. The SCF does not contain a measure of financial knowledge, therefore, the results of this study cannot provide information on whether understanding the price of credit card debt affects revolvers' saving behavior. However, it will be favorable for consumers to make efficient decisions if the cost of credit card balance is provided on credit card statement in dollar amount, since consumers are likely to have better ideas of the price of revolving if the cost is illustrated in dollar amount instead of annual interest rate (APR). For example, information on how long it will take for the card user to pay off the balance if only the minimum payment is made every month would be useful information to include on the monthly statement. Or a simple illustration of how much it will cost to consume a typical item, for instance, a 30 dollar meal, if it is charged on credit card and only minimum payment is made every month. It would be desirable for consumers if public policy could make some regulations for credit card companies to reveal the cost of revolving in dollar amount. Also, some credit card companies encourage their customers to make only the minimum payment by setting this as the default when making online payment. Regulations requiring credit card companies to change the default payment option or to increase the minimum payment requirement should be beneficial to consumers.

6.3 Limitations and Suggestions

Due to limitations of the SCF dataset, some possible explanations cannot be tested in the first step of exploring the factors that affect the likelihood of being financially sufficient revolvers. For example, since the SCF provides information at the household level, we cannot tell whether the wife or the husband alone creates the credit card debt. It could be that saving is a household-decision, while borrowing on credit cards is a husband- or wife- decision. Also, the possibility of default may provide incentive for credit card users to keep balances in their accounts. Decoupling of payments and consumption may make consumers more willing to charge their credit cards, but less willing to repay the balance. This could induce credit card users to postpone their payments. However, these explanations are hard to test using the SCF data.

In the second step of testing how uncertainty and liquidity constraints affect the level of precautionary saving of credit card revolvers, the difference in financial ability among revolvers cannot be fully controlled for, due to the limited information available in the dataset. Previous research about emergency funds (Bi & Montalto, 2004) and this study both indicate that financial planning based on expectations of future events and economic status could be different from actual financial practice, and the former is more consistent with what the utility maximizing economic theories predict. Without controlling for the factors related to households' consumption needs relative to their income, the estimated effects of key variables based on economic model may be biased. In this study, an indicator of saver and interaction terms between saver and key variables are included, however, these only control for whether the revolver saved in the past year

or not, and information on the magnitude of their saving is still not available. This could be the reason why the estimated effects of health insurance coverage, poor health conditions, and not having a working spouse or partner are not as expected in the objective model, but are as expected in the subjective model.

This exploratory study provides a base for additional examination of the behavior of credit card borrowing and asset accumulation. Precautionary saving motives help to explain the puzzle of simultaneously borrowing and saving in liquid form. The research can be extended to credit card debt and other financial assets, such as investment assets and retirement accounts. The effects of using financial planners and the reasons why revolvers using financial planners for saving or investment advice are more likely to hold more liquid assets are worth further exploration. In addition, timing of events may contribute to the inconsistency between the hypothesized and the empirical effects on actual level of precautionary saving of liquidity constraints, health conditions, and insurance coverage. Longitudinal data are desirable for studies of precautionary saving, since such data can better control for expenditure shocks due to situation change in the household, compared to cross-sectional data. Finally, the difference between a household's subjective financial planning and actual financial practice is worth the attention of family financial management researchers. Since the current results suggest that subjective financial planning is more consistent with the utility-maximizing economic theories, understanding the reasons of the discrepancy and how to narrow the gap between planning and practice is important for consumer researchers and educators to help households improve their economic wellness.

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APPENDIX A

DEFINITIONS OF EXPLANATORY VARIABLES FOR LOGISTIC

REGRESSION OF THE LIKELIHOOD OF BEING FINANCIALLY

SUFFICIENT REVOLVERS

Explanatory Variables	Definition
Precautionary Saving Motives	
Directly indicated motives X3006, X3007, X7513, X7514, X7515, X6848	=1 if the respondent indicates saving motives for emergencies, illness or unemployment =0 otherwise
Subjective emergency funds (in $1,000) X7187	Continuous variable, the amount of savings the respondent thinks the family needs to have for emergencies and other unexpected things that may come up
Ability to borrow from friends/relatives X6443	=1 if the household can get financial assistance of $3000 or more from friends or relatives who do not live together =0 otherwise
Expectation of future income	X7364, X7586
Constant, sure	=1 if the respondent expects the total family income will go up about the same as prices, and has a good idea about family's income in the next year =0 otherwise
Growth, sure	=1 if the respondent expects the total family income will go up more than prices, and has a good idea about family's income in the next year =0 otherwise
Decline, sure	=1 if the respondent expects the total family income will go up less than prices, and has a good idea about family's income in the next year =0 otherwise
Not sure	=1 if the respondent does not have a good idea about family's income in the next year =0 otherwise
Other obligations	
Saving motives for commitments X3006, X3007, X7513, X7514, X7515, X6848	=1 if the respondent indicates saving motives for commitments and bills =0 otherwise
Have mortgage MRTHEL	=1 if the respondent has mortgage =0 otherwise
Have other consumer loans INSTALL	=1 if the respondent has car loans, education loans, or other consumer installment loans =0 otherwise
Saving motives for children's education	X3006, X3007, X7513, X7514, X7515, X6848
Have motive and children of age 17-22	=1 if respondent indicates such saving motive and has children of age 17-22 =0 otherwise
Have motive but no child of age 17-22	=1 if respondent indicates such saving motive but does not have children of age 17-22 =0 otherwise

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No such saving motive	=1 if respondent does not indicates such saving motive =0 otherwise
Saving motives for investment X3006, X3007, X7513, X7514, X7515, X6848	=1 if respondent indicates saving motives for investment reasons =0 otherwise
Number of liquid accounts X3502, X3702, X3802	Continuous variable, total number of checking accounts, saving accounts, and money market accounts
Use of financial planners	
For saving/investment advice	=1 if the household uses financial planners for saving/investment advice
X7112-7121, X6865-6869	=0 otherwise
For credit/borrowing advice	=1 if the household uses financial planners for credit/borrowing advice
X7101-7110, X6849, X6861-6864	=0 otherwise
Credit attitude	X401
Good	=1 if respondent thinks credit is a good idea =0 otherwise
Neutral	=1 if respondent thinks credit is good in some ways and bad in others =0 otherwise
Bad	=1 if respondent thinks credit is a bad idea =0 otherwise
Bankruptcy X6772	=1 if the household has filed bankruptcy before =0 otherwise
Family life cycle variables	
Age	X14
Under 35	=1 if the head is under 35 years old =0 otherwise
35 to 44	=1 if the head is 35 - 44 years old =0 otherwise
45 to 54	=1 if the head is 45 - 54 years old =0 otherwise
55 to 64	=1 if the head is 55 - 64 years old =0 otherwise
65 and over	=1 if the head is 65 years old and over =0 otherwise
Household type	X7372, X8021
Legally married	=1 if the respondent's current legal marital status is married =0 otherwise
Male head, not legally married	=1 if the respondent's current legal marital status is not married and the respondent is male =0 otherwise
Female head, not legally married	=1 if the respondent's current legal marital status is not married and the respondent is female =0 otherwise

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Number of children age 16 and under	Continuous variable, number of children of age 16 or under in the household
Other socioeconomic and demographic variables	
Gross Annual Income	household's before-tax total income in 2000
< = $13,000	=1 if yes, =0 otherwise
$13,001 ~ $25,000	=1 if yes, =0 otherwise
$25,001 ~ $42,000	=1 if yes, =0 otherwise
$42,001 ~ $67,000	=1 if yes, =0 otherwise
> $67,000	=1 if yes, =0 otherwise
General financial assets	Same as variable FIN defined in the SCF
< = $20,000	=1 if yes, =0 otherwise
$20,001 ~ $60,000	=1 if yes, =0 otherwise
$60,001 ~ $150,000	=1 if yes, =0 otherwise
$150,001 ~ $370,000	=1 if yes, =0 otherwise
> $370,000	=1 if yes, =0 otherwise
Education	X5901,X5902, X5904, X5905
Less than high school	=1 if the highest educational attainment achieved by the head is less than high school =0 otherwise
High school graduate	=1 if the highest educational attainment achieved by the head is high school =0 otherwise
Some college	=1 if the highest educational attainment achieved by the head t is some college =0 otherwise
Bachelor's degree	=1 if the highest educational attainment achieved by the head is a Bachelor's degree =0 otherwise
Graduate school	=1 if the highest educational attainment achieved by the head is less than high school =0 otherwise
Race/Ethnicity	X6809
White	=1 if the respondent is White =0 otherwise
Black	=1 if the respondent is Black/African-American =0 otherwise
Hispanic	=1 if the respondent is Hispanic/Latino =0 otherwise
Other	=1 if the respondent is Asian, American Indian/Alaska native, native Hawaiian/Pacific Islander, or other =0 otherwise

APPENDIX B

DEFINITIONS OF EXPLANATORY VARIABLES FOR OLS REGRESSION OF

THE LEVEL OF PRECAUTIONARY SAVING

Explanatory variables	Definition
Precautionary saving motives X3006, X3007, X7513, X7514, X7515, X6848	=1 if the respondent indicates saving motives for emergencies, illness or unemployment =0 otherwise
Variables related to uncertainty	
Expectation of future income	X7364, X7586
Constant, sure	=1 if the respondent expects the total family income will go up about the same as prices, and has a good idea about family's income in the next year =0 otherwise
Growth, sure	=1 if the respondent expects the total family income will go up more than prices, and has a good idea about family's income in the next year =0 otherwise
Decline, sure	=1 if the respondent expects the total family income will go up less than prices, and has a good idea about family's income in the next year =0 otherwise
Not sure	=1 if the respondent does not have a good idea about family's income in the next year =0 otherwise
Expectation of future economy	X301
Better economy	=1 if the responder expects the economy over the next five years to perform better than it has over the last five years =0 otherwise
Same economy	=1 if the responder expects the economy over the next five years to perform as the same as it has over the last five years =0 otherwise
Worse economy	=1 if the responder expects the economy over the next five years to perform worse than it has over the last five years =0 otherwise
Health conditions	X6030, X6124
Excellent health	=1 if both the respondent and the spouse/partner, if present, in excellent health condition =0 otherwise
Good health	=1 if either the respondent or the spouse/partner, if present, in good health condition =0 otherwise
Fair health	=1 if either the respondent or the spouse/partner, if present, in fair health

	condition
	=0 otherwise
Poor health	=1 if either the respondent or the spouse/partner, if present, in poor health condition
	=0 otherwise
Variables related to liquidity constraints	
Being turned down before X407, X409	=1 if the household has been turned down any request for credit or not given as much credit as the household applied for, or the household did not apply for credit because they thought they might be turned down in the past five years
	=0 otherwise
Utilization ratio of credit line from credit cards	X413, X414
Utilization ratio < 0.5	=1 if the ratio of credit card debt to line of credit from credit cards < 0.5
	=0 otherwise
Utilization ratio 0.5-0.9	=1 if $0.5 \leq$ the ratio of credit card debt to line of credit from credit cards < 0.9
	=0 otherwise
Utilization ratio $\geq$ 0.9	=1 if the ratio of credit card debt to line of credit from credit cards $\geq$ 0.9
	=0 otherwise
Interest rate on balance (%) X7132	The interest rate on the credit card with the largest balance
Variables related to buffers for consumption shock	
Complete health insurance coverage X6306, X6329, X7397	=1 if every member in the household is covered by government or private insurance =0 otherwise
Having cash value life insurance X4006	=1 if the household has cash value life insurance =0 otherwise
Working status of spouse/partner	X4700, X5111, X8021
Spouse working full time	=1 if the respondent has a full-time working spouse/partner
	=0 otherwise
Spouse working part time	=1 if the respondent has a part-time working spouse/partner
	=0 otherwise
Spouse not working	=1 if the respondent has a spouse/partner not working
	=0 otherwise
Single male headed household	=1 if the respondent is unmarried/unpartnered male
	=0 otherwise
Single female headed household	=1 if the respondent is unmarried/unpartnered female

	=0 otherwise
Other control variables	
Other financial assets	Log of the amount of directly held stocks, bonds, mutual funds, and assets in retirement accounts
Eligible for Medicaid X6303	=1 if anyone in the household is eligible for Medicaid =0 otherwise
Saver X7508-7510	=1 if the household spent less than their income in the past year =0 otherwise
Use of financial planners	
For credit advice X7101-7110, X6849, X6861-6864	=1 if the household uses financial planner for credit/borrowing advice =0 otherwise
For saving advice X7112-7121, X6865-6869	=1 if the household uses financial planner for saving/investment advice =0 otherwise
Risk tolerance	X3014
High risk tolerance	=1 if the respondent and the spouse/partner, if present, are willing to take substantial financial risk when they save or make investments =0 otherwise
Above average risk tolerance	=1 if the respondent and the spouse/partner, if present, are willing to take above average financial risk when they save or make investments =0 otherwise
Average risk tolerance	=1 if the respondent and the spouse/partner, if present, are willing to take average financial risk when they save or make investments =0 otherwise
Not willing to take risk	=1 if the respondent and the spouse/partner, if present, are not willing to take any financial risk when they save or make investments =0 otherwise
Age	Age of the head, X14
Education	X5901,X5902, X5904, X5905
Less than high school	=1 if the highest educational attainment achieved by the head is less than high school =0 otherwise
High school	=1 if the highest educational attainment achieved by the head is high school =0 otherwise
Some college	=1 if the highest educational attainment

	achieved by the head is some college =0 otherwise
Bachelor's degree	=1 if the highest educational attainment achieved by the head is a Bachelor's degree =0 otherwise
Advanced degree	=1 if the highest educational attainment achieved by the head is a graduate school degree =0 otherwise
Race/Ethnicity	X6809
White	=1 if the respondent is White =0 otherwise
Black	=1 if the respondent is Black/African-American =0 otherwise
Hispanic	=1 if the respondent is Hispanic/Latino =0 otherwise
Other	=1 if the respondent is Asian, American Indian/Alaska native, native Hawaiian/Pacific Islander, or other =0 otherwise

APPENDIX C

NOTES ON DERIVING MARGINAL EFFECTS

Deriving marginal effect on ratio of liquid assets to monthly income:

Dependent variable: Log (ratio)

1. The marginal effect of a dichotomous variable, holding other variables constant:

Log (ratio1| $X_i = 1$) – Log (ratio2| $X_i = 0$) = b_i

$$Log \left(\frac{ratio1 | Xi = 1}{ratio0 | Xi = 0} \right) = b_i$$

$$\frac{ratio1 | Xi = 1}{ratio0 | Xi = 0} = e^{bi}$$

(ratio1| $X_i = 1$) = e^{bi} (ratio0| $X_i = 0$)

So, if $b_i > 0$ then (ratio1| $X_i = 1$) > (ratio0| $X_i = 0$);
    if $b_i = 0$ then (ratio1| $X_i = 1$) = (ratio0| $X_i = 0$);
    if $b_i < 0$ then (ratio1| $X_i = 1$) < (ratio0| $X_i = 0$).

2. Transforming the marginal effect of continuous variable, Log_{10}(Other_fin), on

   liquidity ratio back to the effect of change in the amount of other financial assets on

   the liquidity ratio:

Log (Other_fin$_1$) – Log (Other_fin$_0$) = 1
Log (Other_fin$_1$ / Other_fin$_0$) = 1
Other_fin$_1$ / Other_fin$_0$ = 10
Other_fin$_1$ = 10 (Other_fin$_0$)

For every 10 times increase in the amount of other financial assets, the marginal effect on the liquidity ratio is e^b, i.e., (ratio1| Other_fin$_1$) = e^{bi} (ratio0| Other_fin$_0$).

The effect of age
Extreme point: Y = $b_1 X_1 + b_2 X_1^2 + b_i X_i$
$\partial Y / \partial X_1 = b_1 + 2b_2 X = 0$
X = $- b_1 / 2b_2$

APPENDIX D

VARIANCE-INFLATION FACTORS OF EXPLANATORY VARIABLES FOR

THE OLS REGRESSION OF THE LEVEL OF PRECAUTIONARY SAVING

Variables	Variance-Inflation Factor
Precautionary saving motives	1.04
Variables related to uncertainty	
Expectation of future income	
Growth, sure	1.34
Decline, sure	1.35
Not sure	1.41
Expectation of future economy	
Same economy	1.51
Worse economy	1.52
Health conditions	
Good health	4.76
Fair health	4.14
Poor health	2.35
Variables related to liquidity constraints	
Being turned down before	2.74
Utilization ratio of credit line from credit cards	
Utilization ratio 0.5-0.9	2.54
Utilization ratio ≥ 0.9	2.00
Interest rate on balance (%)	1.14
Variables related to buffers for consumption shock	
Complete health insurance coverage	2.32
Having cash value life insurance	3.43
Working status of spouse/partner	
Spouse working part time	1.14
Spouse not working	1.39
Single male headed household	1.25
Single female headed household	1.44
Other control variables	
Other financial assets ($)	1.78
Eligible for Medicaid	1.16
Saver	13.12
Use of financial planners	
For credit / borrowing	1.36
For saving / investment	1.39
Risk tolerance	
High risk tolerance	3.06
Above average risk tolerance	3.96
Not willing to take risk	3.00
Age	34.62
Age_SQ	34.44
Education	

Less than high school	1.38
Some college	1.43
Bachelor's degree	1.44
Advanced degree	1.42
Race/Ethnicity	
Black	1.14
Hispanic	1.14
Other	1.06