The Credit Card Debt Puzzle: The Role of Preferences, Credit Risk, and Financial Literacy

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Abstract

We use the 1979 National Longitudinal Survey of Youth to revisit what is termed the *credit card debt puzzle*: why consumers simultaneously co-hold high-interest credit card debt and low-interest assets that could be used to pay down this debt. Relative to individuals with no credit card debt but positive liquid assets (savers), borrower-savers have higher discount rates, slightly lower financial literacy scores, and very different perceptions on future credit risk: many individuals are using credit cards for precautionary motives. Moreover, changing perceptions about credit risk are essential for predicting transitions among the two groups. Respondents whose credit risk increases over time are more likely to transition from being savers to being borrower-savers, and vice versa. Preferences and the composition of financial portfolios also play a role in these transitions. Importantly, we find that financial literacy may help mitigate the effect of preferences.

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1 Introduction

The credit card debt puzzle describes the phenomenon of consumers rolling over unsecured high-interest credit card debt while simultaneously holding low-interest monetary assets that could be used to pay down this revolving debt—see Morrison (1998) for an early discussion. This behavior has been well-documented in proprietary datasets and in publicly available ones such as the Survey of Consumer Finances (SCF) and the Consumer Expenditure Survey (CEX). We revisit the credit card debt puzzle using the 1979 National Longitudinal Survey of Youth (NLSY79); to our knowledge, we are the first to more closely examine this puzzle using the NLSY79.

The longitudinal structure of the NLSY79 dataset allows for examination of this behavior over different periods of time, as well as exploring how this behavior might signal the potential for future financial trouble. The NLSY79 dataset contains a unique combination of information not available together in other data sources (measures of intelligence, financial literacy, impatience, and risk aversion), and allows us to study the credit card debt puzzle while having a complete picture of household balance sheets—the NLSY79 provides a detailed account of consumers' assets and liabilities, as well as information on past bankruptcies, foreclosures, and credit constraints. In the SCF the puzzle behavior has been documented as early as 1983. While the proportion of households co-holding credit card debt and monetary assets was very stable over time, around 50 percent, it fell during the Great Recession. In the NLSY79, information on credit card usage is available for the period 2004–2012, which encompasses the Great Recession.

There have been many explanations offered for why the credit card debt puzzle exists. A natural explanation is that this puzzle is simply an accounting phenomenon relating to the measurement of revolving credit card debt and liquid asset holdings (a timing mismatch): liquid asset holdings may already be committed to forthcoming expenses. Gross and Souleles (2002) dismiss this reasoning since they find that more than one-third of credit card borrowers keep more than one full month of family income in liquid assets while rolling over credit card debt. Other explanations include self-control problems (see

Laibson, Repetto, and Tobacman, 1998; Haliassos and Reiter, 2007; Bertaut, Haliassos, and Reiter, 2009) or strategic preparation for bankruptcy—Lehnert and Maki (2002). Telyukova and Wright (2008) and Telyukova (2013) stress the need for liquidity and rationalize the credit card debt puzzle as a situation where consumers keep liquid assets to pay for cash-only expenditures. More recently, Fulford (2015) builds a model where consumers optimally choose to simultaneously hold (relatively) high-interest debt and low interest-bearing liquid assets to insure against possibly binding future credit constraints. Druedahl and Jorgensen (2015) also stress the insurance value of revolving credit card balances when borrowing limits tighten. When consumers face adverse shocks, they may not be able to tap new sources of credit and/or may face reduced credit limits on currently available sources. However, credit card lenders cannot demand immediate repayment of outstanding balances. For this reason, some consumers may take advantage of cash advances on credit cards to build a cash buffer, or may choose not to pay balances in full to conserve cash in anticipation of future expenses exceeding income.

While it is unlikely that a single explanation is the "correct" one, it is important to understand if the co-holding behavior described mainly originates from a lack of financial knowledge and can predict future financial trouble, or whether the puzzle phenomenon is more consistent with rational strategic behavior. Credit cards can be useful financial instruments when used wisely and dangerous if not; it is important to understand how consumers use credit cards to determine what kind of interventions, if any, might benefit the general public. Looking ahead, we find that both motives might be at play.

The NLSY79 is a particularly useful dataset to measure revolving credit card debt. After being asked about having credit cards or credit card debt, respondents must answer the following question: *"After the most recent payment, roughly what was the balance still owed on all of these accounts together? If you paid off all of these accounts, please report $0."* Respondents are also asked to report their holdings of low-interest liquid monetary assets: *"Total amount in checking, savings and money market accounts."* Based on the amount of revolving credit card debt and liquid monetary assets (abstracting from other assets, liquid and illiquid, and liabilities for now) an individual holds, we classify NLSY79

respondents into four groups: (1) borrower-saver (puzzle), with positive holdings of both debt and assets, (2) borrowers, with no assets but positive debt, (3) neutral, with zero holdings of debt and assets, and (4) savers, with assets and no debt.

To briefly summarize our main findings, compared to respondents in the neutral and borrower categories, individuals in the puzzle group have more education, higher AFQT scores (a proxy for intelligence), higher financial literacy scores, and more financial resources (income and wealth).[1] They are less present biased and report having a better sense of how to spend money in general. On the other hand, relative to savers, borrower-savers have higher discount rates, are more likely to have middle levels of risk aversion, have slightly lower financial literacy and AFQT scores, fewer years of formal education, and significantly larger holdings of all types of debt.

Our paper is closely related to Gathergood and Weber (2014) who use data from the United Kingdom. They find that individuals in the puzzle group exhibit less self-control than savers, but that there are no differences between the two groups in terms of financial literacy. Our contribution, other than documenting similar patterns based on U.S. data, is a more comprehensive test of the different theories that have been suggested to explain the credit card debt puzzle. Importantly, the panel dimension of the NLSY79 allows us to study transitions in and out of the borrower-saver group, as well as how belonging to the puzzle group may predict future financial trouble (for instance, bankruptcy and foreclosure). More generally, our paper contributes to an expanding literature on household finance, improving our understanding of the way households make financial decisions, differentiating between mistakes and strategic choices.[2]

We are the first to document that individuals in the puzzle group have a different perception of credit risk compared to savers. We find that changing perceptions about credit risk are essential for predicting transitions among the two groups. Respondents whose credit risk increases over time are more likely to transition from being savers to being borrower-savers. On the other hand, individuals whose credit risk decreases over

[1] AFQT stands for "Armed Forces Qualification Test" and measures four areas of intelligence: arithmetic reasoning, mathematics knowledge, paragraph comprehension, and word knowledge.

[2] Campbell (2006) discusses how little we know about the reasons behind the choices and the mistakes people make when they make investment decisions given the instruments available to them.

time are more likely to transition from the puzzle group to the saver group, conditional on other observables. Risk and time preferences, in addition to the composition of the financial portfolios of the respondents, also play a role in these transitions. Moreover, we find that financial literacy may help mitigate the effect of preferences. As shown by previous studies, financial literacy has important implications for portfolio choice and can predict consumer financial trouble.[3]

Overall, the borrower-savers that comprise the puzzle group seem to be a very heterogenous group of individuals. Many members of this group can simultaneously hold revolving credit card debt and liquid assets for extended periods of time without getting into financial trouble, while others cannot. In fact, we find that compared to 2008 savers, respondents who were in the puzzle group in 2008 were significantly more likely to declare bankruptcy or go through foreclosure sometime between 2009 and 2012. We also document, using data from the Survey of Consumer Finances, that the cost of revolving credit card balances varies significantly across households. All in all, our results support the precautionary borrowing hypothesis of Druedahl and Jorgensen (2015) and Fulford (2015).

The paper is organized as follows: in Section 2, we define and characterize the size of the puzzle group relative to the other three groups in the NLSY79; in Section 3, we discuss the main theoretical explanations for the existence of the credit card debt puzzle offered in the literature; in Section 4, we compare the four groups along different dimensions including demographics, time and risk preferences, and financial portfolios. In Section 5, we formally test different theories using a multivariable regression model; in Section 6, we discuss transitions as well as the financial costs of this behavior by looking at the likelihood of bankruptcy and foreclosure; and in Section 7, we discuss the financial costs associated with revolving credit card balances using SCF data. We present our conclusions in Section 8.

[3]Lusardi, van Rooij, and Alessie (2011) show that individuals with lower financial literacy are significantly less likely to participate in the stock market, while Cole, Paulson, and Shastry (2014) show that, in addition to the effects on financial market participation, higher financial literacy dramatically reduces future financial trouble. See Lusardi and Mitchell (2014) for a review of the effects of financial literacy on financial decision making.

2 The Borrower-Saver (Puzzle) Group in the NLSY79

The NLSY79 follows a cohort of 12,686 male and female respondents who were 14–22 years-old in 1979 and were interviewed annually until 1994 and biennially thereafter. Because the NLSY79 oversampled the poor and members of the military, we dropped these subsamples to concentrate our analysis on the random sample that is more broadly representative of the U.S. population.

The NLSY allows for a detailed examination of respondents' behavior by collecting a variety of personal data that ranges from current financial assets and liabilities to health indicators. Compared to the SCF and the CEX, the other U.S. datasets employed to investigate the credit card debt puzzle, the NLSY's longitudinal dimension allows for respondents' behavior to be observed before, during, and after being in the puzzle group. While credit card data was not collected in the NLSY until 2004, the starting point of our analysis, a variety of other variables are available since 1979 for each respondent, thus offering a unique opportunity to look backwards as well as forwards for factors that could contribute to being in the borrower-saver group. Credit card data, available in 2004, 2008, and 2012, allows us to compare respondents who move in and out of the puzzle group as well as respondents who never enter or who are always in the group. As of 2004, the respondents were 39–47 years-old. Our sample consists of approximately 3,500 respondents per year when including all nonmissing controls and restricting the analysis to the random sample.[4]

In 2004, 50 percent of the respondents are female, 90 percent are nonblack/nonHispanic, 70 percent are married, and 80 percent have children. Eighty percent are homeowners and 70 percent are paying a mortgage; 50 percent have a car loan, and a smaller fraction, 10 percent, have student debt. The mean family income is roughly $85,000 (median $72,000), while mean net worth is $345,000 (median $152,000), measured in 2012 US$. Seventy percent of the respondents have credit cards, and the average balance on credit card accounts is $3,432. Average liquid assets (checking, savings, and money market

[4]For example, in 2004 there are 7,501 respondents remaining in the survey. Of these, 7,084 respondents report information on credit card debt. Of those, 5,363 have nonmissing controls for other variables of interest and 3,447 belong to the random sample of the NSLY79.

accounts) are close to $14,000.

2.1 The Distribution of Respondents

Based on the reported holdings of revolving credit card debt and liquid monetary assets, we classify the NLSY79 respondents into four groups: (1) baseline puzzle, meaning borrower-savers who have positive holdings of revolving credit card debt and liquid monetary assets, (2) borrowers, with no assets but positive credit card debt, (3) neutral with zero holdings of both, and (4) savers, with liquid monetary assets and no credit card debt. We abstract from other assets and liabilities to classify respondents in these groups, but we compare respondents in the different groups along many dimensions, including net worth, later on.

Table 1 shows that in 2004, 48.4 percent of the NLSY79 respondents are in the borrower-saver (baseline puzzle) group, 4.6 percent fall in the pure borrower category, 35.6 percent are in the saver group, and 11.4 percent are in the neutral group. These figures are similar to comparable statistics calculated using the SCF. In 2004, 49.3 percent of respondents in SCF revolve credit card debt and keep positive liquid assets.

Over time, the proportion of respondents in the baseline puzzle group declines. By 2012, 40.5 percent of respondents are in the borrower-saver group, 4.5 percent are in the borrower group, 41.3 percent are in the saver group, and 13.8 percent are in the neutral group. The overall number of consumers with revolving credit card debt goes down by 8 percentage points (from 53 percent to 45 percent), consistent with the documented deleveraging of consumer debt during the Great Recession. However, respondents are also older and it is possible debt simply declines when respondents hit their peak earning years.

To reiterate, the baseline puzzle group is defined as those respondents who have positive holdings of both revolving credit card debt and liquid assets—they borrow on credit cards and do not fully repay their monthly balances but also hold some liquid savings. In the NLSY79, the majority of individuals classified as belonging to the puzzle group have modest amounts of revolving credit card debt. The median balance on credit

cards (conditional on having debt) is \$4,254 in 2004, \$5,332 in 2008, and \$4,000 in 2012, while in all three years the 75th percentiles of credit card debt averages about \$10,000—see Figure A.1. A smaller fraction of individuals in the borrower-saver group, however, have more significant amounts of revolving credit card debt. Most individuals in the puzzle group also hold moderate amounts of liquid assets (the medians are \$6,077, \$5,332 and \$5,000 in 2004, 2008 and 2012, respectively) with some clear outliers. In 2004, the average consumer in the puzzle group revolves \$6,472 in credit card debt while holding \$13,412 in liquid assets. In 2008, average revolving credit card debt is slightly higher at \$6,910, as are liquid assets at \$13,971. In 2012, average revolving credit card debt is lower at \$5,897 and liquid savings are even higher at \$18,364.[5] We call the difference between liquid assets and credit card debt *arbitrage* (or the amount of liquid assets that would remain if all credit card debt was paid off). The average arbitrage amount is \$6,940 in 2004 and \$12,467 in 2012. About 56 percent of individuals in the baseline puzzle group are capable of paying off their credit card debt completely in 2004, a figure that changes only slightly over the years (to 54 percent in 2008 and 58 percent in 2012).[6]

Alternative Definitions

To make sure our results are robust as to how the puzzle group is constructed, we also consider alternative definitions. In particular, carrying small balances on credit cards may not be very costly, and/or some of the current balances in liquid assets may already be committed to upcoming expenses. Individuals who were initially placed in the baseline puzzle group are reclassified as savers or borrowers depending on the specific alternative definition used, but we keep the definition of the neutral group unchanged. For example, Telyukova (2013) uses a \$500 threshold for both debt and assets. In this case, an individual with more than \$500 in credit card debt but less than \$500 in liquid savings would be a borrower, while an individual with less than \$500 in credit card debt and more than \$500 in liquid assets would be a saver.[7]

[5] See Table A.3 in Appendix A.

[6] These percentages should be interpreted with caution, as top coding exists for both credit card debt and liquid assets.

[7] When using different puzzle definitions, there are multiple ways to reassign individuals initially in the puzzle group into other categories. We have verified that our specific choices do not change the main

Using a $500 threshold for both debt and assets, Table 2 illustrates that 40.5 percent of the NLSY79 respondents belong to the puzzle group in 2004, while the equivalent number of borrower-savers is 37.8 percent in the SCF. Using CEX data for 2001, Telyukova (2013) reports that 30 percent are in the borrower-saver category. This discrepancy may be due to the fact that her sample uses a different age composition, a different year, or that she strictly defines the puzzle group as those who "revolve debt *habitually*, that is, report paying off their balances in full only sometimes or never."[8] While this distinction is important, we believe that the intent of the question in the NLSY79, while not perfectly expressed, clearly distinguishes between using credit cards for convenience (paying off monthly) and revolving credit card balances.

The distribution of respondents based on other variations in debt-savings thresholds are presented in Table 2. For example, defining the puzzle group by having at least $500 in credit card debt and one month of annual income in monetary assets—a definition that will be used in our robustness analysis and labelled ($500 of credit card debt, one month of saved annual income) or "strict puzzle" from now on—20.1 percent of respondents are in the puzzle group, and 23.2 percent are savers in 2004.[9] These numbers are similar to those from the SCF, where 17 percent of respondents are in the puzzle group when using the strict definition of the puzzle in that same year. As with the baseline definition, the proportion of respondents in the puzzle group declines over time.[10]

2.2 Group Transitions: Does Membership in the Puzzle Group Persist over Time?

Table 3 contains information on transitions over time across the four different respondent categories (borrower-saver, borrower, neutral, and saver). In the first panel, the first four entries can be read as follows: under the baseline puzzle definition, 70.2 percent of members of the puzzle group in 2004 remain in the puzzle group in 2008, 5.7 percent of

conclusions of the paper.

[8]Using 2001 SCF data and the exact definition of Telyukova (2013), 35.5 percent of respondents are in the puzzle group.

[9]To construct the one-month family income threshold, we use a five-year income average.

[10]See Figure A.5 for more detail.

them transition to the borrower group, 3.2 percent transition to the neutral group, and 20.9 percent switch to the saver category. Other rows in this panel and other panels should be read similarly except the last one, which reports the percentages of respondents who remain in the same group for all three periods: 48.5 percent of respondents who were in the puzzle group in 2004 are also in this group in 2008 and 2012, 7 percent of respondents are always borrowers, 47.5 percent are always in the neutral category, and 48.3 percent are always savers. Being in the puzzle group seems to be quite a stable condition, comparable to being in the neutral and saver categories.

When using the strict puzzle definition, ($500 of credit card debt, one month of saved annual income), the picture is somewhat different. From 2004 to 2008, 43.9 percent of respondents in the borrower-saver group stay there, while 18.1 percent become savers; 58.1 percent of savers remain savers, while 12.9 percent of savers transition into the puzzle group. Overall, belonging to the puzzle group appears to fluctuate, with 21.2 percent of respondents in the puzzle group in 2004 remaining in the group throughout the whole period, compared to 43.7 percent of savers who always stay savers. This finding indicates that it is important to consider alternative definitions of the credit card debt puzzle going forward, while acknowledging that a nontrivial fraction of individuals are in the puzzle category during all three sample periods, even when a more strict puzzle definition is considered.

3 Theoretical Explanations for the Credit Card Debt Puzzle

Our ultimate goal is to use NLSY79 data to test the different theoretical explanations for the credit card debt puzzle. Four distinct explanations stand out in the literature. First, individuals or couples may have self-control issues when it comes to shopping that they recognize needs to be dealt with. Bertaut, Haliassos, and Reiter (2009) propose an accountant-shopper model. The rational accountant (self or partner) has a motive not to fully pay credit card balances to limit spending by a more impatient shopper

(self or partner)—upper limits on credit cards would be reached more quickly if balances are not paid for in full, and this restrains spending.[11] This accountant-shopper theory suggests that individuals in the puzzle group would tend to be more impatient than others (or have relatively more impatient partners), not necessarily financially illiterate. Using survey data from the United Kingdom, Gathergood and Weber (2014) provide empirical support for models that stress managing self-control problems as an explanation for the puzzle (as opposed to explanations based on a misunderstanding of basic personal finance). They find that households that co-hold credit card debt and assets tend to be impulsive shoppers with higher levels of financial literacy than other households. Certain questions in the NLSY79 allow us to compute discount rates (for the respondents, not their partners) and document any differences in impatience across groups. Financial literacy questions are also available in this dataset, while questions on shopping-related impulsiveness are not available.

Second, Lehnert and Maki (2002) find that states with higher asset protection from bankruptcy have higher bankruptcy rates and more households in the puzzle group. Mankart (2014) builds an explanatory model of the credit card debt puzzle around the idea that bankruptcy laws in the United States create an incentive for individuals who may default in the near future to hold debt and assets simultaneously: when filing for bankruptcy, debts are forgiven (under Chapter 7) and assets can be kept up to an exemption level. His model delivers no strong positive relationship between exemption levels and default rates; the reason is that borrowers who default in the model do not own much wealth so very few households are affected by increases in the exemption level. This implication is consistent with the findings in Lefgren and McIntyre (2009), who document that state bankruptcy rate differentials reflect the relative costs of filing for formal bankruptcy protection versus informal default, rather than differences in exemption lev-

[11] This behavior is different from hyperbolic discounting and present bias—Laibson (1997). Individuals are said to be present-biased if they prefer to receive a lower amount today rather than tomorrow, but will also gladly wait one extra day in a year in order to receive the higher amount. For example, an individual who prefers \$500 today to \$1,000 tomorrow, also prefers \$1,000 366 days from today to \$500 365 days from today. Present-biased individuals are said to have time-inconsistent preferences. We do not expect present-biased individuals to belong to the puzzle group, as such individuals (when recognizing their bias) would tend to hold credit card debt and illiquid assets (as a commitment device) instead of liquid assets.

els. Nevertheless, in section 6.2, we explore whether respondents in the puzzle group are more likely to declare bankruptcy or be foreclosed on their properties. While individuals preparing for bankruptcy may strategically want to hold positive balances on credit card debt and liquid assets, such incentives should not be present with foreclosure. If we see a differential effect on bankruptcy and foreclosure, strategic behavior may be at play. In contrast, if individuals in the puzzle group go bankrupt and are also foreclosed on their properties more often than others, this may indicate a poor understanding of financial matters rather than strategic behavior.

Third, Fulford (2015) and Druedahl and Jorgensen (2015) stress the precautionary motive for revolving credit card balances. Access to new debt may be limited when facing adverse shocks (income/wealth, health, and so on), but (under current U.S. law) lenders cannot demand immediate payment of outstanding balances. Future credit reductions could come in many forms, including being unable to open a new line of credit, or more relevantly, losing access to currently available sources. Using the Federal Reserve Bank of New York Consumer Credit Panel data, Fulford (2015) documents that credit limits vary over time, and that there is a significant and positive probability of experiencing a credit limit reduction. Moreover, this credit reduction is observed across consumers of all credit quality levels.[12] This credit risk (not being able to borrow or use currently available credit in the future), in combination with legal credit card holder rights (lenders cannot demand early repayment of outstanding balances on unsecured debt), may be what potentially motivates some individuals to revolve their credit card balances while keeping some liquid assets on hand that could have been used to repay revolving balances. Druedahl and Jorgensen (2015) provide a complete catalog of what is needed to generate a large borrower-saver group in their augmented buffer-stock model of savings. Individuals have to be impatient enough, have the right degree of risk aversion, and they must perceive income and credit risk as positively correlated. Their model also predicts that

[12]Similarly, VantageScore Solutions (2011) reports that as a response to the Credit Card Act of 2009, many lenders reduced credit limits and closed lines of credit on existing customers to reduce their exposure to market risk. Importantly, this credit reduction was seen across all levels of initial credit quality (credit card holders in the lowest (highest) Vantage score range, 501–600 (901–990), had their limits reduced by 58 (56) percent).

the borrower-saver behavior that defines the puzzle group is most optimal for individuals with intermediate levels of financial net worth. The richness of the NLSY79 allow us to test the predictions of this model as well. We refer to this explanation as the precautionary borrowing hypothesis.

Finally, Telyukova (2013) explains the borrower-saver puzzle as a need for liquidity: certain expenses can only be paid for in cash (e.g., mortgage or rent, utilities, babysitting, child/elder care services, or taxes).[13] Her explanation could be interpreted as cash being committed for future expenses that require liquid payment, a hypothesis that combines the timing-mismatch explanation and the precautionary borrowing explanation of the credit card debt puzzle. Unfortunately, the NLSY79 contains very limited information on spending, except for information on mortgages and other types of debt (like car loans and student debt), and we are not able to formally test her model. One implication of Telyukova's model is that the size of the puzzle group should decline as credit cards usage becomes more widespread, a pattern we observe in the NLSY79. However, there are several alternative explanations for this trend over our sample 2004–2012 period, such as the overall reduction in credit supply during and following the financial crisis, and/or possible side effects related to the Credit Card Act of 2009.

4 Comparisons Across the Four Groups

In this section, we compare respondents in the four different groups along several dimensions, each considered separately. (Most variable definitions can be found in Appendix A.) Table 4 provides a quick summary of the differences across groups in 2004, while a series of tables in Appendix A, Tables A.4–A.10, present more detailed statistics including the formal tests for differences in means. Figures A.2–A.4 depict the distributions of some of these variables.

To preview our findings, respondents in the puzzle group are very similar to savers in many ways: they have similar AFQT scores, and levels of education, financial literacy

[13] While in reality some of these expenses may be charged to a credit card, in many cases they involve paying a fee.

and financial knowledge. On the other hand, those in the puzzle and saver groups have much higher levels of AFQT scores, education levels, and financial literacy scores than those in the borrower and neutral groups. The puzzle group has slightly lower family income and lower wealth than the saver group, but respondents in the puzzle group are notably wealthier than those in the borrower and neutral groups.

When comparing the borrower-savers in the puzzle group to the saver group, what most distinguishes the former is their appetite for credit (borrower-savers have the highest loan application rates among all groups), their attitudes towards risk and time preferences (borrower-savers have higher discount rates than savers, and are more likely to have middle levels of risk aversion), and higher credit risk (actual and perceived).

We reach similar conclusions when comparing respondents in the puzzle group with savers using the strict puzzle definition. Compared to baseline savers, the different characteristics between the two groups (in terms of formal and financial knowledge, time preferences and resources) lessen or disappear. This implies that the behavior associated with the credit card debt puzzle may be strategically informed; i.e. there is some financial sophistication informing these choices at least among some subset of the puzzle group.

Education and AFQT Scores

Respondents in the puzzle and saver groups have similar levels of education and AFQT scores (a normalized average score of 59 out of 100). The puzzle group, however, exhibits much higher levels of education and AFQT scores than those in the borrower and neutral groups (with average AFQT scores of 44.6 and 30, respectively). For the top two education categories (college and advanced degrees), the puzzle group is 8–15 percentage points above the neutral/borrower groups in all three survey years, and 2–5 percentage points below the savers. For the bottom two education categories (less than high school and high school), the puzzle group is between 4–21 percentage points below the borrower/neutral groups and 2–4 percentage points above savers.

Financial Literacy and Financial Knowledge

The NLSY79 includes objective questions regarding financial literacy and self-assessed

financial knowledge—Appendix A describes these questions in detail. Although these questions are only asked in the 2012 survey year, it is unlikely that financial knowledge changes significantly beyond middle age. Using five objective questions relating to financial literacy, we first compute a financial literacy score (varying from 0 to 5) by counting the number of correct answers. Respondents are also asked to rate their strength at managing day-to-day money matters, and their financial knowledge on a scale of 1 to 7 (a larger number indicates higher skills).

Members of the puzzle and saver groups are very similar in terms of their financial knowledge and literacy. While savers score higher in both categories, the discrepancies are quite small and many times are not statistically significant. Conversely, by a substantial margin, the borrower and neutral groups exhibit statistically significant lower levels of financial literacy, and to a lesser extent, lower levels of self-assessed financial knowledge. For the purpose of our regressions, we construct two dummy variables that indicate whether a respondent has above-median financial literacy or above-median self-reported financial knowledge.

Preferences: Risk Aversion, Discount Rates, and Present Bias

Over the years, NLSY79 respondents have been asked several questions that can be used to construct proxies for preference parameters such as risk aversion and impatience—more details are supplied in Appendix A. We explore observed differences in such parameters across groups to assess their importance.

Following the methodology described in Barsky et al. (1997) and Kimball, Sahm, and Shapiro (2008), we construct an ordinal measure of risk aversion that divides respondents into four risk aversion groups. We use 1993 data, the earliest year the question was asked, to minimize the effect of confounding current background risk and classify respondents into middle risk aversion and others. Middle risk aversion is a dummy variable equal to one if the respondent is in groups 2 or 3 of risk aversion, and zero if the respondent is in either group 1 or 4 (that is, we lump the two extremes into the zero category). We follow Druedahl and Jorgensen (2015), who find that a sizeable puzzle group can be generated only if households are neither too risk tolerant nor too risk averse. Fulford

(2015) also highlights the importance of preference heterogeneity in risk aversion. About 30 percent of the respondents are in the middle risk-aversion group according to this simple definition. Puzzle group respondents are more likely to be in this category than borrowers and neutrals, and they are very similar to savers in this characteristic.

To explore the differences in discount rates across respondents, based on questions from the 2006 wave designed to measure long-term and short-term patience, we construct two dummy variables, high discount rate and present bias. The high discount rate dummy is equal to one if a respondent is below the median level of measured long-term patience, and is zero otherwise. Present bias is a dummy variable based on a measure that compares a respondent's short-term and long-term time preferences. It is equal to one if the measure is below the median level for all respondents, and is zero otherwise. Compared to savers, respondents in the puzzle group have higher discount rates but similar levels of present bias. Consistent with the findings on present bias in Meier and Sprenger (2010), respondents in the borrower and neutral groups compared unfavorably with the members of the saver and puzzle groups.

Financial Resources

In 2004, the average family income for the borrower-saver group is $89,295. The average family income for the saver group is $97,195, about $7,900 higher. Those households in the borrower and neutral groups have significantly less annual income ($33,478 and $49,345, respectively). Household wealth as reported in the 2004 survey paints a similar picture: the saver group has accumulated the most wealth and the neutral group the least amount. On average, respondents in the saver group have accumulated about $492,574; those in the puzzle group $322,574, almost $170,000 less, and those in the borrower and neutral groups $129,540 and $67,574, respectively. In 2004, compared to all the other groups, the puzzle group has higher total debt (including credit card, mortgage, car, student, and other types), averaging close to $144,000 per household.

Besides reporting amounts for different assets and liabilities, respondents in the NLSY79 are asked to estimate their current net asset position: do they currently have money left over, do they break even, or are they in debt? When comparing answers about net assets

to calculated net worth, it is clear that the majority of respondents understand their overall financial situation. In 2004, around 87 percent of the respondents in the puzzle and saver groups report having money leftover (positive net worth), about 9 percent report breaking even, and 5 percent report net indebtedness. For the borrower group, these respective numbers are 67 percent, 18 percent, and 16 percent. For the neutral group, 49 percent, 29 percent, and 23 percent, respectively.

The large fraction of respondents in the borrower-saver category reporting positive net asset positions indicates that, on average, the puzzle group members are not experiencing significant amounts of financial distress, contrary to those in the borrower and neutral groups. However, respondents in the puzzle group hold substantially less wealth and more debt than their counterparts in the saver group. In terms of portfolio composition, respondents in the puzzle group are more likely to have other types of debt (car debt, mortgage, and student loans) than other respondents. Interestingly, they are also more likely to be homeowners, and just slightly less likely than savers to own stocks and mutual funds. They also have less home equity than savers, averaging 44 percent of the home's value in 2004—this difference stems from larger mortgages as opposed to self-reported differences in home values.

Access to Credit

Individuals in the puzzle group appear to have a greater appetite for credit and relatively good access to it. In 2004, 2008, 2010, and 2012, respondents answered questions regarding credit/loan applications in the last five years: whether they applied for credit, whether they thought about applying for credit but changed their minds, and whether they were turned down for new credit.

Respondents in the puzzle group are the most likely to have applied for credit in the last five years and the least likely to have changed their minds about applying. For example, in 2004, 67 percent of respondents in the puzzle group had applied for credit, compared to 55 percent of borrowers, 51 percent of savers, and 18 percent of neutrals. Puzzle group respondents were also less likely to have been turned down for credit when compared to those in the neutral and borrower groups, but more likely to be turned

down than savers. In 2004, 19 percent of the puzzle group had been turned down when applying for a loan, compared to 13 percent for savers, 41 percent for borrowers and 44 percent for those in the neutral group.

Income Volatility

Respondents with high income volatility may have an incentive to maintain sufficient levels of liquid monetary assets to insure against a potential future decline in access to credit. Obtaining an accurate measure of expected income volatility is required in order to investigate whether the puzzle group's behavior is motivated by the desire to insure against income risk.

A simple approach is to assume that past income volatility signals future income volatility. Our simplest measure of volatility (down risk in particular) is the cumulative number of times family income fell by at least 20 percent during the last six years. This measure does not take into account whether the respondent was able to predict the income decline. Therefore, we also create a measure of income volatility that removes the deterministic component of income. Following Gorbachev (2016), for each year of data, we first compute biennial arc growth rates of real income as $gy_{i,t} = (y_{i,t} - y_{i,t-2})/\bar{y}$, where $\bar{y} = (y_{i,t} + y_{i,t-2})/2$. We then regress arc income growth $gy_{i,t}$ on cohort, age, race, and gender dummies.[14] We compute income volatility as the absolute value of the residuals obtained from this income regression.

While past income volatility may be indicative of future income volatility, this is not always the case. To allow for this possibility, we also construct a measure of income uncertainty based on the standard deviation of forecast errors, augmenting the methodology described in Li and Feigenbaum (2012). In particular, we run a regression of the log of (real) family income on the information available to the respondents at the time of the interview, including past income shocks.[15] Using a linear projection, we forecast

[14]Income volatility constructed this way differs from the usual measures in important ways: this measure minimizes outliers, is symmetric, and is bounded between –2 and 2.

[15]The regressors include a time trend, gender and education dummies, and their interactions with the time trend, a quadratic term based on age, two- and four-year lags of the log of real family income, and two-year lags of marital status dummies, occupation and industry dummies, number of children and adults in the household, number of hours worked by the husband and/or wife, and the percent of time spent unemployed and out of labor force during the past year.

family income one period ahead, and construct *forward volatility* as the standard deviation of the difference between realized and expected income. The more forecasted income deviates from actual income, the larger is the income uncertainty that respondents are expected to face.

It is possible that the measures of income volatility described above could suffer from mismeasurement: what an econometrician considers volatility/uncertainty might not actually be uncertainty to an individual, and vice versa. To overcome this problem, we also construct measures of income volatility that are based on detailed work histories. In particular, we utilize answers to the question, *"What is the main reason you happened to leave this job?"* This response is as close as we can get to measuring an unexpected (exogenous) income shock. We create an unexpected job loss variable, termed job shock, that includes the total number of times since the previous interview, that a respondent lost his/her job for unexpected reasons (such as being discharged or fired, laid off, job eliminated, business closings, business bankruptcies, and/or failure, quits for disabilities or health reasons). We also construct a similar measure of voluntary separations, termed job quit, to measure the number of times an individual voluntarily quits work (to look for or to take another job, or to stay at home due to pregnancy, or to take care of family members, to attend school, or to move to another geographic location).

In 2004, respondents in the puzzle group are basically indistinguishable from savers when considering four of the five income volatility measures just described (down risk, forward volatility, job shock, and job quit), while overall savers have higher past income volatility. Across all groups and most definitions of income uncertainty (except those constructed on work histories), there is a slight increase in income uncertainty over the 2004–2012 time period. In all periods, by a wide measure the neutral group has the most volatile incomes. On average, respondents in the puzzle group seem to have the lowest income volatility of all groups (see Table A.10 in Appendix A for more details).

5 Regression Results: Testing Explanations for the Credit Card Debt Puzzle

The rest of the paper examines what factors determine the probability of being in the puzzle group, where we try to disentangle the different reasons motivating this behavior. In particular, we test to what extent individual preferences (discount factors and risk aversion), formal education, financial literacy, and financial knowledge seem to predict the borrower-saver phenomenon. Most importantly, we test the precautionary borrowing hypothesis: do individuals with high future credit risk respond by borrowing on their credit cards while keeping some monetary assets on hand to insure against the possibility that credit constraints will prove binding in the future? For the United States, Fulford (2015) documents that the volatility of credit card limits is much larger than the volatility of income. He interprets this finding as indicative of credit risk, and proceeds to show that in a model of rational consumers, credit risk can lead to the behavior known as the credit card debt puzzle. In a similar vein, Druedahl and Jorgensen (2015) show that the puzzle behavior can be generated in a buffer-stock model of savings if adverse income shocks are perceived to be positively correlated with a reduction in available credit.

We pool all three years of credit card data together (2004, 2008, and 2012), and estimate weighted linear probability regressions (WLS) of the form:

$$\boldsymbol{P_{ist}} = \alpha + \boldsymbol{N_i}\theta + \boldsymbol{M_i}\gamma + \boldsymbol{X_{it}}\beta + \boldsymbol{F_{it}}\eta + \mu\boldsymbol{L_{it}} + \nu\boldsymbol{\sigma^Y_{it}} + \lambda_t + \lambda_s + \boldsymbol{\epsilon_{i,t}}, \tag{1}$$

where $\boldsymbol{P_{ist}}$ is a vector of dummy variables that is equal to one if individual i who lives in state s at time t is in the puzzle group and is zero otherwise. The vector $\boldsymbol{N_i}$ measures the respondents intelligence as proxied by the AFQT score, level of completed education, financial literacy and self-assessed financial knowledge (the last two are dummies for being above or below the median); the vector $\boldsymbol{M_i}$ measures personal traits that may affect the desire for credit such as risk aversion (being in the middle group vs. the rest and time preferences (being below or above the median discount rate and the median present-bias measure); a matrix $\boldsymbol{X_{it}}$ measures demographics including age, race, gender, marital

status, and the presence of children in the household. $\boldsymbol{F_{it}}$ is a financial information matrix: it has a dummy variable for whether the respondent is a net debtor (based on the self-assessed measure of total liabilities exceeding total assets) and dummy variables for the respondent's past demand for credit. The vector $\boldsymbol{L_{it}}$ denotes credit risk, and is measured with a dummy equal to one if, in the past five years, the respondent applied for and was denied credit, and is zero otherwise—the assumption is that individuals who were denied credit in the past are more likely to expect rejection in the future.[16] The sign and statistical significance of the coefficient μ is our primary interest, and we expect μ to be positive. The vector $\boldsymbol{\sigma_{it}^{Y}}$ serves as our measure of income volatility. We include time fixed effects, λ_t, to control for aggregate market changes, and any other time trends. We also include state fixed effects, λ_s, to control for differences in personal bankruptcy regulations across the states, along with any other time invariant differences across states that may affect the probability of being in the puzzle group. Standard errors are clustered by respondent in all regressions.[17]

According to the summary statistics, respondents in the puzzle group are very similar to savers, so in the main text we present results comparing respondents in the puzzle group to savers—comparisons to all other respondents can be found in Appendix B, Table B.1. In Table 5, columns (1)–(4), we present results for the baseline puzzle definition (positive balances on credit card debt and liquid savings), while column (5) focuses on the strict puzzle definition, ($500 in credit card debt and one month of annual income in liquid savings).

In column (1), we control for demographics, time preference parameters, risk aversion, intelligence, formal and financial knowledge, and aggregate shocks. Relative to savers, individuals who more heavily discount the future are 5.4 percentage points more likely to be in the puzzle group, while individuals falling in the middle of the risk aversion spectrum are 2.8 percentage points more likely to be in the borrower-saver group. Present bias does

[16]We also experiment with defining credit constrained individuals as those who applied and were denied credit plus those who were discouraged from applying because they thought that they would be denied credit. The results presented in the paper are not sensitive to this change in the definition of credit constraints, see Tables B.4 and B.5 in Appendix B.

[17]Probit regressions give qualitatively similar results. Results are available upon request.

not seem to have a statistically significant effect, as expected. The effect of impatience is consistent with the accountant-shopper model of Bertaut, Haliassos, and Reiter (2009). The fact that both discount rates and risk aversion matter for placement in the puzzle group is consistent with the model of credit risk posited by Druedahl and Jorgensen (2015).

Demographic results, not tabulated in the interest of brevity, indicate that black respondents are less likely to be in the puzzle group, while women are more likely to be in this group. Racial effects are difficult to explain, but may be related to the credit available to certain groups. A married couple with children is 8.8 percentage points more likely to be in the puzzle group. The probability of being in the puzzle group has been declining over time, a development that might reflect changes in credit card lending following the Credit Card Act of 2009 (it has been argued that this regulation has made credit cards less available in general), or more general credit supply restrictions enacted during the Great Recession.

Turning to the effect of intelligence, education and financial literacy, individuals with more formal and informal knowledge are less likely to be in the puzzle group. Having a college degree lowers the probability of being in the puzzle group by 6.1 percentage points. Having above-median financial literacy decreases the probability of being in the puzzle group by 4.9 percentage points, while having above-median self-assessed financial knowledge does not have an additional effect beyond the previous controls. This result differs from Gathergood and Weber (2014), who find no differences in financial literacy scores between respondents in the puzzle and saver categories.[18] Interestingly, higher AFQT scores are associated with a higher probability of being in the puzzle group, all else constant—a one standard deviation higher AFQT score increases the probability of being in the puzzle group by 2.9 percentage points.[19]

In column (2), we control for credit risk and income volatility, and ultimately test the

[18]This difference might come from several sources, including the fact that the questions on financial literacy differ greatly between the two datasets, as well as the different types of debt being used to create the puzzle group. We define the puzzle group as those individuals who co-hold credit card debt and positive liquid assets, while Gathergood and Weber (2014) count all debt except mortgages in their definition.

[19]We have verified that the sign of this coefficient is not the result of multicollinearity.

precautionary borrowing hypothesis. We find that respondents with higher levels of credit risk are significantly more likely to belong to the puzzle group, keeping all else constant. In particular, a one percentage point increase in the probability of being denied credit is associated with a 4.8 percentage point increase in the likelihood of belonging to the puzzle group. Income volatility does not have an independent, statistically significant effect in these regressions. This result is similar to that of Gathergood and Weber (2014), who control for subjective measures of income and credit risk in their regressions, and find that only credit risk has predictive power.[20,21]

In column (3), we include state fixed effects. We find that this inclusion does not change our main results or the regression's predictive power, a result that casts some doubt for the strategic bankruptcy hypothesis. We expand on this observation in Section 6.2.

In Table 5, column (4), we show the results after including information on the individual respondent's overall balance sheet. In particular, we include a self-reported measure of net assets (a dummy variable equal to one if assets are higher than liabilities), a home-ownership dummy conditional on whether or not there is a mortgage on the property, and dummies for the presence of car loans and student debt. Not surprisingly, people with positive net worth are less likely to be in the puzzle group, and are 5.4 percentage points more likely to be savers. On the other hand, having other types of debt results in a higher probability of puzzle-group membership: the presence of a mortgage, car loans, and student debt increase the probability of being in the puzzle group by 18, 14.4, and 13.6 percentage points, respectively. These results may speak to liquid savings already being earmarked for certain expenditures, consistent with Telyukova (2013), or to debt repayment prioritization by the respondents.

To rule out the possibility that our results are simply driven by timing mismatch—

[20]We experimented with all the different measures of income volatility described in Section 4, but ultimately chose to present the results obtained from our most exogenous measure, job shock, for brevity and for better sample size. The results using other measures are similar and are available upon request.

[21]We also constructed measures of permanent and transitory income volatility since it is easier to insure against transitory income shocks than permanent income shocks, but for each shock the results were the same: credit risk matters, not income volatility. However, these results should be taken with a grain of salt since it is notoriously difficult to construct measures of permanent and transitory volatility of individual income.

the reality where liquid assets are already committed to expenses, though it appears that respondents have funds available to repay revolving credit card debt—we focus on the strict definition of the puzzle group in column (5). The number of observations is lower because under this definition there are fewer respondents in both the puzzle group and the saver category.[22] The main changes with the strict puzzle definition are as follows: (1) the coefficient for the middle risk aversion dummy turns negative, but it is very small and statistically insignificant; (2) the effect of AFQT scores disappears; (3) the effect of having a mortgage goes away, but the coefficient on homeowners without a mortgage becomes significant: homeowners who own their homes outright are 11.7 percentage points more likely to be savers.

Robustness Checks

So far, we have used information on being credit constrained in the past five years to measure future credit risk. Our working assumption has been that individuals who were denied credit in the past are more likely to expect some nonzero probability of future rejection. This backward-looking credit constraint measure is potentially problematic since it may be correlated with unobserved heterogeneity terms. In fact, a backward-looking credit risk measure could be conflating the inherent appetite for credit that the puzzle group seems to exhibit with the strategic behavior we are trying to test: holding liquid assets with positive levels of revolving credit card debt. In other words, it is possible that what has led an individual to be in the puzzle group in the first place, is what led her/him to experience credit constraints in the past. To deal with this endogeneity problem, ideally we would like to instrument for credit risk. Not being able to find a good instrument, we address the identification problem by using *predicted* credit risk instead of actual (past) credit risk in our regressions.

In particular, we predict credit risk at time t as a function of: (1) the respondents' intelligence, education and financial knowledge, $\boldsymbol{N_i}$, and preferences, $\boldsymbol{M_i}$, as defined in equation (1); (2) backward-looking measures of demographics, $\boldsymbol{X_{it-s}}$, such as information

[22]To achieve a symmetric treatment of respondents in the puzzle and saver groups, we also require that savers had at least one month of annual income in liquid assets. The results are very similar if the saver group is kept unchanged.

on marital status and the presence of children in the household at time $t-2$ and $t-4$; (3) past financial information, $\boldsymbol{F_{it-s}}$;[23] and (4) income volatility, $\boldsymbol{\sigma_{it}^{Y}}$.[24] We pool all years together in our estimations and include time fixed effects, λ_t, to control for time varying needs for liquidity; and state fixed effects, λ_s, to account for time-invariant differences across states that may affect individuals' access to credit. (Standard errors are clustered by respondent.) In words, an individual's expected credit risk depends on his/her expectation of future need for liquidity, which in turn depends on the expected magnitude of future adverse shocks (proxied by income volatility), the individual's overall needs (proxied by demographic characteristics), his/her financial position, as well as his/her preferences and knowledge.

The results from this estimation are summarized in Table 6. In column (1), we include all controls except income volatility. Respondents who are more present-biased and who have higher discount rates are more likely to be credit constrained. Risk-tolerant respondents are 2.5 percentage points less likely to be credit constrained, while those with middle levels of risk aversion are statistically the same as the most-risk averse respondents. Credit-constrained individuals are generally less educated than those without credit constraints, have lower levels of financial literacy, and significantly lower levels of self-assessed financial knowledge. Individuals whose total liabilities exceeded total assets at $t-4$ are almost 14 percentage points more likely to be credit constrained than other respondents. Individuals with prior car loans are 3.2 percentage points more likely to be credit constrained, but having a mortgage in the past does not predict future rejections for credit. Not surprisingly, individuals who changed their minds about applying for credit, anticipating that they would be denied credit, are almost 14 percentage points less likely to be denied credit, holding everything else constant.

[23] In particular, we include a dummy variable for whether the respondent applied for credit any time during the past five years; a dummy variable for whether the respondent decided not to apply for credit any time during the past five years because she thought she might be denied credit; a dummy variable for whether a respondent's total liabilities exceeded total assets at $t-4$; and dummy variables for mortgage and car debt, separately, at $t-4$.

[24] Income volatility is measured based on income variability between t and $t-6$ based on the income volatility measure used. Including variability of income between t and $t-2$ assumes that individuals have some private information regarding future income shocks. See Hendren (2015) for support of this assumption.

In columns (2)–(4), we present the results that control for income volatility. In column (2), we use the down-risk measure (the total number of times family income fell by more than 20 percent over the last 6 years). In column (3), we use the absolute value of the residuals from backward-looking income regressions that remove the deterministic component of income. In column (4), we use the most exogenous measure of income volatility (job shock, or the number of jobs that ended unexpectedly since the last NLSY interview), and its two-year lag.[25] Irrespective of how income volatility is measured, we find that respondents with higher past income volatility are significantly more likely to be credit constrained. We use column (4) as our preferred specification, since it uses the most exogenous set of regressors (in particular, income volatility) while maintaining the largest sample size. We construct our measure of credit risk as the predicted probability of being credit constrained based on the estimated equation. Predicted credit risk and past credit risk are both standardized (mean zero and a standard deviation of one) for easier comparison of the effects of these two variables.

In our baseline specification given by equation (1), using this predicted credit risk instead of the actual credit risk as a regressor, we find further support for the precautionary borrowing hypothesis (see the top panel of Table 7). As expected, the coefficient on the credit risk measure increases from 0.048 to 0.075. According to this more exogenous specification, a one standard deviation increase in the predicted probability of being credit constrained is associated with 7.5 percentage point higher probability of belonging to the puzzle group, all else equal. Other results remain virtually unchanged.[26] The only exception—the effect of income risk, as measured by the exogenous job shock variable—is now statistically significant and negative in the baseline specification, but is nearly zero and insignificant once we include financial controls. Income risk remains statistically insignificant with the strict definition of the puzzle.

We also test the stability of our results to the inclusion of a forward $(t + 4)$ measure of predicted credit risk in our regressions instead of the contemporaneous measure of

[25] In results not shown for brevity, we also controlled for income uncertainty using forward (forecast) income volatility. We found that this variable has very little predictive power.

[26] See Table B.2 in Appendix B for complete results, and Table B.8 for multinomial logit regressions.

predicted credit risk. This lets us control for the fact that there might still be some endogeneity in our predicted credit risk variable due to the fact that the measure is derived in part from questions on whether a respondent chose to apply for credit in the last five years, or not to apply for credit during the last five years because s/he thought the request might be denied. The forward measure of predicted credit risk is significantly less likely to have this problem, especially since we also control for risk aversion and time preferences in our regressions. Moreover, to further control for endogeneity, we also use four-year lags of financial variables.

In Table 7, the middle panel, we present results from our most exogenous specification. Including the forward measure of predicted credit risk and four-year lagged measures of financial variables significantly reduces the sample size because we lose 2004 and 2012 data. Importantly, this specification does not change this section's main results. The only notable change is that the middle-risk aversion term, while still positive, is no longer statistically significant.[27]

Moreover, individuals might have private information about their future income risk and might react to this information (as they learn it) before the shock is actually realized. Hendren (2015), using PSID data, finds that individuals have some private information about their likelihood of becoming unemployed and that their consumption falls two periods before an unemployment shock is realized. Thus, it is likely that in anticipation of possible future income shocks that may lead to tighter credit constraints, individuals respond by borrowing while their credit is still good and income is still steady, and keeping some liquid assets on hand. We test this hypothesis by including a forward $(t + 4)$ measure of income risk. These results, shown in the bottom panel of Table 7 support this hypothesis.[28] Individuals who expect to experience job loss in the future are more likely to belong to the puzzle group than to the saver category. In fact, as the likelihood of future job loss rises by one standard deviation, the probability that an individual belongs to the puzzle group rises by a statistically significant 3 percentage points. With the inclusion of forward income risk, other results remain unchanged.

[27]Full results of this specification are available in Table B.3 in Appendix B.

[28]In Appendix B, Table B.4 presents the full results.

Finally, using our most exogenous specification, we find that when faced with high future credit risk, the more financially literate respondents are more likely to belong to the puzzle group than the saver group. In particular, we estimate equation (1), including an interaction of financial literacy and predicted credit risk. Table 8 shows these results.[29] Comparing respondents in the puzzle group to savers, the coefficient on this interaction term is positive and statistically significant both for the basic and the strict puzzle definition.[30] According to the puzzle's strict definition, the increase in credit risk has no explanatory power for respondents with lower financial literacy scores. On the other hand, financially literate individuals are 6.5 percentage points more likely to belong to the puzzle group (be borrower-savers) than to be savers when their credit risk is one standard deviation higher than the mean (all else equal).

We further explore this result by focusing on the interaction of predicted credit risk and a dummy variable for whether a respondent answers a question on compound interest correctly (the second question in Appendix A). Respondents who understand the concept of compound interest and have one standard deviation higher credit risk than the mean are 9 percentage points *more* likely to belong to the puzzle group than to be savers, all else equal. On the other hand, respondents that incorrectly answer the interest rate question are not statistically different from savers in their responses to credit risk.

To summarize, we find that credit risk, private information about future income shocks, time preferences, risk aversion and other financial obligations all play a role in distinguishing the puzzle group from the saver group. On average, individuals in the puzzle group have slightly lower financial literacy and fewer completed years of formal education than those in the saver group. However, as an individual's credit risk rises, more financially savvy respondents have a greater likelihood of belonging to the puzzle group than to the saver group. In other words, the membership characteristics that define the puzzle group are quite mixed: some consumers seem to be acting strategically given

[29]Full results are in Table B.4 in in Appendix B.

[30]Interestingly, interactions between credit risk and other measures of knowledge are never statistically significant, except for the interaction with the AFQT score. The coefficient on the interaction with the AFQT score is positive and statistically significant. We also examined interactions of credit risk with time discounting, risk-aversion, and present-bias dummies, but found these interactions to be statistically insignificant.

their shocks, and their time and risk preferences, while others may not fully understand how costly this borrower-saver behavior can be.

6 Exploring the Panel Dimension

We exploit the data's panel feature by first looking at transitions from the puzzle group to the saver group and from the saver group to the puzzle group. We then explore how membership in the puzzle group affects the probability of future financial distress, measured by bankruptcy and/or foreclosure.

The findings in this section are subject to a data caveat: since answers about credit card debt and liquid assets are only available every four years, we cannot determine what happens to respondents' co-holding patterns in the years in between the NLSY79 surveys.

6.1 Transitions Into and Out of Puzzle

Starting with respondents in the puzzle group at time $t-4$, we define a transition from the puzzle group to the saver group ($P \to S$) as a dummy variable equal to one at time t if the respondent transitions from the puzzle category to the saver category at time t, and equal to zero if the respondent remains in the puzzle group. Analogously but starting with savers at $t-4$, a transition from the saver group to the puzzle group ($S \to P$) is a dummy variable equal to one at time t if the respondent transitions from the saver group to the puzzle group at time t, and is zero if the respondent remains in the saver group at time t.[31]

In Table 9, columns (1) and (2), present the results for transitions from the puzzle group to the saver group for the baseline and the strict puzzle definitions, respectively. We find that time discounting, homeownership, and (predicted) credit risk play a major role in predicting these transitions. Respondents with lower discount rates are 3.4 percentage

[31]Respondents who transition to other groups are dropped from these regressions without loss of generality. See Table 3 for transition rates. Tables B.9–B.10 in Appendix B present results from multinomial logit regressions, which includes transitions to other groups, focusing on the strict puzzle definition and the predicted measure of credit risk for brevity. These results are consistent with those obtained using linear probability models.

points more likely to transition from the puzzle group to the saver group. As respondents become more optimistic about their ability to obtain credit, their need for hedging (or precautionary saving via revolving credit card debt) falls; hence, they become more likely to pay down their credit card debt and transition from the puzzle group to the saver group. Specifically, as the change in predicted credit risk falls by one standard deviation, the likelihood of transitioning from the puzzle group to the saver group rises by 2.5 percentage points, according to the puzzle's baseline definition. Having past $(t-4)$ car loans and student debt lowers the likelihood of transitioning from the puzzle group to the saver group by 4.6 and 6 percentage points, respectively.

Under the puzzle strict definition, discount rates play a significantly more important role than any other variables, except homeownership, in predicting transitions from the puzzle group to the saver group. Respondents with lower discount rates are 10.4 percentage points more likely to transition from the puzzle group to the saver group, but the change in credit risk, while of the same sign as in the baseline definition, has no statistical power in these regressions. Moreover, being a homeowner (at $t-4$) increases the transition likelihood by a substantial and statistically significant 22 percentage points for those in the strict puzzle group who have a mortgage, and by 25 percentage points for those without a mortgage. This finding could be explained by the fact that home-equity loans can also be used to smooth consumption, and these lines of credit are typically more cost-effective than credit card debt—they likely entail lower interest rates and partially reduce income tax obligations.

Including state fixed effects does not change our results for the baseline or the strict puzzle definition. There are substantially more transitions from the puzzle group to the saver group between 2008 and 2012 than between 2004 and 2008. Given that both income risk and (likely) credit risk rose for many individuals during the 2008–2012 period because of the Great Recession, we would have expected more transitions from the saver to the puzzle group during this period, not less. This finding is indeed intriguing, and may speak of an increased cost of this behavior, amongst other reasons, as we discuss in Section 7.

In Table 9, columns (3) and (4) contain the results for transitions from the saver group

to the puzzle group. Depending on the puzzle definition used, we find that respondents with middle levels of risk aversion are 5 to 6 percentage points more likely to transition from the saver group to the puzzle group. Moreover, those with increased credit risk and previous car loans and student debt are also more likely to transition from being savers to borrower-savers. On the other hand, homeowners without a mortgage (at $t-4$) are between 9.3 and 13.7 percentage points less likely to change groups. There is no statistically significant change in the likelihood of these transitions over time.

Fixed Effects

Although the NLSY79 has a great deal of information about respondents, unobserved factors could still be affecting our results. To address this issue, we run individual fixed effect regressions, controlling for other potentially important, but unobserved individual specific traits to determine the robustness of our findings. It is noteworthy that our results regarding the importance of the precautionary borrowing hypothesis do not change; the effect of predicted credit risk on puzzle membership is highly significant for both our baseline and strict puzzle definitions—see Table 10.[32] Since the effect of credit risk is identified from respondents whose credit risk changes over time, these results are most comparable to the transition results previously discussed.

6.2 Are Puzzle Respondents More Likely to Have Financial Trouble in the Future?

We examine whether being in the puzzle group can predict the likelihood of future financial trouble. In particular, we focus on bankruptcy and foreclosure decisions. Respondents in the NLSY79 are asked if they filed for bankruptcy, and when, several times throughout the survey. Foreclosure questions are asked only in 2010 and 2012 (for the 2009–2012 reference period). We construct dummy variables to indicate whether a respondent filed for bankruptcy or went through foreclosure any time during the 2009–2012 period. During these years, 3.3 percent of our sample respondents filed for personal bankruptcy, while

[32]Full results are in Table B.7 of Appendix B.

5.2 percent of respondents who were homeowners went through foreclosure. Table 11 summarizes the bankruptcy and foreclosure rates for each group (puzzle, borrower, neutral or saver). Using our baseline puzzle definition and classifying respondents based on 2008 financial information, borrowers have the highest bankruptcy and foreclosure rates (8.7 and 22.6 percent, respectively), and savers have the lowest rates (0.6 and 2 percent, respectively). Differences in bankruptcy and foreclosure rates between the puzzle and saver groups exist (4.4 versus 0.6 percent for bankruptcy, and 5.7 versus 2 percent for foreclosure), but fall slightly when we move from the baseline to the more strict definition of the puzzle behavior (2.9 versus 0.4 percent for bankruptcy, and 3.2 versus 1.1 percent for foreclosure). We also calculate bankruptcy and foreclosure rates for the 2005–2008 period, based on 2004 data regarding assets and liabilities. The overall bankruptcy rate during this four-year period is slightly lower at 2.7 percent.

Going forward, we study the 2009–2012 period and focus on comparisons between borrower-savers and savers. We estimate weighted linear probability regressions for each outcome controlling for whether the respondent was in the puzzle group in 2008 as well as using other typical controls in bankruptcy/foreclosure regressions. Foreclosure regressions are restricted to the sample of homeowners as of the 2008 survey. We consider both our baseline and the stricter puzzle definitions. We construct dummies for whether the respondent goes through a divorce or experiences an onset of health problems that limit their ability to work during the 2008–2012 period. We also control for the amount of debt and assets respondents have in 2008 (in logs), their net worth position (a dummy), self-employment, and whether they filed for bankruptcy before 2009. Other controls include demographics, education, financial literacy, financial knowledge, AFQT scores, present bias, risk aversion, discount rates, and state fixed effects. The regression results are summarized in Table 12 (for brevity, some coefficients are not reported in the table).

Individuals with higher discount rates are more likely to go through bankruptcy or foreclosure—an exception is how the strict puzzle category affects the likelihood of foreclosure. Health and divorce shocks affect outcomes in both baseline and strict puzzle

definitions, and higher levels of debt precede bankruptcy filings and foreclosure.[33] Being self-employed in 2008 is positively correlated with both bankruptcy and foreclosure. Age, race, gender, AFQT scores, risk aversion, present bias, financial literacy and financial knowledge do not predict bankruptcy or foreclosure during this period. Individuals who previously experienced at least one bankruptcy are less likely to file for bankruptcy (which is not surprising since under U.S. law, it may not be possible for them to file again quite yet), but they are more likely to go through foreclosure (under the baseline definition of the puzzle, not the strict definition). As expected, respondents with more financial liabilities than assets are more likely to file for bankruptcy or go through foreclosure. Individuals with a college education or more are less likely to undergo foreclosure.

Turning our attention to the coefficient of interest, when using our baseline puzzle definition, we find that being in the puzzle group in 2008 increases the probability of filing for bankruptcy by 3.1 percentage points (relative to savers). When focusing on the strict puzzle definition, at 1.8 percent, the coefficient is lower but it is precisely estimated. These are substantial effects, given that the unconditional probability of filing for bankruptcy in the sample of borrower-savers and savers is 2.7 percent for the baseline definition and 1.45 percent for the strict definition.

Being in the puzzle group in 2008 also correlates with experiencing foreclosure: these individuals are 2.3 percentage points more likely to report this outcome. When considering the stricter definition of the puzzle, there are no statistical differences between savers and respondents in the puzzle group in terms of foreclosure. The fact that the coefficients are smaller for the strict puzzle definition indicates that it is those puzzle group respondents with little savings relative to debt (those who are more similar to borrowers) who mostly go through foreclosure.

Further, we explore whether it matters if the respondent had been in the puzzle group before 2008; the results are shown in Table 13, Panel A.[34] When considering the

[33]For the foreclosure outcome only under the strict definition of the puzzle, the health-shock coefficient is negative. We are not sure how to interpret this result other than in some states, such as California, laws exist to protect borrowers behind on their mortgage due to poor health.

[34]We experimented with 2008 savers transitioning to this category from the other three groups in 2004, but the coefficients were not statistically different from each other, so we chose not to present these results.

bankruptcy outcome for the baseline puzzle definition, respondents who were in the puzzle group in 2008 but were in the borrower or neutral category in 2004 are 5.2 percentage points more likely to file for bankruptcy between 2009 and 2012, compared to respondents who were savers in 2008. Respondents who were in the puzzle group both in 2004 and 2008 are 2.3 percentage points more likely to go through bankruptcy sometime between 2009 and 2012 compared to 2008 savers. But respondents who were savers in 2004 and in the puzzle group in 2008 have statistically the same likelihood of experiencing bankruptcy as respondents who were savers in 2008. In a statistical sense, however, the group membership in 2004, does not seem to matter for the likelihood of filing for bankruptcy sometime between 2009 and 2012. The three coefficients are not statistically different from each other.[35] Under the strict puzzle definition, the three coefficients are more similar in magnitude and again not statistically different from each other.

Respondents who were in the borrower or neutral groups in 2004 and transitioned to the puzzle group in 2008, are 7.8 percentage points more likely to be foreclosed on than those in the 2008 saver group. Respondents who transitioned from the 2004 saver group to the 2008 puzzle group are 3.1 percentage points more likely to go through foreclosure than are 2008 savers. These two coefficients are statistically different from each other with a p-value of 0.07. On the other hand, 2008 puzzle respondents who were in the puzzle group in 2004 are 1.5 percentage points more likely to be foreclosed on compared to 2008 savers. Under the strict puzzle definition, all the coefficients are statistically the same and are not different from zero.

To summarize, being in the 2008 puzzle group can predict bankruptcy but it does not much matter which of the four groups the respondent belonged to in 2004. On the other hand, under the baseline definition, respondents who were in the borrower/neutral groups in 2004 but in the 2008 puzzle, are significantly more likely to be foreclosed on than 2008 savers and other puzzle respondents.

Interestingly, being in the puzzle group in 2004 (using 2004 controls, bankruptcy

[35]The p-values for the tests "Puzzle 2008, Borrower/Neutral 2004=Puzzle 2008, Puzzle 2004", "Puzzle 2008, Borrower/Neutral 2004=Puzzle 2008, Saver 2004" and "Puzzle 2008, Puzzle 2004=Puzzle 2008, Saver 2004" are 0.38, 0.2, and 0.29, respectively.

pre-2005, net assets as of 2004, and so on) does not predict bankruptcy during the 2005–2008 period (panel B of Table 13), nor foreclosure in the 2009–2012 period. This finding suggests that unanticipated shocks experienced during the Great Recession or side-effects stemming from the Credit Reform Act of 2009 may have resulted in financial pressures for some consumers, who under less adverse circumstances may have been able to stay afloat and avoid bankruptcy.

In sum, it seems that some respondents in the 2008 puzzle group experienced significant financial trouble during the Great Recession. The fact that this effect is similar for those undergoing bankruptcy and foreclosure casts some doubt on the strategic bankruptcy hypothesis. However, we cannot completely rule out this explanation because of the differential effect for bankruptcy and foreclosure when using the strict puzzle definition (we find an effect for bankruptcy but not for foreclosure). To clarify this, in Table 13, panel C, we present results from regressions that use an additional interaction of the puzzle group dummy with a dummy variable equal to one if the respondent correctly answers financial literacy question pertaining to the concept of compound interest. These regressions reveal that it is those respondents who understand compound interest that are driving the positive coefficient for the puzzle dummy in the bankruptcy regressions, while there is no differential effect for foreclosure. We interpret this result as further evidence that some people chose to undergo bankruptcy for strategic reasons.[36]

We must note that although some individuals experience financial trouble, the majority of individuals in the puzzle group manage to simultaneously carry revolving credit card debt and keep liquid assets on hand without experiencing major financial difficulties: 94 percent of individuals do not file for bankruptcy nor undergo foreclosure between 2009 and 2012. All in all, the results again point to a very mixed group of individuals in the puzzle group.

[36]Results, not tabulated for brevity, are similar if we interact the puzzle dummy with the total financial literacy score.

7 The Cost of Revolving Credit Card Debt

In this section we explore, the costs associated with being a borrower-saver by examining information on credit card interest rates. The NLSY79 does not provide this information, so we use data from the SCF, which collects the interest rate on a individual's credit card with the largest balance. We use data from the closest years in the SCF to our NLSY79 sample (2004 for 2004, 2007 for 2008, and 2010 for 2012). In 2004, the average annual percentage rate (APR) on credit cards held by U.S. consumers was 11.6 percent, and it increased over time to 13.9 percent by 2010.

To document the changes in the distribution of the interest rates paid by consumers, we create quartiles of the range of interest rates based on the full sample of SCF respondents in 2004 (0–7.9 percent, 7.91–11.16 percent, 11.17–17 percent and 17+ percent). Keeping the thresholds the same, we examine how the distribution of puzzle respondents in each interest rate quartile evolves over time. We restrict the sample to those SCF respondents who were born any time between 1957 and 1965, inclusively, to be consistent with the age distribution of the NLSY79 sample. Figure 1 illustrates how dramatic the change in the distribution of interest rates charged to the borrower-savers has been. In 2004, 28 percent of respondents in the puzzle group were in the first quartile paying under 7.9 percent on their credit card debt, while 23 percent were in the fourth quartile paying more than 17 percent. By 2010, only 18 percent of the respondents were in the first quartile and 32 percent were in the fourth quartile.

The patterns for the stricter definition of the puzzle are even starker. In 2004, 35 percent of respondents in the puzzle group were in the first quartile, and only 15 percent were in the fourth quartile paying high fees. By 2010, the first quartile shrunk significantly to 22 percent, while the fourth quartile increased significantly to 29 percent of the respondents in the puzzle group. These trends may help explain why the size of the puzzle group declined so significantly between 2004 and 2012: as the costs of holding debt rose, these costs began to outweigh the potential benefits of borrowing on credit cards for precautionary reasons.

To illustrate how costly habitually rolling over credit card balances can be, we use

2004 SCF data and make some strong assumptions when computing these numbers. We classify respondents in the 2004 puzzle group according to the APR on the highest balance credit card, and compute average APRs, average revolving balances, and average annual family income in each quartile—see Table 14. We compute the interest cost of the average revolving balance under two assumptions: (1) the balance is paid off after one year; (2) the individual pays only the minimum monthly payment (set at the minimum of $15 or 2 percent of the total balance) and no other payments or charges are made. We find that the lower the APR, the less costly it is to carry over balances; the larger the debt and the longer you wait to repay it, the costlier it is. These results are, of course, not surprising.

Interestingly, the cost of revolving credit, relative to annual family income, is not large if the household is able to fully repay the credit card balance within one year. For people in the first APR quartile, the interest cost at the end of a year is only 0.37 percent of 2004 average annual family income, and for those in the fourth quartile, it is 2 percent.[37] On the other hand, if a family pays only the minimum payment until the credit card balance is fully paid off, the cost of rolling over debt is substantial, and grows exponentially with higher APRs. With an initial balance of $5,927 (the average for the fourth quartile) and a 20 percent APR, it takes 728 months (or over 60 years) to fully repay and the total interest cost is $26,761, or 41 percent of 2004 annual family income. If instead the APR was 25 percent, it would take that individual 960 months (or 80 years) to repay the original balance, and interest payments would amount to $181,485 or 2.79 times 2004 average annual family income. However, with a beginning balance of $8,959 and a 4 percent APR (the first quartile), it would take 203 months (16 years) to repay the balance but the interest cost would be much lower at $1,712, or 1.72 percent of 2004 average annual family income.

Thus, if a respondent is in the puzzle group for a short period of time (a few years) to smooth current shocks or to insure against future uncertainty, the interest cost is not large. Revolving credit card balances over longer periods of time can be very costly, but not prohibitive if the APRs are low. To the extent that individuals pay very different

[37]To simplify the calculations, we take 2004 average family income as being constant, and do not adjust for future raises or inflation.

APRs on their credit card balances, there is a great deal of heterogeneity in the cost of carrying balances. It is likely that a fraction of individuals in the puzzle group are financial savvy individuals who take advantage of low promotional interest rates However, there are some individuals who clearly do not understand the power of compound interest.[38]

8 Conclusion

Using data from the NLSY79, this paper revisits the so-called credit card debt puzzle—why consumers simultaneously choose to hold (potentially high-interest) credit card debt and low-interest liquid assets that could be used to pay down this debt.

We find that the borrower-savers in the puzzle group are less present biased and more educated, have higher AFQT and financial literacy scores, and significantly more financial resources than respondents in the neutral and borrower categories. Relative to savers, respondents in the puzzle group have higher discount rates and are more likely to have middle levels of risk aversion. They also have slightly lower levels of financial literacy, fewer years of completed education, and significantly higher levels of all types of debt. These factors make the puzzle group appear less favorably when compared to the saver group. While on average, the unconditional differences between respondents in the puzzle group and the saver category are small, using a multiple regression analysis we find that time preferences, risk aversion, credit risk, and financial literacy are important determinants for placing respondents in the puzzle group and for transitions between the puzzle and saver categories over time.

We find support for what we call the precautionary borrowing hypothesis of Fulford (2015) and Druedahl and Jorgensen (2015): revolving credit card debt held simultaneously with liquid assets for precautionary reasons since credit tends to become unavailable when one needs it the most. We find that higher credit risk (i.e., a higher predicted prob-

[38]Zinman (2007) uses a different methodology to calculate the cost of "borrowing high and lending low" by first calculating what he calls a wedge (or the minimum of credit card debt and liquid assets), and then multiplying this wedge by the difference between the APR paid on credit card debt and the prevailing rate on checking/saving accounts. His conclusions are consistent with ours in the sense that he does not find the cost of these wedges to be large for most households (and can be rationalized by the implicit value of liquidity), but possibly for some of them. In our dataset, the average (median) wedge is roughly $3,000 ($2,000).

ability of being credit constrained in the future) increases the probability that individuals will be placed in the puzzle group compared to the saver group.

We document that being a borrower-saver has clear financial costs, especially for those in the 2008 puzzle group. These respondents are significantly more likely than savers to go bankrupt and to go through a property foreclosure some time between 2009 and 2012. Interestingly, those in the 2004 puzzle group were no more likely to experience bankruptcy between 2005 and 2008 than 2004 savers. This result indicates that the new financial environment that arose from the Great Recession significantly changed the cost of holding credit card debt for precautionary reasons. Using data from the SCF, we document that this is indeed the case (average APRs on credit cards increased significantly between 2004 and 2010). The SCF data also shows the heterogenous costs of revolving credit card debt: for some individuals the cost is small relative to their income, while for others it might be substantial.

To summarize, we provide evidence that the puzzle group is highly heterogeneous. Some savvy individuals understand the costs associated with such behavior and are unharmed by it, but others fall victim to their large appetites for credit, perhaps due to lower financial literacy. Changing this behavior will not be easy since as it is highly dependent on individual preferences towards risk and time discounting, but as indicated by our findings on financial literacy, better financial knowledge may help mitigate the effect of preferences.

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Table 1: Group Distribution: NLSY79 versus SCF

Year	Puzzle %	Borrower %	Neutral %	Saver %	Respondents Number
	NLSY79, All				
2004	48.4	4.6	11.4	35.6	3,447
2008	46.0	5.0	12.1	36.8	3,512
2012	40.5	4.5	13.8	41.3	3,570
	SCF, All				
2004	49.3	1.8	7.2	41.6	3,012
2007	50.1	1.0	7.1	41.7	2,874
2010	42.5	0.8	7.4	49.3	4,260
	SCF, Ages 39–47 matching NLSY79				
2004	53.7	1.9	5.5	38.9	806
2007	52.6	0.5	7.6	39.3	813
2010	46.0	0.6	6.5	47	1,172

Notes: All percentages are weighted using survey weights. Puzzle indicates a borrower-saver. Groups are defined using the *baseline* definition: (1) puzzle: credit card debt and savings > 0; (2) borrower: credit card debt > 0, savings$= 0$; (3) neutral: credit card debt and savings $= 0$; (4) saver: credit card debt $= 0$; savings> 0.

Table 2: Group Distribution, NLSY79: Alternative Definitions

Year	Puzzle %	Borrower %	Neutral %	Saver %	Respondents Number
Baseline: Credit Card Debt and Savings > 0					
2004	48.4	4.6	11.4	35.6	3,447
2008	46.0	5.0	12.1	36.8	3,512
2012	40.5	4.5	13.8	41.3	3,570
Credit Card Debt and Savings $\geq$*\$500*					
2004	40.5	13.1	11.4	35.1	3,447
2008	39.2	12.7	12.1	36.0	3,512
2012	34.3	12.6	13.8	39.3	3,570
Strict: Credit Card Debt $\geq$*\$500* Savings $\geq$ one month annual income					
2004	20.1	45.4	11.2	23.2	3,433
2008	18.1	46.8	12.0	23.1	3,503
2012	16.2	43.9	13.6	26.3	3,560

Notes: All percentages are weighted using survey weights. Puzzle indicates a borrower-saver.
Baseline: (1) puzzle: credit card debt and savings > 0; (2) borrower: credit card debt> 0, savings$= 0$; (3) neutral: credit card debt and savings$= 0$; (4) saver: credit card debt$= 0$; savings> 0.
Credit Card Debt and Savings $\geq$*\$500*: (1) puzzle: credit card debt and savings $\geq$ \$500; (2) borrower: credit card debt> 0, savings $<$ \$500 (3) neutral: credit card debt and savings$= 0$; (4) saver: credit card debt$<$ \$500, savings $\geq$ \$500.
Strict: (1) puzzle: credit card debt $\geq$ \$500 and savings$\geq$one month income; (2) borrower: credit card debt> 0, savings$<$ one month income (3) neutral: credit card debt and savings$= 0$; (4) saver: credit card debt$<$ \$500, savings$\geq$ one month income.

Table 3: Transition Matrices

	2008, Baseline Definition				2008, Strict Definition			
2004	Puzzle	Borrower	Neutral	Saver	Puzzle	Borrower	Neutral	Saver
Puzzle	70.2	5.7	3.2	20.9	43.9	36.1	1.9	18.1
Borrower	51.3	15.2	18.9	14.6	13.3	66.4	8.7	11.6
Neutral	10.4	6.2	56.5	27.0	2.4	34.8	56.5	6.3
Saver	24.5	2.6	8.0	64.9	12.9	25.2	3.8	58.1

	2012, Baseline Definition				2012, Strict Definition			
2008	Puzzle	Borrower	Neutral	Saver	Puzzle	Borrower	Neutral	Saver
Puzzle	65.6	4.6	4.5	25.3	40.8	32.7	4.0	22.5
Borrower	33.7	21.9	18.4	26.1	12.2	64.5	9.9	13.5
Neutral	5.4	5.4	61.7	27.5	0.6	29.9	61.4	8.1
Saver	21.9	1.3	8.6	68.2	13.3	18.1	3.7	64.9

	2012, Baseline Definition				2012, Strict Definition			
2004	Puzzle	Borrower	Neutral	Saver	Puzzle	Borrower	Neutral	Saver
Puzzle	59.4	4.8	6.0	29.7	36.0	35.1	5.1	23.9
Borrower	42.1	12.3	24.3	21.4	12.8	61.3	11.6	14.2
Neutral	8.5	4.2	56.8	30.5	1.2	33.2	56.7	8.9
Saver	25.2	3.0	8.6	63.2	12.9	24.0	3.5	59.6

	All Periods in Same Group as 2004							
	Baseline Definition				Strict Definition			
	Puzzle	Borrower	Neutral	Saver	Puzzle	Borrower	Neutral	Saver
2004	48.5	7.0	47.5	48.3	21.2	47.7	47.8	43.7

Notes: All reported numbers are in percentages and weighted using survey weights. Puzzle indicates a borrower-saver.
Baseline: (1) puzzle: credit card debt and savings > 0; (2) borrower: credit card debt> 0, savings$= 0$; (3) neutral: credit card debt and savings$= 0$; (4) saver: credit card debt$= 0$; savings> 0.
Strict: (1) puzzle: credit card debt $\geq$ \$500 and savings$\geq$one month income; (2) borrower: credit card debt> 0, savings$<$ one month income (3) neutral: credit card debt and savings$= 0$; (4) saver: credit card debt$<$ \$500, savings$\geq$ one month income.

Table 4: Summary Statistics by Group in 2004

	Baseline					Strict	
	Total	Puzzle	Saver	Borrower	Neutral	Puzzle	Saver
AFQT Score/1000	55.20	59.27	59.04	44.62	30.11	60.91	64.70
	(28.03)	(25.36)	(28.86)	(23.72)	(23.43)	(24.50)	(26.89)
Highest Grade	13.77	14.00	14.16	12.78	11.94	14.32	14.68
Completed	(2.57)	(2.41)	(2.72)	(2.05)	(2.01)	(2.42)	(2.67)
College or More	0.30	0.32	0.37	0.14	0.06	0.39	0.46
	(0.46)	(0.47)	(0.48)	(0.35)	(0.24)	(0.49)	(0.50)
Financial Literacy,	3.45	3.52	3.64	3.04	2.74	3.60	3.84
0–5	(1.16)	(1.11)	(1.14)	(1.17)	(1.14)	(1.10)	(1.04)
Financial Knowledge,	4.89	4.89	5.02	4.78	4.56	5.02	5.20
1–7	(1.42)	(1.32)	(1.38)	(1.56)	(1.79)	(1.28)	(1.23)
Present Bias	0.49	0.48	0.46	0.56	0.60	0.46	0.41
	(0.50)	(0.50)	(0.50)	(0.50)	(0.49)	(0.50)	(0.49)
High Discount Rate	0.52	0.54	0.48	0.52	0.53	0.50	0.45
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Middle Risk Aversion	0.31	0.32	0.32	0.30	0.25	0.32	0.36
	(0.46)	(0.47)	(0.47)	(0.46)	(0.44)	(0.47)	(0.48)
Family Income	85.04	89.30	97.19	55.82	39.95	100.71	110.55
(Thousands)	(62.60)	(56.08)	(71.99)	(30.21)	(39.62)	(63.50)	(75.50)
Net Worth	345.07	322.57	492.00	129.54	67.54	468.56	627.13
(Thousands)	(607.76)	(526.79)	(755.62)	(329.70)	(265.00)	(672.52)	(804.45)
Assets $>$ Liabilities	0.82	0.87	0.88	0.67	0.48	0.93	0.97
	(0.39)	(0.34)	(0.33)	(0.47)	(0.50)	(0.26)	(0.18)
Has Credit Card	0.72	1.00	0.53	1.00	0.04	1.00	0.72
	(0.45)	(0.00)	(0.50)	(0.00)	(0.19)	(0.00)	(0.45)
No. Max-Out Credit	0.16	0.21	0.06	0.68	0.06	0.10	0.02
Cards	(0.68)	(0.70)	(0.59)	(1.20)	(0.46)	(0.52)	(0.26)
Credit Card Debt	3.43	6.47	0.00	6.52	0.00	6.45	0.03
(Thousands)	(5.45)	(6.01)	(0.00)	(6.28)	(0.00)	(5.79)	(0.10)
Liquid Assets	13.84	13.41	20.63	0.00	0.00	25.59	32.37
(Thousands)	(19.17)	(17.10)	(22.41)	(0.00)	(0.00)	(19.02)	(21.08)
Arbitrage	10.41	6.94	20.63	–6.52	0.00	19.15	32.33
(Thousands)	(20.18)	(18.07)	(22.41)	(6.28)	(0.00)	(19.08)	(21.10)
Homeowner	0.79	0.87	0.82	0.64	0.40	0.90	0.91
	(0.41)	(0.33)	(0.39)	(0.48)	(0.49)	(0.30)	(0.29)
Has Mortgage	0.68	0.80	0.67	0.57	0.22	0.82	0.74
	(0.47)	(0.40)	(0.47)	(0.50)	(0.41)	(0.38)	(0.44)
Has Car Loan	0.47	0.58	0.40	0.54	0.21	0.57	0.38
	(0.50)	(0.49)	(0.49)	(0.50)	(0.41)	(0.50)	(0.49)
Has Student Debt	0.07	0.08	0.05	0.11	0.05	0.06	0.03
	(0.25)	(0.27)	(0.22)	(0.31)	(0.22)	(0.24)	(0.18)
Has Stocks	0.23	0.25	0.27	0.10	0.05	0.34	0.35
	(0.42)	(0.43)	(0.45)	(0.30)	(0.21)	(0.47)	(0.48)
Has Mutual Funds	0.19	0.18	0.27	0.08	0.03	0.25	0.35
	(0.40)	(0.39)	(0.44)	(0.27)	(0.17)	(0.44)	(0.48)
Applied for Credit,	0.55	0.67	0.51	0.55	0.17	0.66	0.54
Past Five Years	(0.50)	(0.47)	(0.50)	(0.50)	(0.38)	(0.47)	(0.50)
Observations	3,447	1,579	1,192	172	504	651	745

Notes: mean weighted coefficients; sd in parentheses. All amounts are in 2012 dollars.

Table 5: Characteristics of the Puzzle Respondents Compared to Savers

	(1)	(2)	(3)	(4)	(5)
	Baseline				Strict
Present Bias	0.013	0.011	0.013	0.006	0.027
	(0.016)	(0.016)	(0.016)	(0.015)	(0.020)
High Discount Rate	0.053***	0.050***	0.051***	0.047***	0.043**
	(0.016)	(0.015)	(0.016)	(0.015)	(0.020)
Middle Risk Aversion	0.029*	0.029*	0.032*	0.026*	–0.002
	(0.017)	(0.016)	(0.017)	(0.016)	(0.021)
AFQT Score	0.029***	0.026***	0.028***	0.022**	0.002
	(0.010)	(0.010)	(0.010)	(0.010)	(0.014)
College or More	–0.061***	–0.055***	–0.054***	–0.068***	–0.063***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.024)
Financial Literacy	–0.047***	–0.046***	–0.049***	–0.052***	–0.055**
	(0.017)	(0.017)	(0.017)	(0.016)	(0.023)
Financial Self-Knowledge	–0.011	–0.004	–0.003	–0.002	0.010
	(0.016)	(0.016)	(0.016)	(0.016)	(0.022)
Credit Risk		0.048***	0.048***	0.037***	0.028**
		(0.006)	(0.006)	(0.006)	(0.013)
Job Shock		–0.006	–0.007	–0.003	0.004
		(0.006)	(0.006)	(0.006)	(0.010)
Assets > Liabilities				–0.055***	–0.087**
				(0.019)	(0.038)
Homeowner, with Mortgage				0.179***	0.058
				(0.021)	(0.036)
Homeowner, No Mortgage				–0.018	–0.116***
				(0.026)	(0.039)
Has Car Loan				0.144***	0.140***
				(0.012)	(0.018)
Has Student Debt				0.138***	0.185***
				(0.026)	(0.043)
Year=2008	–0.041**	–0.041**	–0.042**	–0.039**	–0.067***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.024)
Year=2012	–0.091***	–0.097***	–0.100***	–0.089***	–0.164***
	(0.033)	(0.032)	(0.032)	(0.031)	(0.043)
Observations	8,250	8,250	8,250	8,250	4,075
R squared	0.02	0.03	0.04	0.10	0.11
State Fixed Effects	No	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. All regressions control for demographics (age, race, gender, marital status, and the number of children), and time and State Fixed Effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 6: Predicting Credit Risk

	(1)	(2)	(3)	(4)
Present Bias	0.021***	0.021***	0.019**	0.021***
	(0.007)	(0.007)	(0.008)	(0.007)
High Discount Rate	0.018***	0.018***	0.022***	0.017**
	(0.007)	(0.007)	(0.008)	(0.007)
Middle Risk Averse	–0.013	–0.013	–0.012	–0.012
	(0.010)	(0.010)	(0.011)	(0.010)
Risk Tolerant	–0.019**	–0.018**	–0.022**	–0.017*
	(0.009)	(0.009)	(0.010)	(0.009)
AFQT Score	0.000	0.001	0.003	0.001
	(0.005)	(0.005)	(0.005)	(0.005)
Education	–0.004**	–0.003**	–0.004**	–0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Financial Literacy	–0.021***	–0.021***	–0.024***	–0.021***
	(0.008)	(0.008)	(0.009)	(0.008)
Financial Self-Knowledge	–0.033***	–0.034***	–0.030***	–0.033***
	(0.008)	(0.008)	(0.009)	(0.008)
Applied for Credit	0.198***	0.199***	0.196***	0.198***
	(0.007)	(0.007)	(0.008)	(0.007)
Wanted to Apply But Didn't	–0.047***	–0.051***	–0.050***	–0.052***
	(0.005)	(0.005)	(0.006)	(0.005)
L4: Total Liabilities > Total Assets	0.130***	0.127***	0.141***	0.127***
	(0.016)	(0.016)	(0.018)	(0.016)
L4: Has Car Loan	0.006	0.008	0.006	0.006
	(0.006)	(0.006)	(0.007)	(0.006)
L4: Has Student Debt	–0.026***	–0.025***	–0.019**	–0.025***
	(0.008)	(0.008)	(0.008)	(0.008)
No. Times Income Fell by $\geq 20\%$		0.024***		
		(0.004)		
Past Income Volatility			0.021**	
			(0.008)	
Job Shock				0.034**
				(0.014)
L2: Job Shock				0.054***
				(0.014)
Observations	10,481	10,481	8,780	10,481
R squared	0.15	0.16	0.15	0.16

Notes: The dependent variable is a dummy variable equal to one if the respondent was denied credit in the last 5 years, and is zero otherwise. L4 and L2 denote four and two-year lags. All regressions control for demographics (age, race, gender, marital status, and the number of children); time and state fixed effects. Robust standard errors are (in parentheses) clustered at the state level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 7: Puzzle versus Savers: Robustness Checks

	(1)	(2)	(3)	(4)
	Baseline			Strict
Predicted Credit Risk	0.073***	0.073***	0.047***	0.042***
	(0.007)	(0.007)	(0.006)	(0.010)
Job Shock	–0.013**	–0.014**	–0.008	0.002
	(0.006)	(0.006)	(0.006)	(0.010)
Observations	8,041	8,041	8,041	3,971
R squared	0.04	0.05	0.10	0.11
Financial Controls	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
F4: Predicted Credit Risk	0.064***	0.066***	0.054***	0.048***
	(0.011)	(0.011)	(0.011)	(0.016)
Job Shock	–0.005	–0.004	–0.004	0.007
	(0.010)	(0.011)	(0.010)	(0.016)
Observations	2,639	2,639	2,639	1,269
R squared	0.04	0.05	0.08	0.11
Lagged Financial Controls	No	No	Yes	Yes
State Fixed Effects	No	Yes	Yes	Yes
F4: Predicted Credit Risk	0.063***	0.065***	0.053***	0.049***
	(0.011)	(0.011)	(0.011)	(0.016)
F4: Job Shock	0.029**	0.032**	0.032**	0.011
	(0.013)	(0.013)	(0.013)	(0.022)
Observations	2,639	2,639	2,639	1,269
R squared	0.04	0.06	0.08	0.11
Lagged Financial Controls	No	No	Yes	Yes
State Fixed Effects	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. F4 is a four-period forward operator. All regressions control for formal knowledge (years of completed education and AFQT scores), demographics (age, race, gender, marital status, and the number of children); financial variables (having mortgage, car, and student debt, and whether the respondent has larger liabilities than assets); time and state fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 8: Puzzle versus Savers: Interactions

	(1)	(2)	(3)	(4)
	Baseline		Strict	
F4: Predicted Credit Risk	0.028*	–0.012	0.008	–0.025
	(0.015)	(0.021)	(0.025)	(0.035)
F4: Pr. Risk × Fin. Literacy	0.045**		0.065**	
	(0.021)		(0.032)	
F4: Pr. Risk × Int. Rate Q.		0.085***		0.093**
		(0.024)		(0.039)
F4: Job Shock	0.031**	0.030**	0.009	0.010
	(0.013)	(0.013)	(0.022)	(0.022)
Observations	2,639	2,638	1,269	1,269
R squared	0.09	0.09	0.12	0.12
State Fixed Effects	Yes	Yes	Yes	Yes
Lagged Financial Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. F4 is a four-period forward operator. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of children); financial variables (having mortgage, car, and student debt, and whether the respondent has larger liabilities than assets); and time and state fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 9: Transitions from Puzzle to Saver and from Saver to Puzzle

	(1)	(2)	(3)	(4)
	P → S		S → P	
	Baseline	Strict	Baseline	Strict
Present Bias	0.004	0.035	–0.010	–0.021
	(0.021)	(0.043)	(0.023)	(0.027)
High Discount Rate	–0.034*	–0.104**	0.019	0.014
	(0.020)	(0.042)	(0.022)	(0.026)
Middle Risk Aversion	–0.013	–0.030	0.051**	0.061**
	(0.022)	(0.046)	(0.025)	(0.029)
Financial Literacy	0.024	–0.013	–0.014	–0.042
	(0.023)	(0.046)	(0.027)	(0.034)
Financial Self-Knowledge	–0.020	–0.019	–0.041	0.015
	(0.022)	(0.048)	(0.026)	(0.032)
Change in Predicted Credit Risk	–0.025***	–0.010	0.023**	0.031***
	(0.009)	(0.018)	(0.010)	(0.012)
Change in Job Shock	0.000	–0.008	0.008	0.014
	(0.010)	(0.025)	(0.009)	(0.015)
L4: Assets > Liabilities	–0.019	–0.089	–0.003	0.034
	(0.029)	(0.088)	(0.040)	(0.087)
L4: Homeowner, with Mortgage	0.022	0.218***	–0.023	–0.071
	(0.032)	(0.067)	(0.037)	(0.060)
L4: Homeowner, No Mortgage	0.046	0.251***	–0.093**	–0.137**
	(0.047)	(0.090)	(0.041)	(0.063)
L4: Has Car Loan	–0.046**	–0.018	0.073***	0.047*
	(0.019)	(0.039)	(0.021)	(0.025)
L4: Has Student Debt	–0.060*	–0.053	0.184***	0.012
	(0.032)	(0.085)	(0.062)	(0.079)
Year=2012	0.052*	0.159***	0.017	0.011
	(0.027)	(0.054)	(0.031)	(0.038)
Observations	2,615	731	2,108	1,132
R squared	0.05	0.13	0.09	0.11

Notes: The dependent variable is a dummy variable equal to one if the transition from puzzle to saver, $\boldsymbol{P \rightarrow S}$ (or from saver to puzzle $\boldsymbol{S \rightarrow P}$) occurred, and zero if the respondent remained in the puzzle (or the saver) category. All regressions also control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of children); and state fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 10: Puzzle versus Savers: Individual Fixed Effects

	(1)	(2)	(3)	(4)
	Baseline			Strict
Predicted Credit risk	0.034***	0.034***	0.029***	0.028**
	(0.007)	(0.007)	(0.007)	(0.011)
Job Shock	–0.003	–0.003	–0.003	0.010
	(0.006)	(0.006)	(0.006)	(0.012)
Observations	7,612	7,548	7,548	3,156
R squared	0.65	0.66	0.66	0.71
Financial Controls	No	No	Yes	Yes
Individual Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of kids); financial variables (having a mortgage, a car loan, student debt, and whether the respondent has larger liabilities than assets); and time fixed effects, as appropriate. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 11: Bankruptcy and Foreclosure Rates

	2008 Classification				2004 Classification	
	Bankruptcy, 2009–2012		Foreclosure, 2009–2012		Bankruptcy, 2005–2008	
	Baseline	Strict	Baseline	Strict	Baseline	Strict
Borrower	8.7	4.5	22.6	7.9	6.6	4.8
Neutral	5.4	5.1	10.5	11.1	2.3	2.3
Puzzle	4.4	2.9	5.7	3.2	3.1	0.9
Saver	0.6	0.4	2.0	1.1	1.9	0.6
Total	3.3	3.2	5.2	5.2	2.7	2.7
Observations	2,927	2,921	2,286	2,282	2,880	2,872

Notes: Mean coefficients

Table 12: Bankruptcy and Foreclosure. Puzzle versus Savers, 2008 Classification

	(1)	(2)	(3)	(4)
	Bankruptcy, 2009–12		Foreclosure, 2009–12	
	Baseline	Strict	Baseline	Strict
Puzzle 2008	0.031***	0.018**	0.023***	0.014
	(0.006)	(0.007)	(0.009)	(0.009)
Present Bias	0.010	0.012	0.005	–0.012
	(0.008)	(0.011)	(0.009)	(0.009)
High Discount Rate	0.022***	0.020***	0.030***	0.005
	(0.005)	(0.006)	(0.009)	(0.010)
Middle Risk Aversion	0.005	–0.003	0.016	0.013
	(0.006)	(0.008)	(0.011)	(0.009)
AFQT Score	–0.000	0.000	–0.000	–0.001
	(0.005)	(0.007)	(0.008)	(0.008)
College or More	–0.004	0.000	–0.016**	–0.023**
	(0.007)	(0.008)	(0.007)	(0.010)
Financial Literacy	0.006	0.003	0.018	0.008
	(0.008)	(0.009)	(0.013)	(0.013)
Financial Knowledge	–0.004	–0.011	–0.007	0.009
	(0.008)	(0.009)	(0.010)	(0.010)
Log Debt 2008	0.001*	0.001	0.002***	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
Log Assets 2008	0.001	0.004	0.001	0.002
	(0.003)	(0.004)	(0.007)	(0.008)
Assets > Debt, 2008	–0.081***	–0.087**	–0.102***	–0.062
	(0.021)	(0.038)	(0.026)	(0.037)
Self Employed 2008	0.026**	0.019*	0.045***	0.034**
	(0.011)	(0.010)	(0.012)	(0.013)
Bankruptcy Pre-2009	–0.055***	–0.030***	0.036*	–0.030*
	(0.009)	(0.010)	(0.020)	(0.015)
Health Shock	0.043**	0.028	0.031	–0.022**
	(0.021)	(0.028)	(0.024)	(0.010)
Divorce Shock	0.021	0.074**	0.114**	0.041
	(0.021)	(0.034)	(0.049)	(0.054)
Observations	2,420	1,173	2,061	1,065
R squared	0.07	0.10	0.12	0.11

Notes: The dependent variables are dummies equal to one if the respondent filed for bankruptcy or went through foreclosure during the specified periods. All regressions control for demographics (age, race, gender, marital status, presence of kids) as well as state fixed effects. Standard errors (in parentheses) clustered at the state level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 13: Bankruptcy and Foreclosure. Puzzle versus Savers: Additional Specifications

	(1)	(2)	(3)	(4)
A) Adding Group in 2004	Bankruptcy, 2009–12		Foreclosure, 2009–12	
	Baseline	Strict	Baseline	Strict
Puzzle 2008, Borrower/Neutral 2004	0.052*	0.017*	0.078**	0.009
	(0.030)	(0.009)	(0.037)	(0.013)
Puzzle 2008, Puzzle 2004	0.023***	0.018**	0.015*	0.011
	(0.007)	(0.009)	(0.009)	(0.011)
Puzzle 2008, Saver 2004	0.011	0.015	0.031*	–0.009
	(0.010)	(0.017)	(0.017)	(0.010)
Controls 2008	Yes	Yes	Yes	Yes
Observations	1,979	1,126	1,979	1,028
R squared	0.08	0.09	0.12	0.11
B) Bankruptcy in Previous Period	Bankruptcy, 2005–08		Foreclosure, 2009–12	
	Baseline	Strict	Baseline	Strict
Puzzle 2004	0.009	0.004	0.012	0.009
	(0.006)	(0.005)	(0.008)	(0.012)
Controls 2004	Yes	Yes	Yes	Yes
Observations	2,410	1,226	2,391	1,217
R squared	0.09	0.12	0.05	0.07
C) Interaction with Financial Literacy	Bankruptcy, 2009–12		Foreclosure, 2009–12	
	Baseline	Strict	Baseline	Strict
Puzzle 2008	0.010	–0.000	0.021	0.010
	(0.011)	(0.015)	(0.018)	(0.020)
Puzzle 2008 × Interest Question	0.027**	0.022	0.003	0.006
	(0.013)	(0.017)	(0.017)	(0.018)
Controls 2008	Yes	Yes	Yes	Yes
Observations	2,420	1,173	2,061	1,065
R squared	0.08	0.10	0.12	0.11

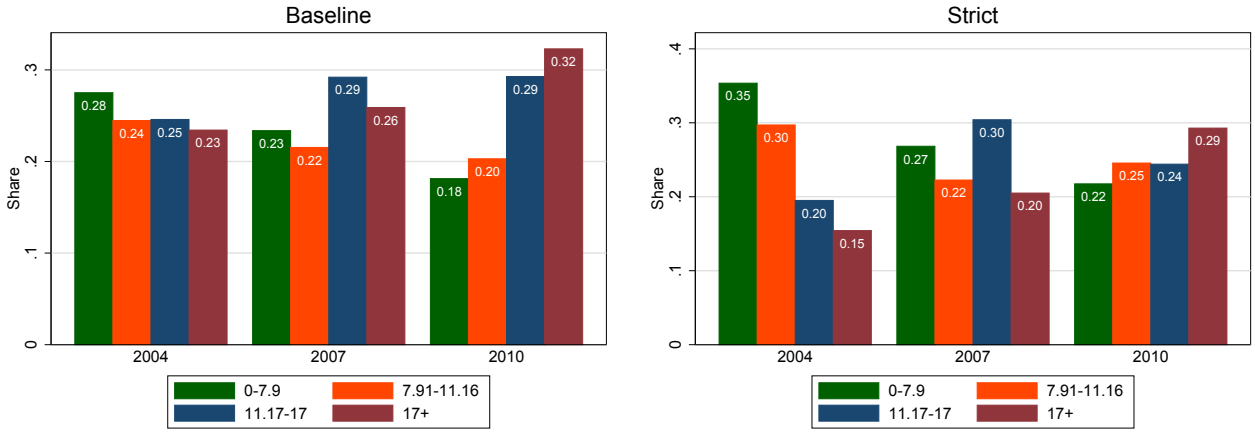
Notes: The dependent variables are dummies equal to one if the respondent filed for bankruptcy or went through foreclosure during the specified periods. Additional controls as in Table 12, also demographics (age, race, gender, marital status, presence of kids), and state fixed effects. Standard errors (in parentheses) clustered at the state level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table 14: The Interest Cost of Revolving Credit Card Debt

	Quartiles of Interest Rates			
	1	2	3	4
Average Percentage Rate, %	4	10	14	20
Beginning Balance, US$	8,959	7,385	5,999	5,927
Annual Family income in 2004, US$	99,412	84,714	87,988	65,002
	A. Balance is Paid in Full After One Year			
Balance after 12 months, US$	7,325	6,415	5,426	5,694
Interest Paid in 12 months, US$	368	773	896	1,300
Interest as Percentage of Annual Income, %	0.37	0.91	1.02	2.00
	B. Only Minimum Payments are Made			
Total Number of Months to Repay	203	260	324	728
Total Interest Paid, US$	1,714	4,963	7,732	26,761
Interest as Percentage of Annual Income, %	1.72	5.86	8.71	41.17

Notes: Calculations are based on data from the Survey of Consumer Finances using 2004 average values, splitting the sample of respondents in the puzzle group according to interest rate quartiles in 2004. For panel B, we assume that only the monthly minimum payment is made (set at the maximum of 2 percent of the total balance or $15) until the entire balance is paid off.

Figure 1: Interest Rates Paid on the Credit Card with the Highest Balance



Source: Authors' calculations based on the Survey of Consumer Finances data.
Notes: Sample of respondents born between 1957 and 1965 to match the NLSY79 sample. The four colors indicate the four quartiles of annual percentage rates (APR) charged on the respondent's credit card with the highest balance.

(Online Appendices)

A Variable Definitions and Summary Statistics

Financial Literacy and Financial Knowledge

Financial Literacy scores are constructed by combining the number of correct answers to the following questions:

> (1) ‘‘Do you think that the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund.’’
>
> (2) ‘‘Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After five years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102?’’
>
> (3) ‘‘Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?’’
>
> (4) ‘‘If interest rates rise, what will typically happen to bond prices?’’
>
> (5) ‘‘Do you think that the following statement is true or false? A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.’’

The self-reported measures of being good with money and financial knowledge are derived from the following two questions:

> (1) ‘‘How strongly do you agree or disagree with the following statements? Please give your answer on a scale of 1 to 7, where 1 means ‘‘strongly disagree’’ 7 means ‘‘strongly agree,’’ and 4 means ‘‘neither agree nor disagree’’: I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses.’’
>
> (2) ‘‘On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge.’’

Net Asset Position

Self-reported net asset position is constructed from a question that reads:

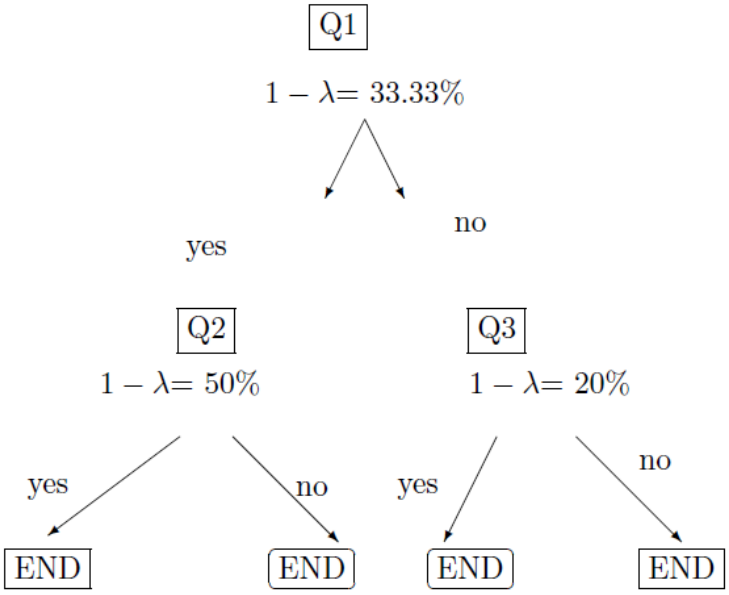
> ‘‘Suppose you [and] [Spouse/partner’s name] were to sell all of your major possessions (including your home), turn all of your investments and other assets into cash, and pay all of your debts. Would you have something left over, break even, or be in debt?’’

Risk Aversion

The NLSY79 contains a series of questions on how willing respondents are to take jobs with different income prospects. The questions are asked in 1993, 2002, 2004, 2006 and 2010, and read as follows:

> ‘‘Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and a 50-50 chance that it will cut your (family) income by (*amount*). Would you take the new job?’’

The initial cut (denoted $1-\lambda$) is a third. Subsequent questions adjust to higher/lower downside risk, half or a fifth.



From expected utility theory, if a respondent answers “yes” to a particular question, then:

$$\frac{1}{2}U(2c) + \frac{1}{2}U(\lambda c) \geq U(c).$$

Assuming equality and a constant relative risk aversion utility function, $U(c) = \frac{1}{1-\sigma}c^{1-\sigma}$, it follows that $\lambda = (2-2^{1-\sigma})^{\frac{1}{1-\sigma}}$. By changing the cut-off point $(1-\lambda)$, one can bracket the respondent’s willingness to take risk measured by the coefficient of relative risk aversion as shown in Table A.1. We could calculate the conditional mean of σ in each group following the methodology described in Barsky et al. (1997), and also correct for transitory errors as in Kimball, Sahm, and Shapiro (2008), given that these questions have been asked

Table A.1: Risk Aversion Mapping from the Survey Questions

		Risk Aversion	
Group	Answers	Lower Bound	Upper Bound
1	Yes/Yes	0	1
2	Yes/No	1	2
3	No/Yes	2	3.7
4	No/No	3.7	∞

in multiple survey years. Previous researchers have argued that a cardinal measure is preferable to using a simpler ordinal measure but our results are qualitatively similar when using a simpler ordinal measure. In our baseline specification, we use a dummy variable for "middle risk aversion" equal to one if the respondent is in groups 2 and 3, and is zero otherwise—this choice is guided by Druedahl and Jorgensen (2015), who find that a large puzzle group can be generated only if households are neither too risk tolerant nor too risk averse. We use 1993, the earliest year the question was asked, to minimize the effect of current background risk. Thirty percent of the respondents are in groups 2 and 3.

Discount Factors and Present Bias

The 2006 wave of the NLSY79 contains the following two questions:

> (1) "Suppose you have won a prize of $1000, which you can claim immediately. However, you can choose to wait one month to claim the prize. If you do wait, you will receive more than $1000. What is the smallest amount of money in addition to the $1000 you would have to receive one month from now to convince you to wait rather than claim the prize now" ($amount_{month}$)
>
> (2) "Let me ask the same question but with a one year wait instead of one month. What is the smallest amount of money in addition to the $1000 you would have to receive one year from now to convince you to wait rather than claim the prize now?" ($amount_{year}$)

Following Courtemanche, Heutel, and McAlvanah (2015), we construct discount factors and measures of present bias and long-run patience from the responses given. Specifically, we can calculate yearly and monthly discount factors as follows:

$$DF_{year} = \frac{1000}{1000 + amount_{year}},$$

$$DF_{month} = \frac{1000}{1000 + amount_{month}}.$$

Time-consistent preferences would imply $DF_{year} = (DF_{month})^{12}$, which is rarely the case in the data. Instead, assuming hyperbolic discounting, respondents discount an amount t periods in the future by $\beta\delta^t$, where β capture a respondent's present bias, and δ signifies

long-run patience, δ. Using the year and month amounts from the previous questions, we can write:

$$\beta\delta = \frac{1000}{1000 + amount_{year}},$$

$$\beta\delta^{\frac{1}{12}} = \frac{1000}{1000 + amount_{month}}.$$

Solving for β and δ yields:

$$\beta = \frac{1000}{\delta(1000 + amount_{year})}.$$

$$\delta = \left(\frac{1000 + amount_{month}}{1000 + amount_{year}}\right)^{\frac{12}{11}}.$$

Higher levels of $amount_{year}$ imply greater impatience and lower levels of δ. Values of $\beta < 1$ imply present bias. To explore the differences in discount rates (in a general sense) between respondents in the different groups, we initially construct two dummies, "high discount rate" and "present bias". The high discount rate is equal to one if a respondent is below the median level of long-run patience, δ, and is zero otherwise. Present bias is a dummy variable equal to one if β is below its median level and is zero otherwise (although anybody with $\beta < 1$ should technically be classified as having present bias, results are not dependant on the exact definition of this dummy). When answering these questions, respondents give a very wide range of responses including values over \$1,000. In keeping with previous studies, we winsorize responses above the 95 percentile.

Summary Statistics Tables and Figures

Table A.2 presents summary statistics for all survey respondents for our 2004 regressions sample. These statistics are described in Section 2. Tables A.3–A.10 compare respondents in the different asset-debt groups in the various dimensions discussed in Section 4. These tables should be self-explanatory. Figures A.1–A.4 depict the distributions of key variables in our analysis.

Table A.2: Summary Statistics, NLSY79 in 2004

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Age	43.3	2.3	39	48	3,447
Female	0.5	0.5	0	1	3,447
White	0.9	0.2	0	1	3,447
Married	0.7	0.5	0	1	3,447
Has Kids	0.8	0.4	0	1	3,447
AFQT Score	55.2	28	0	100	3,447
Highest Grade Completed	13.8	2.6	0	20	3,447
College or More	0.3	0.5	0	1	3,447
Financial Literacy, 0-5	3.5	1.2	0	5	3,447
Financial Knowledge, 1-7	4.9	1.4	1	7	3,441
Present Bias	0.5	0.5	0	1	3,447
High Discount Rate	0.5	0.5	0	1	3,447
Middle Risk Aversion	0.3	0.5	0	1	3,447
Family Income US$	85,036.9	62,602.6	3,999.9	428,123.7	3,433
Net Worth US$	345,073.8	607,762.2	–7,815.2	3,122,736	3,447
Assets > Liabilities	0.8	0.4	0	1	3,447
Has Credit Card	0.7	0.4	0	1	3,447
No. Max-Out Credit Cards	0.2	0.7	0	10	3,436
Credit Card Debt	3,432.2	5,450.8	0	18,231.4	3,447
Liquid Assets	13,843.3	19,168.3	0	60,771.3	3,447
Homeowner	0.8	0.4	0	1	3,374
Has Mortgage	0.7	0.5	0	1	3,447
Has Car Loan	0.5	0.5	0	1	3,447
Has Student Debt	0.1	0.3	0	1	3,447

Notes: Income, debt, and wealth variables measured in dollars of 2012.

Table A.3: Margins of the Puzzle

	Liquid Assets	Credit Card Debt	Arbitrage
		2004	
Puzzle (Baseline)	13,412***	6,472***	6,940***
Borrower (+/–)	–13,412***	48	
Neutral (+/–)	–13,412***	–6,472***	
Saver (+/–)	7,218***	–6,472***	
		2008	
Puzzle (Baseline)	13,971***	6,910***	7,061***
Borrower (+/–)	–13,971***	1,028*	
Neutral (+/–)	–13,971***	–6,910***	
Saver (+/–)	9,846***	–6,910***	
		2012	
Puzzle (Baseline)	18,364***	5,897***	12,467***
Borrower (+/–)	–18,364***	702	
Neutral (+/–)	–18,364***	–5,897***	
Saver (+/–)	11,457***	–5,897***	

Notes: P-weighted. Average 2012 dollar amounts for the baseline group. (+/−) indicates relative to the baseline category. Arbitrage=Assets-Debt.

Table A.4: Education and AFQT

	< High School	High School	Some College	College	College+	AFQT 50
			2004			
Puzzle (Baseline)	0.04***	0.39***	0.26***	0.18***	0.14***	9.27***
Borrower (+/–)	0.07***	0.13***	–0.01	–0.09***	–0.09***	–14.65***
Neutral (+/–)	0.21***	0.16***	–0.11***	–0.13***	–0.13***	–29.16***
Saver (+/–)	0.02***	–0.04*	–0.04**	0.01	0.04***	–0.23
			2008			
Puzzle (Baseline)	0.04***	0.37***	0.27***	0.18***	0.15***	9.15***
Borrower (+/–)	0.08***	0.10**	0.02	–0.13***	–0.08***	–14.55***
Neutral (+/–)	0.19***	0.16***	–0.09***	–0.14***	–0.12***	–29.22***
Saver (+/–)	0.01	–0.02	–0.06***	0.02	0.05***	0.53
			2012			
Puzzle (Baseline)	0.03***	0.38***	0.24***	0.18***	0.17***	10.24***
Borrower (+/–)	0.04**	0.11**	0.04	–0.11***	–0.09***	–14.50***
Neutral (+/–)	0.19***	0.15***	–0.06***	–0.13***	–0.15***	–29.70***
Saver (+/–)	0.01	–0.02	–0.02	0.01	0.02	–1.23

Notes: P-weighted. Proportion of respondents in each education category. AFQT 50 reports the mean AFQT score in the group centered at 50. (+/−) indicates relative to the baseline category.

Table A.5: Financial Literacy and Financial Knowledge

	Total (0–5)	Interest q. (0–1)	Good at $ (1–7)	Fin. Knowledge (1–7)
			2004	
Puzzle (Baseline)	3.52***	0.75***	5.80***	4.89***
Borrower (+/–)	–0.48***	–0.13***	–0.52***	–0.11
Neutral (+/–)	–0.78***	–0.17***	–0.84***	–0.32***
Saver (+/–)	0.12***	0.04**	0.15**	0.14**
			2008	
Puzzle (Baseline)	3.53***	0.76***	5.83***	4.92***
Borrower (+/–)	–0.45***	–0.06*	–0.42**	–0.22*
Neutral (+/–)	–0.80***	–0.18***	–0.82***	–0.28***
Saver (+/–)	0.13***	0.02	0.04	0.07
			2012	
Puzzle (Baseline)	3.58***	0.76***	5.81***	4.90***
Borrower (+/–)	–0.41***	–0.08**	–0.39**	–0.27**
Neutral (+/–)	–0.78***	–0.17***	–0.92***	–0.25***
Saver (+/–)	0.03	0.03	0.12*	0.12**

Notes: P-weighted. The columns report the average of each variable for the baseline group. (+/−) indicates relative to the baseline category.

Table A.6: Preferences

	Middle Risk-Averse	High Discount	Present Bias
		2004	
Puzzle (Baseline)	0.32***	0.54***	0.48***
Borrower (+/–)	–0.02	–0.02	0.08*
Neutral (+/–)	–0.07***	–0.01	0.12***
Saver (+/–)	–0.01	–0.06***	–0.02
		2008	
Puzzle (Baseline)	0.33***	0.54***	0.48***
Borrower (+/–)	–0.03	0.04	0.09**
Neutral (+/–)	–0.11***	0.01	0.13***
Saver (+/–)	–0.02	–0.07***	–0.03*
		2012	
Puzzle (Baseline)	0.35***	0.54***	0.47***
Borrower (+/–)	–0.07*	0.03	0.07*
Neutral (+/–)	–0.13***	–0.00	0.14***
Saver (+/–)	–0.04**	–0.05**	0.00

Notes: P-weighted. Proportions of respondents classified as having middle risk aversion, high discount rate or present bias. (+/−) indicates relative to the baseline category.

Table A.7: Resources

	Family Income	Net Worth	Total Debt	Leftover	Even	In Debt
			2004			
Puzzle (Baseline)	89,295.37***	322,574.17***	143,899.63***	0.87***	0.09***	0.05***
Borrower (+/–)	–33,477.85***	–193,030.23***	–52,709.23***	–0.20***	0.09***	0.11***
Neutral (+/–)	–49,344.95***	–255,035.15***	–115,045.22***	–0.38***	0.20***	0.18***
Saver (+/–)	7,897.34***	169,428.38***	–29,738.75***	0.01	–0.01	–0.00
			2008			
Puzzle (Baseline)	96,252.83***	370,566.31***	153,036.48***	0.86***	0.09***	0.05***
Borrower (+/–)	–30,316.56***	–253,983.97***	–40,268.29***	–0.27***	0.09***	0.18***
Neutral (+/–)	–57,499.94***	–311,448.47***	–122,010.33***	–0.44***	0.24***	0.20***
Saver (+/–)	14,713.37***	285,447.54***	–37,742.96***	0.02*	–0.00	–0.02**
			2012			
Puzzle (Baseline)	104,442.90***	376,391.70***	135,678.80***	0.83***	0.09***	0.08***
Borrower (+/–)	–42,328.17***	–262,389.92***	–26,702.81***	–0.35***	0.10***	0.26***
Neutral (+/–)	–61,028.38***	–310,468.90***	–103,034.96***	–0.38***	0.22***	0.17***
Saver (+/–)	6,399.41*	219,253.36***	–37,325.32***	0.03**	–0.01	–0.03***

Notes: P-weighted. The first three columns are average 2012 dollar amounts (for the baseline group). The last three columns are proportions. (+/−) indicates relative to the baseline category.

Table A.8: Debts and Assets

	Car Loans	Student Debt	Mortgage	Stocks	Mutual Funds	Home Owner	Home Equity	Negative H. Equity
				2004				
Puzzle (Baseline)	0.58***	0.08***	0.80***	0.25***	0.18***	0.87***	0.44***	0.01***
Borrower (+/–)	–0.04	0.02	–0.23***	–0.16***	–0.11***	–0.23***	–0.13***	0.00
Neutral (+/–)	–0.38***	–0.03**	–0.59***	–0.20***	–0.15***	–0.47***	–0.17***	–0.00
Saver (+/–)	–0.19***	–0.03***	–0.13***	0.02	0.09***	–0.05***	0.05***	0.00
				2008				
Puzzle (Baseline)	0.55***	0.08***	0.80***	0.20***	0.16***	0.89***	0.47***	0.01***
Borrower (+/–)	–0.06	0.04	–0.22***	–0.12***	–0.11***	–0.21***	–0.15***	0.01
Neutral (+/–)	–0.34***	–0.02*	–0.56***	–0.16***	–0.14***	–0.49***	–0.19***	–0.01
Saver (+/–)	–0.17***	–0.05***	–0.18***	0.07***	0.11***	–0.07***	0.08***	–0.00
				2012				
Puzzle (Baseline)	0.50***	0.07***	0.75***	0.17***	0.11***	0.87***	0.44***	0.04***
Borrower (+/–)	–0.04	0.05*	–0.14***	–0.12***	–0.08***	–0.17***	–0.14***	0.01
Neutral (+/–)	–0.34***	–0.01	–0.50***	–0.13***	–0.09***	–0.44***	–0.19***	0.00
Saver (+/–)	–0.18***	–0.03***	–0.16***	0.06***	0.06***	–0.06***	0.09***	–0.01*

Notes: P-weighted. All columns except home equity are proportions of respondents with that asset/liability. Home equity reported as a proportion of the value of the home (zero for renters). (+/−) indicates relative to the baseline category.

Table A.9: Access to Credit

	Apply Credit	Fickle Credit	Turned Down
		2004	
Puzzle (Baseline)	0.67***	0.06***	0.19***
Borrower (+/–)	–0.12***	0.10**	0.22***
Neutral (+/–)	–0.49***	0.16***	0.25***
Saver (+/–)	–0.16***	0.02	–0.06***
		2008	
Puzzle (Baseline)	0.62***	0.07***	0.17***
Borrower (+/–)	–0.04	0.10**	0.21***
Neutral (+/–)	–0.42***	0.11***	0.32***
Saver (+/–)	–0.16***	0.00	–0.05***
		2012	
Puzzle (Baseline)	0.63***	0.08***	0.20***
Borrower (+/–)	–0.12***	0.20***	0.23***
Neutral (+/–)	–0.43***	0.12***	0.27***
Saver (+/–)	–0.16***	0.01	–0.05***

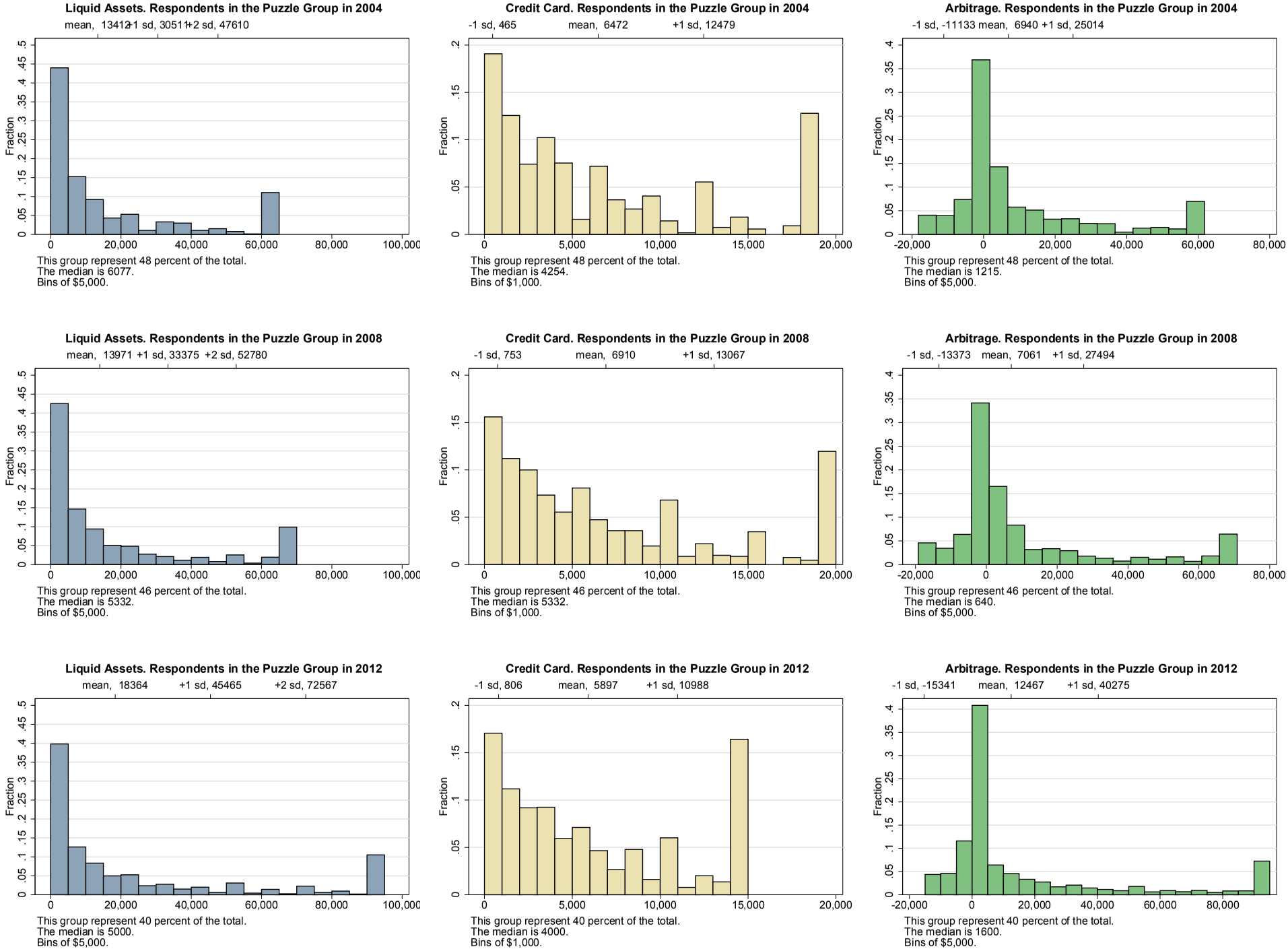
Notes: P-weighted. The columns report proportions of respondents who applied for credit, changed their mind about applying or were turned down within the last five years. (+/−) indicates relative to the baseline category.

Table A.10: Volatility

	Past Vol.	No. $\downarrow$ *Inc.* 20%	Foward Vol.	Job Shock	Job Quit
			2004		
Puzzle (Baseline)	0.26***	0.55***	0.18***	0.06***	0.07***
Borrower (+/–)	0.11***	0.20***	0.14*	–0.01	–0.03
Neutral (+/–)	0.28***	0.26***	0.50***	0.09***	0.02
Saver (+/–)	0.05***	0.08***	0.05	0.02	0.01
			2008		
Puzzle (Baseline)	0.26***	0.61***	0.19***	0.05***	0.09***
Borrower (+/–)	0.11***	0.20***	0.02	0.03	0.01
Neutral (+/–)	0.34***	0.41***	0.46***	0.05***	0.00
Saver (+/–)	0.07***	0.08***	0.11**	0.01	–0.00
			2012		
Puzzle (Baseline)	0.27***	0.64***	0.20***	0.03***	0.02***
Borrower (+/–)	0.14***	0.26***	0.07	0.03	0.00
Neutral (+/–)	0.25***	0.40***	0.59***	0.02	0.00
Saver (+/–)	0.05***	0.10***	0.15***	–0.01	–0.00

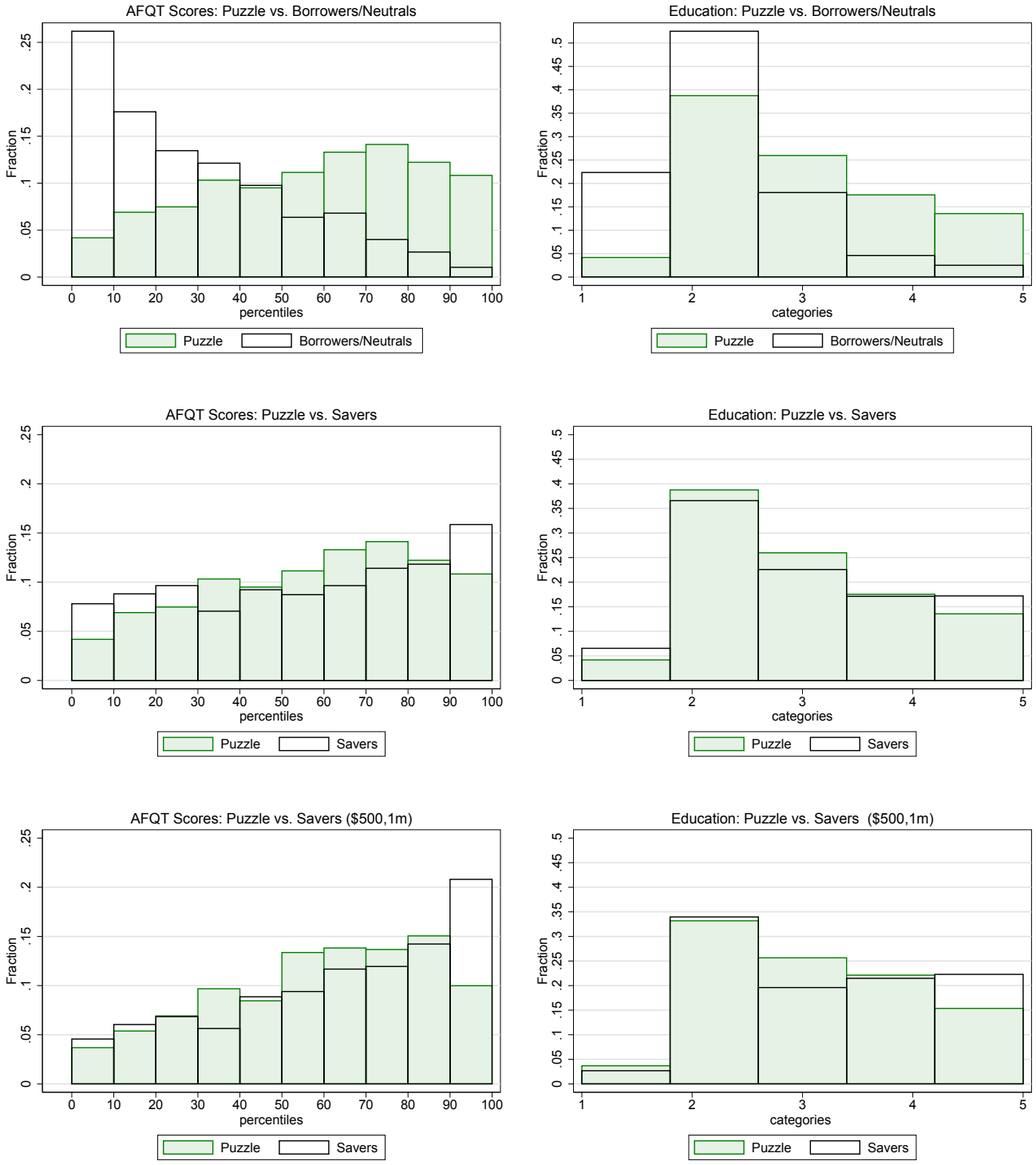
Notes: P-weighted. The columns report averages of the different measures of income volatility described in Section 4: past volatility, the number of times income went down by 20 percent or more in the last five years,forward volatility, and the dummies job shock and job quit that capture if the respondent lost his/her job due to exogenous factors or not. (+/−) indicates relative to the baseline category.

Figure A.1: Liquid Assets, Credit Card Debt, and Arbitrage (the difference) for the Puzzle Group



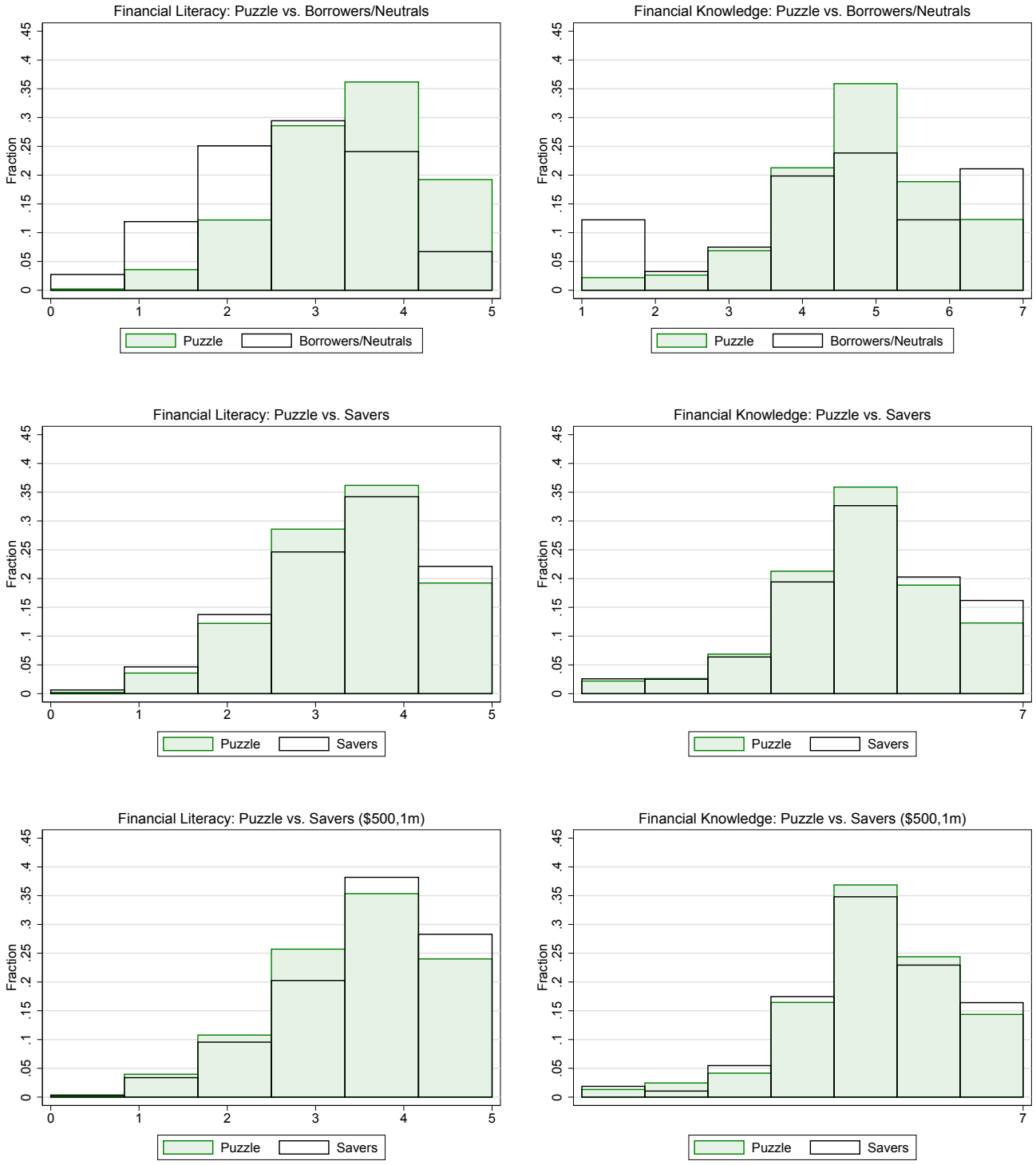
Source: Authors' calculations using the NLSY79

Figure A.2: Education and AFQT Scores



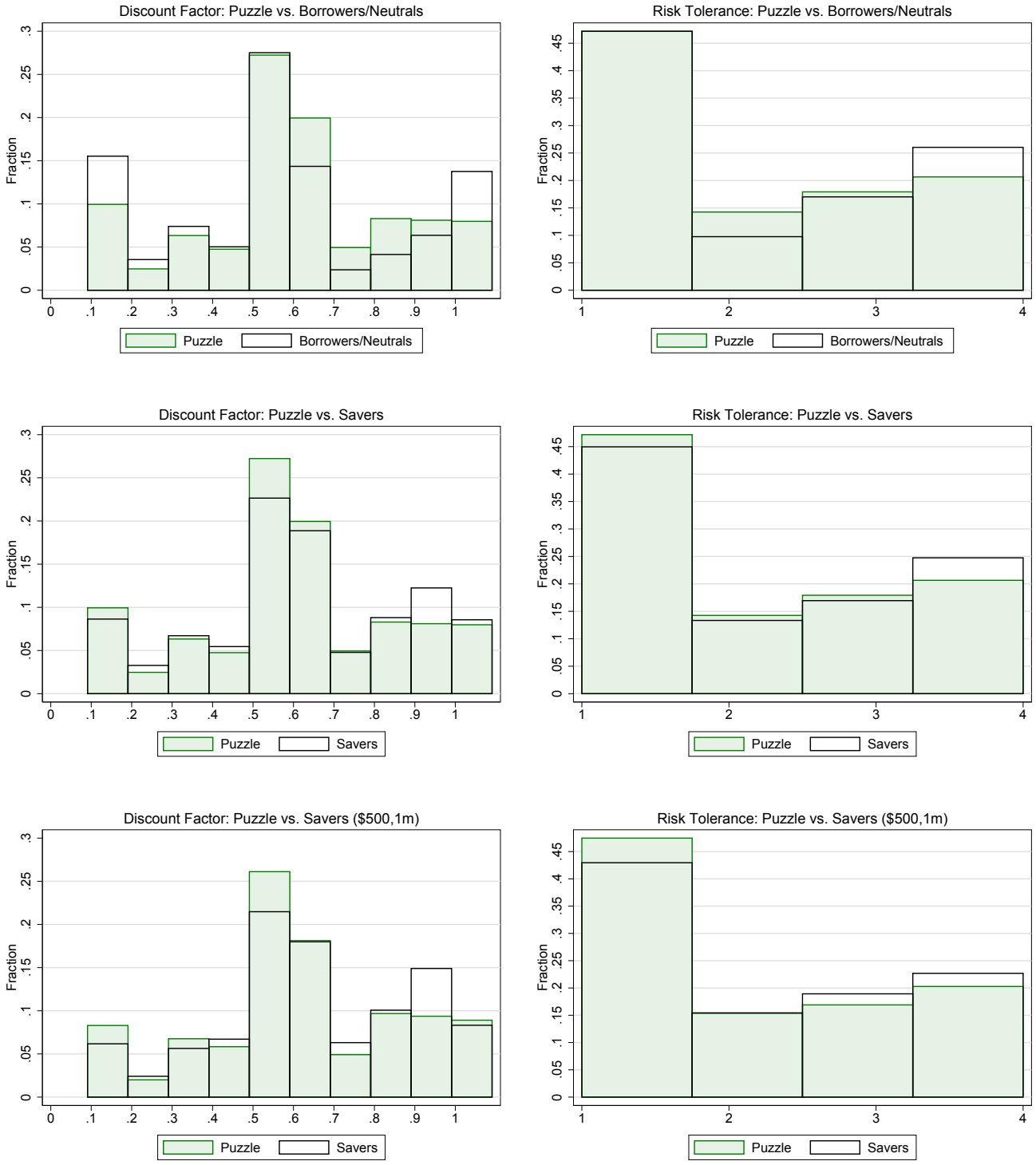
Source: Authors' calculations using the NLSY79

Figure A.3: Financial Literacy and Financial Knowledge



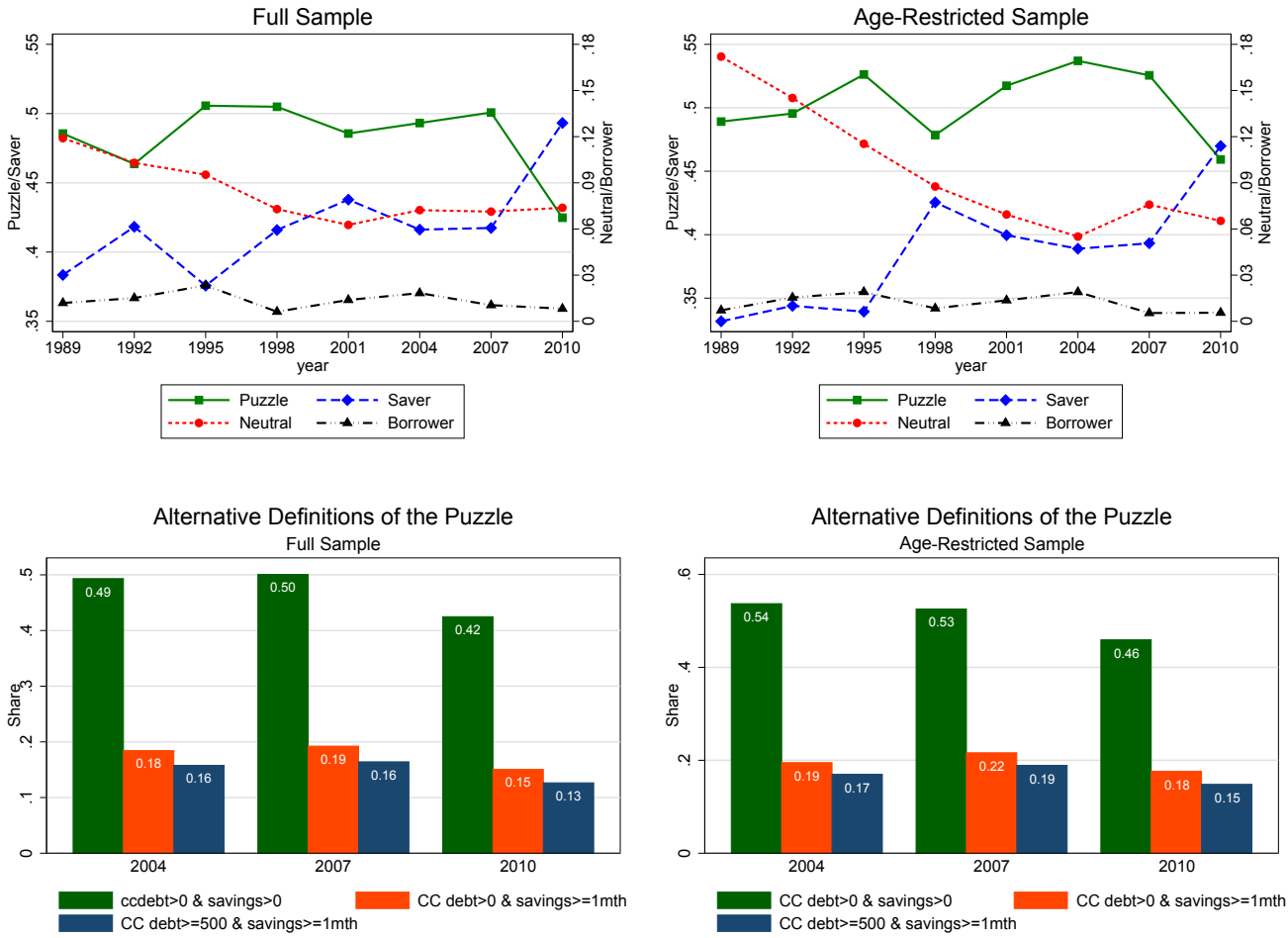
Source: Authors' calculations using the NLSY79

Figure A.4: Discount Factor and Risk Tolerance



Source: Authors' calculations using the NLSY79

Figure A.5: Distribution of Respondents in the SCF



Notes: The age restricted sample includes respondents born between 1956 and 1965 and is consistent with the birth years of the NLSY79 sample.

B Tables with Additional Results

Tables B.1–B.7 present additional supporting results. In Table B.1, we compare respondents in the puzzle group to those in the borrower or neutral categories. We find that overall knowledge (education, AFQT score, financial literacy, and financial knowledge) increases the probability of being in the puzzle group relative to borrower/neutral respondents, while present bias lowers the probability. As when comparing puzzle respondents to savers, credit risk increases the probability of being in the puzzle group (except for the strict definition of the puzzle group). Tables B.2–B.7 are expanded versions of the results discussed in Section 5, and present results with predicted versions of our credit risk measure as well as interactions of predicted credit risk with financial literacy measures. The main message of these tables is that results are robust to different specifications of the financial credit risk measure. Moreover, more financially literate individuals (and particularly those who understand the concept of compound interest) are the ones driving our main finding. All in all, this evidence points to a puzzle group that includes individuals capable of acting strategically, and who revolve credit card balances for precautionary motives. Furthermore, Tables B.8–B.10 present results from multinomial logit regressions focusing on the strict puzzle definition and the predicted measure of credit risk for brevity. These results are consistent with the main results in the paper using a simpler linear probability specification.

Table B.1: The Probability of Being in the Puzzle Group versus Borrower and Neutral Groups

	(1)	(2)	(3)	(4)	(5)
	Baseline				Strict
Present Bias	–0.026*	–0.033***	–0.029**	–0.027**	–0.022
	(0.013)	(0.013)	(0.013)	(0.012)	(0.015)
High Discount Rate	0.002	–0.008	–0.009	–0.005	–0.026*
	(0.013)	(0.013)	(0.013)	(0.011)	(0.015)
Middle Risk Aversion	0.019	0.017	0.017	0.008	–0.006
	(0.014)	(0.013)	(0.013)	(0.012)	(0.016)
AFQT Score	0.126***	0.118***	0.114***	0.091***	0.030***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
College or More	0.044***	0.055***	0.056***	0.046***	0.087***
	(0.014)	(0.014)	(0.015)	(0.014)	(0.021)
Financial Literacy	0.047***	0.054***	0.051***	0.027**	0.040**
	(0.015)	(0.015)	(0.014)	(0.013)	(0.016)
Financial Self-Knowledge	0.038***	0.052***	0.053***	0.015	0.057***
	(0.014)	(0.014)	(0.014)	(0.013)	(0.015)
Credit Risk		0.047***	0.049***	0.040***	0.008
		(0.006)	(0.006)	(0.006)	(0.007)
Job Shock		–0.030***	–0.029***	–0.018***	–0.005
		(0.006)	(0.006)	(0.006)	(0.006)
Assets > Liabilities				0.163***	0.173***
				(0.017)	(0.014)
Homeowner, with Mortgage				0.239***	0.096***
				(0.019)	(0.017)
Homeowner, No Mortgage				0.156***	0.135***
				(0.025)	(0.025)
Has Car Loan				0.083***	–0.009
				(0.011)	(0.014)
Has Student Debt				0.008	–0.063***
				(0.021)	(0.023)
Year=2008	–0.015	–0.016	–0.014	–0.005	–0.053***
	(0.015)	(0.015)	(0.015)	(0.014)	(0.019)
Year=2012	–0.025	–0.041	–0.037	–0.004	–0.099***
	(0.028)	(0.028)	(0.028)	(0.026)	(0.032)
Observations	6158	6158	6158	6158	5958
R squared	0.22	0.23	0.25	0.34	0.15
State Fixed Effects	No	No	Yes	Yes	Yes

Notes: Dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and is zero if in the borrower or the neutral groups. All regressions also control for demographics, $\boldsymbol{X_{it}}$, such as age, race, gender, marital status, and the number of children; and time fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.2: Puzzle versus Savers: Robustness Checks I

	(1)	(2)	(3)	(4)
	Baseline			Strict
Present Bias	–0.000	0.002	–0.001	0.022
	(0.016)	(0.016)	(0.015)	(0.020)
High Discount Rate	0.038**	0.040**	0.040***	0.035*
	(0.015)	(0.016)	(0.015)	(0.020)
Middle Risk Aversion	0.028*	0.032*	0.028*	–0.003
	(0.016)	(0.016)	(0.016)	(0.021)
AFQT Score	0.021**	0.022**	0.020**	–0.005
	(0.010)	(0.010)	(0.010)	(0.014)
College or More	–0.043**	–0.042**	–0.061***	–0.054**
	(0.019)	(0.019)	(0.019)	(0.024)
Financial Literacy	–0.038**	–0.041**	–0.046***	–0.047**
	(0.017)	(0.017)	(0.016)	(0.023)
Financial Self-Knowledge	0.015	0.017	0.011	0.022
	(0.016)	(0.016)	(0.016)	(0.023)
Predicted Credit Risk	0.073***	0.073***	0.047***	0.043***
	(0.007)	(0.007)	(0.006)	(0.010)
Job Shock	–0.018**	–0.018**	–0.011	0.003
	(0.008)	(0.008)	(0.008)	(0.013)
Assets > Liabilities			–0.061***	–0.083**
			(0.019)	(0.039)
Homeowner, with Mortgage			0.176***	0.060*
			(0.021)	(0.037)
Homeowner, No Mortgage			–0.014	–0.108***
			(0.026)	(0.040)
Has Car Loan			0.129***	0.121***
			(0.013)	(0.018)
Has Student Debt			0.135***	0.166***
			(0.026)	(0.044)
Year=2008	–0.042**	–0.043**	–0.042**	–0.073***
	(0.017)	(0.017)	(0.017)	(0.024)
Year=2012	–0.119***	–0.122***	–0.107***	–0.187***
	(0.033)	(0.033)	(0.032)	(0.044)
Observations	8,047	8,047	8,047	3,975
R squared	0.04	0.05	0.10	0.11
Financial Controls:	No	No	Yes	Yes
State Fixed Effects:	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. All regressions control for demographics (age, race, gender, marital status, and the number of children) and time fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.3: Puzzle versus Savers: Robustness Checks II

	(1)	(2)	(3)	(4)
	Baseline			Strict
Present Bias	0.012	0.016	0.007	0.022
	(0.021)	(0.021)	(0.021)	(0.030)
High Discount Rate	0.047**	0.050**	0.049**	0.067**
	(0.020)	(0.021)	(0.020)	(0.030)
Middle Risk Aversion	0.025	0.026	0.022	0.037
	(0.022)	(0.022)	(0.022)	(0.032)
AFQT Score	0.013	0.011	0.008	–0.033
	(0.014)	(0.014)	(0.014)	(0.021)
College or More	–0.066***	–0.061**	–0.070***	–0.045
	(0.025)	(0.026)	(0.026)	(0.036)
Financial Literacy	–0.047**	–0.052**	–0.048**	–0.024
	(0.023)	(0.023)	(0.023)	(0.034)
Financial Self-Knowledge	0.018	0.019	0.015	0.011
	(0.022)	(0.022)	(0.022)	(0.033)
F4: Predicted Credit Risk	0.064***	0.066***	0.054***	0.048***
	(0.011)	(0.011)	(0.011)	(0.016)
Job Shock	–0.005	–0.004	–0.004	0.007
	(0.010)	(0.011)	(0.010)	(0.016)
L4: Assets > Liabilities			–0.045	–0.085
			(0.031)	(0.062)
L4: Homeowner, with Mortgage			0.079**	0.037
			(0.031)	(0.053)
L4: Homeowner, No Mortgage			–0.061	–0.084
			(0.043)	(0.063)
L4: Has Car Loan			0.107***	0.112***
			(0.021)	(0.030)
L4: Has Student Debt			0.163***	0.176***
			(0.038)	(0.067)
Observations	2,639	2,639	2,639	1,269
R squared	0.04	0.05	0.08	0.11
State Fixed Effects	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle and zero if saver. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of children); financial variables (having mortgage, car, and student debt, and whether the respondent has larger liabilities than assets); and time effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.4: Puzzle versus Savers: Robustness Checks III

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline			Strict		
Present Bias	0.007	0.007	0.009	0.022	0.022	0.024
	(0.021)	(0.021)	(0.021)	(0.030)	(0.030)	(0.030)
High Discount Rate	0.049**	0.048**	0.050**	0.067**	0.068**	0.069**
	(0.020)	(0.020)	(0.020)	(0.030)	(0.030)	(0.029)
Middle Risk Aversion	0.021	0.020	0.020	0.037	0.035	0.035
	(0.022)	(0.022)	(0.022)	(0.032)	(0.032)	(0.032)
AFQT Score	0.009	0.009	0.007	–0.033	–0.033	–0.034
	(0.014)	(0.014)	(0.014)	(0.021)	(0.021)	(0.021)
College or More	–0.069***	–0.067**	–0.064**	–0.044	–0.042	–0.043
	(0.026)	(0.026)	(0.026)	(0.036)	(0.036)	(0.036)
Financial Literacy	–0.049**	–0.056**	–0.053**	–0.024	–0.029	–0.026
	(0.022)	(0.023)	(0.022)	(0.034)	(0.034)	(0.034)
Financial Self-Knowledge	0.016	0.014	0.015	0.011	0.008	0.012
	(0.022)	(0.022)	(0.022)	(0.033)	(0.033)	(0.033)
F4: Job Shock	0.032**	0.031**	0.030**	0.011	0.009	0.010
	(0.013)	(0.013)	(0.013)	(0.022)	(0.022)	(0.022)
F4: Predicted Credit Risk	0.053***	0.028*	–0.012	0.049***	0.008	–0.025
	(0.011)	(0.015)	(0.021)	(0.016)	(0.025)	(0.035)
F4: Pr. Risk × Fin. Literacy		0.045**			0.065**	
		(0.021)			(0.032)	
F4: Pr. Risk × Int. Rate Q.			0.085***			0.093**
			(0.024)			(0.039)
L4: Assets > Liabilities	–0.043	–0.045	–0.043	–0.084	–0.094	–0.093
	(0.031)	(0.031)	(0.031)	(0.062)	(0.062)	(0.061)
L4: Homeowner, with Mortgage	0.081***	0.080**	0.077**	0.036	0.036	0.038
	(0.031)	(0.031)	(0.031)	(0.053)	(0.053)	(0.052)
L4: Homeowner, No Mortgage	–0.059	–0.059	–0.064	–0.085	–0.084	–0.081
	(0.042)	(0.042)	(0.042)	(0.063)	(0.063)	(0.063)
L4: Has Car Loan	0.106***	0.105***	0.107***	0.111***	0.108***	0.110***
	(0.021)	(0.021)	(0.021)	(0.030)	(0.030)	(0.030)
L4: Has Student Debt	0.163***	0.164***	0.160***	0.178***	0.180***	0.182***
	(0.038)	(0.038)	(0.038)	(0.067)	(0.067)	(0.067)
Observations	2,639	2,639	2,638	1,269	1,269	1,269
R squared	0.08	0.09	0.09	0.11	0.12	0.12
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of children); financial variables (having mortgage, car, and student debt, and whether the respondent has larger liabilities than assets); and time fixed effects. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.5: Puzzle vs. Savers: Robustness Checks IV. Alternative Credit Risk Definition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline				Strict			
Present bias	0.001	0.003	0.002	0.002	0.015	0.016	0.014	0.016
	(0.021)	(0.021)	(0.021)	(0.021)	(0.023)	(0.031)	(0.031)	(0.031)
High discount rate	0.042**	0.043**	0.040*	0.042**	0.064***	0.064**	0.063**	0.064**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.023)	(0.031)	(0.030)	(0.030)
Middle risk aversion	0.024	0.023	0.024	0.023	0.013	0.040	0.039	0.038
	(0.022)	(0.022)	(0.022)	(0.022)	(0.024)	(0.032)	(0.032)	(0.032)
AFQT score	0.019	0.020	0.021	0.018	–0.000	–0.024	–0.024	–0.024
	(0.014)	(0.014)	(0.014)	(0.014)	(0.017)	(0.021)	(0.021)	(0.022)
College or more	–0.064**	–0.065**	–0.057**	–0.058**	–0.069**	–0.040	–0.034	–0.038
	(0.026)	(0.026)	(0.026)	(0.026)	(0.028)	(0.037)	(0.037)	(0.037)
Financial literacy	–0.047**	–0.048**	–0.058**	–0.052**	–0.049*	–0.024	–0.024	–0.023
	(0.023)	(0.023)	(0.023)	(0.023)	(0.026)	(0.034)	(0.034)	(0.034)
Financial self-knowledge	0.031	0.029	0.028	0.028	0.014	0.025	0.023	0.024
	(0.023)	(0.023)	(0.023)	(0.023)	(0.026)	(0.034)	(0.034)	(0.034)
Job Shock	–0.006				0.015			
	(0.010)				(0.013)			
F4.Job Shock		0.024*	0.024*	0.022		0.003	0.005	0.003
		(0.014)	(0.014)	(0.014)		(0.022)	(0.023)	(0.023)
F4.Predicted Credit Risk	0.062***	0.057***	0.015	–0.007		0.054**	–0.004	0.002
	(0.015)	(0.015)	(0.019)	(0.025)		(0.024)	(0.034)	(0.042)
F4.Pr. Risk × Fin. Literacy			0.079***				0.098**	
			(0.024)				(0.039)	
F4.Pr. Risk × Int.Rate Q.				0.085***				0.068
				(0.027)				(0.045)
L4.Assets > Liabilities	–0.037	–0.037	–0.042	–0.039	0.017	–0.077	–0.094	–0.086
	(0.032)	(0.032)	(0.031)	(0.031)	(0.046)	(0.062)	(0.062)	(0.062)
L4.Homeowner, with mortgage	0.089***	0.089***	0.087***	0.086***	–0.000	0.044	0.040	0.043
	(0.032)	(0.032)	(0.032)	(0.032)	(0.041)	(0.053)	(0.053)	(0.052)
L4.Homeowner, No mortgage	–0.059	–0.059	–0.061	–0.062	–0.156***	–0.084	–0.087	–0.083
	(0.043)	(0.043)	(0.043)	(0.042)	(0.047)	(0.063)	(0.063)	(0.063)
L4.Has car debt	0.112***	0.112***	0.108***	0.111***	0.117***	0.116***	0.112***	0.115***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.030)	(0.030)	(0.030)
L4.Has student debt	0.163***	0.164***	0.165***	0.159***	0.187***	0.178***	0.178***	0.177***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.049)	(0.068)	(0.068)	(0.068)
Observations	2644	2644	2644	2643	2633	1272	1272	1272
R sq.	0.08	0.08	0.08	0.08	0.09	0.11	0.11	0.11

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle and zero if saver. The predicted credit risk variable is computed using information on whether households were denied credit after applying and those discouraged from applying from credit. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of kids); financial variables (presences of mortgage, car and student debt, and whether the respondent has larger liabilities than assets); state and time fixed effects. Robust standard errors (in parentheses) clustered at the individual level. ***(**)[*] significant at the 1(5)[10] percent level.

Table B.6: Transitions from Puzzle to Saver and from Saver to Puzzle II. Alternative Credit Risk Definition

	(1)	(2)	(3)	(4)
	P → S		S → P	
	Baseline	Strict	Baseline	Strict
Present Bias	0.003	0.035	–0.011	–0.022
	(0.021)	(0.043)	(0.023)	(0.027)
High Discount Rate	–0.034*	–0.105**	0.020	0.014
	(0.020)	(0.042)	(0.022)	(0.026)
Middle Risk Aversion	–0.014	–0.031	0.050**	0.061**
	(0.022)	(0.046)	(0.025)	(0.029)
Financial Literacy	0.024	–0.013	–0.013	–0.043
	(0.023)	(0.046)	(0.027)	(0.034)
Financial Self-Knowledge	–0.019	–0.019	–0.044*	0.016
	(0.022)	(0.048)	(0.026)	(0.032)
Change in Credit Risk	–0.018*	–0.009	0.015	0.036**
	(0.010)	(0.020)	(0.011)	(0.014)
Change in Job Shock	0.003	–0.007	0.007	0.009
	(0.010)	(0.026)	(0.009)	(0.016)
L4: Assets > Liabilities	–0.022	–0.088	–0.003	0.035
	(0.030)	(0.088)	(0.040)	(0.089)
L4: Homeowner, with Mortgage	0.026	0.219***	–0.025	–0.070
	(0.032)	(0.067)	(0.037)	(0.060)
L4: Homeowner, No Mortgage	0.050	0.252***	–0.097**	–0.141**
	(0.047)	(0.090)	(0.041)	(0.063)
L4: Has Car Loan	–0.045**	–0.018	0.071***	0.046*
	(0.019)	(0.039)	(0.021)	(0.025)
L4: Has Student Debt	–0.060*	–0.054	0.184***	0.006
	(0.032)	(0.085)	(0.062)	(0.079)
Year=2012	0.054**	0.160***	0.016	0.003
	(0.028)	(0.054)	(0.032)	(0.039)
Observations	2619	731	2111	1133
R squared	0.05	0.13	0.08	0.11

Notes: The dependent variable is a dummy variable equal to one if the transition from puzzle to saver, $\boldsymbol{P \rightarrow S}$ (or from saver to puzzle $\boldsymbol{S \rightarrow P}$) occurred, and zero if the respondent remained in the puzzle (or the saver) category. The predicted credit risk variable is computed using information on whether households were denied credit after applying and those discouraged from applying from credit. All regressions control for formal knowledge (years of completed education and AFQT scores); demographics (age, race, gender, marital status, and the number of kids); and state fixed effects. Robust standard errors (in parentheses) clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.7: Puzzle versus Savers: Fixed Effect Regressions

	(1)	(2)	(3)	(4)
	Baseline			Strict
Predicted Credit Risk	0.034***	0.034***	0.029***	0.027**
	(0.007)	(0.007)	(0.007)	(0.011)
Job Shock	–0.004	–0.004	–0.004	0.013
	(0.009)	(0.009)	(0.008)	(0.016)
Assets > Liabilities			–0.070***	–0.070
			(0.023)	(0.059)
Homeowner, with Mortgage			0.163***	0.173***
			(0.028)	(0.047)
Homeowner, No Mortgage			0.091***	0.148***
			(0.033)	(0.054)
Has Car Loan			0.036***	0.013
			(0.014)	(0.022)
Has Student Debt			0.053	0.131**
			(0.036)	(0.064)
Married	0.043	0.040	0.009	0.008
	(0.029)	(0.029)	(0.029)	(0.045)
Has kids	0.007	0.066	0.061	0.100
	(0.108)	(0.105)	(0.105)	(0.148)
Year=2008	–0.035	–0.043	0.044	–0.022
	(0.055)	(0.055)	(0.077)	(0.118)
Year=2012	–0.087	–0.102	0.000	0.000
	(0.129)	(0.131)	(.)	(.)
Observations	7,652	7,596	7,558	3,162
R squared	0.65	0.66	0.66	0.71
Individual Fixed Effects:	Yes	Yes	Yes	Yes
State Fixed Effects:	No	Yes	Yes	Yes

Notes: The dependent variable is a dummy variable equal to one if the respondent is in the puzzle group and zero if a saver. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

B.1 Multinomial Logit Regressions

Table B.8: Multinomial Logit. Characteristics of the Puzzle Respondents Compared to Others. Strict Puzzle Definition

	(1) Borrower	(2) Neutral	(3) Saver
Present Bias	0.136	0.242*	–0.067
	(0.077)	(0.115)	(0.088)
High Discount Rate	0.076	0.178	–0.184*
	(0.076)	(0.113)	(0.088)
Middle Risk Aversion	–0.061	–0.109	0.019
	(0.082)	(0.127)	(0.092)
Female	–0.013	–0.201	–0.036
	(0.077)	(0.116)	(0.089)
Hispanic	–0.098	–0.006	–0.109
	(0.162)	(0.228)	(0.189)
Black	0.266	0.484**	0.137
	(0.143)	(0.173)	(0.181)
Age	–0.053**	–0.034	–0.056**
	(0.017)	(0.025)	(0.020)
Year=2008	0.328***	0.309*	0.217*
	(0.086)	(0.128)	(0.097)
Year=2012	0.607***	0.627**	0.700***
	(0.153)	(0.229)	(0.176)
Married	–0.201*	–0.717***	0.009
	(0.094)	(0.125)	(0.108)
Has kids	0.267**	0.903***	–0.150
	(0.099)	(0.156)	(0.108)
AFQT Score	–0.089	–0.695***	0.085
	(0.052)	(0.078)	(0.059)
College or More	–0.383***	–0.722***	0.172
	(0.096)	(0.190)	(0.107)
Financial Literacy	–0.055	–0.173**	0.089
	(0.039)	(0.055)	(0.047)
Financial Self-Knowledge	–0.289***	–0.358**	-0.074
	(0.085)	(0.122)	(0.099)
Job Shock	0.019	0.159*	–0.031
	(0.049)	(0.066)	(0.056)
Predicted Credit Risk	–0.028	–0.345***	–0.171***
	(0.036)	(0.053)	(0.040)
Assets > Liabilities	–1.078***	–1.700***	0.400*
	(0.116)	(0.143)	(0.160)
Homeowner, with Mortgage	–0.609***	–1.684***	–0.349*
	(0.126)	(0.155)	(0.154)
Homeowner, No Mortgage	–0.743***	–1.015***	0.466**
	(0.153)	(0.189)	(0.174)
Has Car Loan	0.041	–0.825***	–0.582***
	(0.069)	(0.110)	(0.077)
Has Student Debt	0.220	0.021	–0.716***
	(0.137)	(0.222)	(0.191)
Observations	9,899		

Notes: The table presents marginal effects from multinomial logit regressions with individuals in the puzzle group as the comparison group. Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.9: Multinomial Logit. Transitions from the Puzzle Group to Other Groups. Strict Puzzle Definition

	(1)	(2)	(3)
	Puzzle to Saver	Puzzle to Borrower	Puzzle to Neutral
Present Bias	0.008	0.009	0.145
	(0.178)	(0.154)	(0.406)
High Discount Rate	–0.376*	0.116	–0.678
	(0.179)	(0.154)	(0.434)
Middle Risk Aversion	–0.176	–0.117	–0.905
	(0.189)	(0.163)	(0.586)
Female	–0.300	–0.175	–0.548
	(0.180)	(0.156)	(0.402)
Hispanic	0.059	0.118	–20.884***
	(0.427)	(0.342)	(0.517)
Black	0.504	0.852*	0.715
	(0.532)	(0.390)	(0.738)
Age	–0.105**	–0.036	–0.073
	(0.040)	(0.035)	(0.085)
Year=2012	0.714**	0.166	1.452*
	(0.251)	(0.219)	(0.654)
Married	0.112	–0.061	–0.950*
	(0.218)	(0.187)	(0.462)
Has kids	–0.532*	–0.051	0.122
	(0.228)	(0.206)	(0.609)
AFQT Score	0.047	–0.293**	–0.504
	(0.138)	(0.113)	(0.325)
College or More	–0.270	–0.173	–0.515
	(0.216)	(0.185)	(0.575)
Financial Literacy	–0.001	–0.039	–0.508*
	(0.088)	(0.081)	(0.213)
Financial Self-Knowledge	–0.001	–0.336*	0.218
	(0.208)	(0.170)	(0.482)
Change in Job Shock	0.046	0.184	0.454
	(0.105)	(0.119)	(0.256)
Change in Predicted	–0.065	–0.086	–0.387
Credit Risk	(0.089)	(0.076)	(0.232)
L4: Assets > Liabilities	–0.454	–0.641*	–1.016
	(0.392)	(0.291)	(0.654)
L4: Homeowner, with Mortgage	1.094*	–0.004	–0.766
	(0.437)	(0.282)	(0.607)
L4: Homeowner, No Mortgage	1.370**	–0.544	–0.447
	(0.500)	(0.369)	(0.766)
L4: Has Car Loan	–0.197	–0.042	–0.367
	(0.175)	(0.154)	(0.414)
L4: Has Student Debt	–0.418	0.368	–0.322
	(0.417)	(0.282)	(1.062)
Observations	1,144		

Notes: The table presents marginal effects from multinomial logit regressions with individuals transitioning from the puzzle group to other groups (puzzle to puzzle being the baseline of comparison). Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

Table B.10: Multinomial Logit. Transitions from the Saver Group to Other Groups. Strict Puzzle Definition

	(1) Saver to Puzzle	(2) Saver to Borrower	(3) Saver to Neutral
Present Bias	–0.084	0.289	0.237
	(0.184)	(0.153)	(0.366)
High Discount Rate	0.149	0.184	0.126
	(0.177)	(0.152)	(0.369)
Middle Risk Aversion	0.322	–0.111	–0.268
	(0.185)	(0.169)	(0.419)
Female	–0.133	–0.021	–0.775*
	(0.176)	(0.157)	(0.376)
Hispanic	–0.081	0.033	–0.528
	(0.534)	(0.427)	(0.751)
Black	0.010	0.077	0.026
	(0.427)	(0.358)	(0.553)
Age	–0.021	0.008	0.117
	(0.039)	(0.033)	(0.083)
Year=2012	–0.016	–0.476*	–0.618
	(0.247)	(0.210)	(0.494)
Married	–0.065	–0.366*	–1.730***
	(0.239)	(0.177)	(0.414)
Has kids	0.060	0.503**	1.187**
	(0.222)	(0.193)	(0.417)
AFQT Score	–0.199	–0.310**	–0.843***
	(0.131)	(0.109)	(0.250)
College or More	–0.352	–0.303	–0.693
	(0.200)	(0.189)	(0.526)
Financial Literacy	–0.017	–0.008	–0.044
	(0.101)	(0.080)	(0.155)
Financial Self-Knowledge	0.039	–0.431*	–0.383
	(0.217)	(0.168)	(0.402)
Change in Job Shock	0.257	0.122	–0.390*
	(0.163)	(0.125)	(0.192)
Change in Predicted	0.248**	0.120	–0.159
Credit Risk	(0.092)	(0.077)	(0.185)
L4: Assets > Liabilities	0.112	-1.068**	–1.172*
	(0.585)	(0.388)	(0.571)
L4: Homeowner, with Mortgage	–0.544	–0.041	–0.714
	(0.311)	(0.257)	(0.456)
L4: Homeowner, No Mortgage	–1.075**	–0.725*	–1.508**
	(0.370)	(0.296)	(0.553)
L4: Has Car Loan	0.453*	0.088	–0.607
	(0.177)	(0.152)	(0.404)
L4: Has Student Debt	0.420	0.857*	1.280
	(0.499)	(0.436)	(0.755)
Observations	1,420		

Notes: The table presents marginal effects from multinomial logit regressions with individuals transitioning from the saver group to other groups (saver to saver being the baseline of comparison). Robust standard errors (in parentheses) are clustered at the individual level. The symbols ***(**)[*] indicate significance at the 1(5)[10] percent level.

C Income Profiles

We have established that there are some differences in time preferences and risk attitudes across respondents in the puzzle group and other groups. These differences may also interact with differential income profiles or income realizations. For example, individuals with steeper income profiles (other things equal) would tend to accumulate more debt early on (although not necessarily hold debt and assets simultaneously). We find some evidence of this in the data, but the differences between the saver and the puzzle groups are not large.

In Figure C.2, we depict biennial arc growth rates of real income for individuals in the puzzle group relative to other individuals (the NLSY79 was administered biennially beginning in 1994). Arc income growth in year t for individual i is defined as $gy_{i,t} = (y_{i,t} - y_{i,t-2})/\bar{y}$, where $\bar{y} = (y_{i,t} + y_{i,t-2})/2$. We use arc income growth because it is bounded to the [–2,2] interval, which is convenient when dealing with outliers. In particular, we plot average or median income growth for the puzzle group minus average or median income growth for all other respondents or for savers. When households are classified based on 2004 or 2012 data, it seems that income growth was indeed higher for individuals in the puzzle group around the time credit card and liquid assets were measured. The pattern is not so clear around 2008, which is not surprising as the time coincides with the onset of the Great Recession.

For a more formal test, we calculate (at the individual level) a backward-looking moving average of income growth for the three years in which we can measure credit card debt: 2004, 2008 and 2012. In particular, we compute $gy^B_{i,t} = (gy_{i,t} + gy_{i,t-2})/2$, where $gy_{i,t}$ is biennial arc income growth in period t. We regress this variable on a dummy for being in the puzzle group and a series of controls (education dummies, an age polynomial, race, gender, marital status, presence of kids, year dummies and state dummies), clustering standard errors at the state level. When compared to all individuals, biennial income growth is 2.1 percent higher for respondents in the puzzle group (significant at the 1 percent level). Income growth for respondents in the puzzle group is 0.7 percent higher than for savers but this estimate is not precise. We reach similar conclusions if we use a three-period or one-period moving average instead.

We also look into the evolution of income going forward (which we cannot do for 2012 which is the last survey year available), as households in different groups may expect differential income growth to continue in the future. We regress $gy^F_{i,t} = (gy_{i,t+2} + gy_{i,t+4})/2$ on the same set of controls as before. The coefficients for the puzzle dummy remain positive but are no longer significant except for 2004, when we find that respondents in the puzzle group have 2.3 percent higher biennial future income growth than other respondents—see Table C.1.

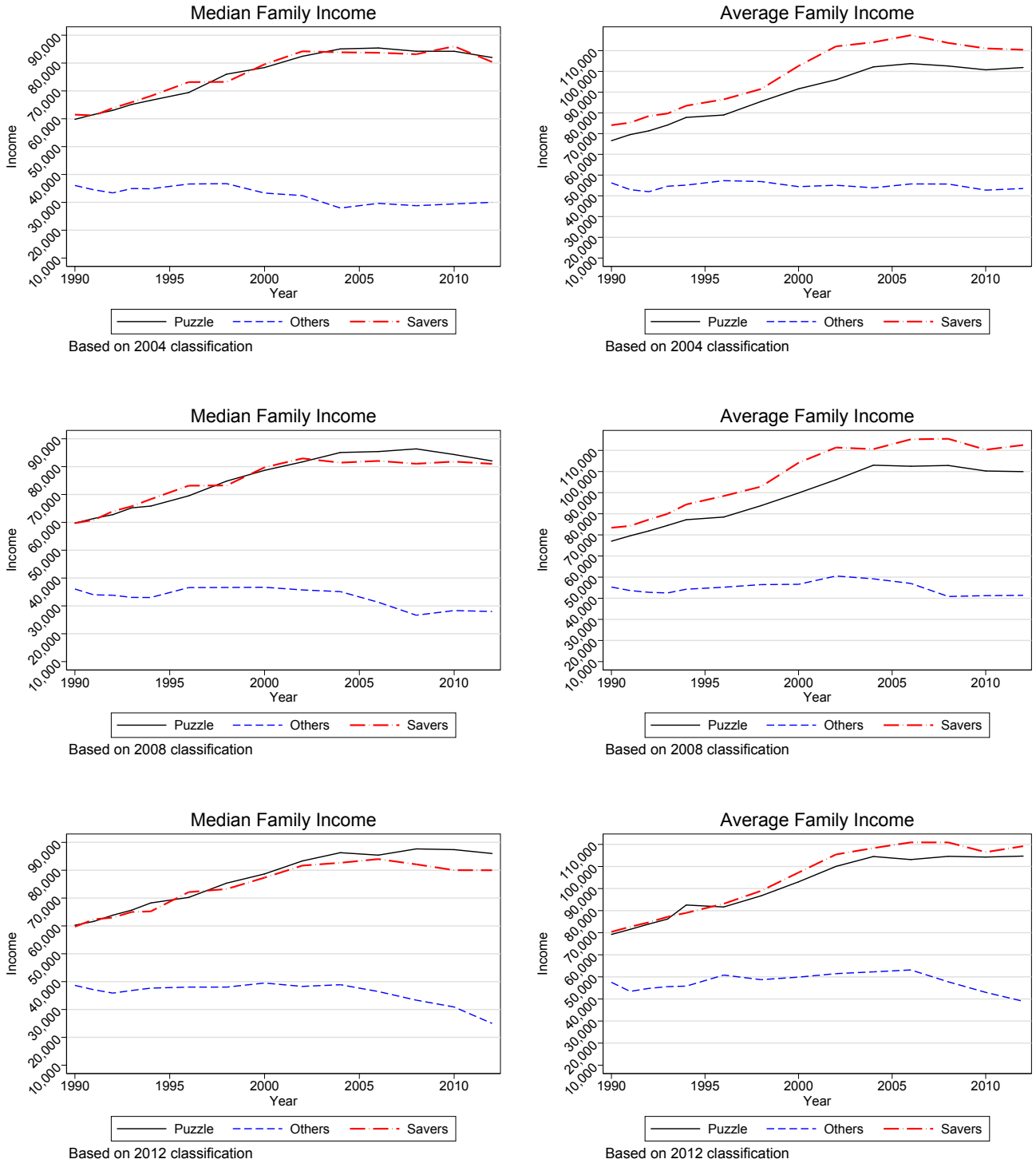
In summary, there is some evidence that income profiles may be steeper for individuals in the puzzle group prior to the time in which we measure credit card balances.

Table C.1: Income Growth and the Puzzle

	(1)	(2)	(3)	(4)
	Backward Income Growth		*Forward Income Growth*	
	vs. All	vs. Savers	vs. All	vs. Savers
	All years			
Puzzle dummy	0.021***	0.007	0.004	0.007
	(3.35)	(1.07)	(0.49)	(0.94)
Observations	7,947	6,515	5,467	4,494
	2004			
Puzzle Dummy	0.025**	0.015	0.023**	0.014
	(2.17)	(1.32)	(2.17)	(1.28)
Observations	2,457	2,089	2,806	2,314
	2008			
Puzzle Dummy	0.016	–0.003	–0.014	0.001
	(1.53)	(–0.24)	(–1.28)	(0.09)
Observations	2,813	2,284	2,654	2,173
	2012			
Puzzle Dummy	0.020*	0.008		
	(1.73)	(0.69)		
Observations	2,671	2,132		

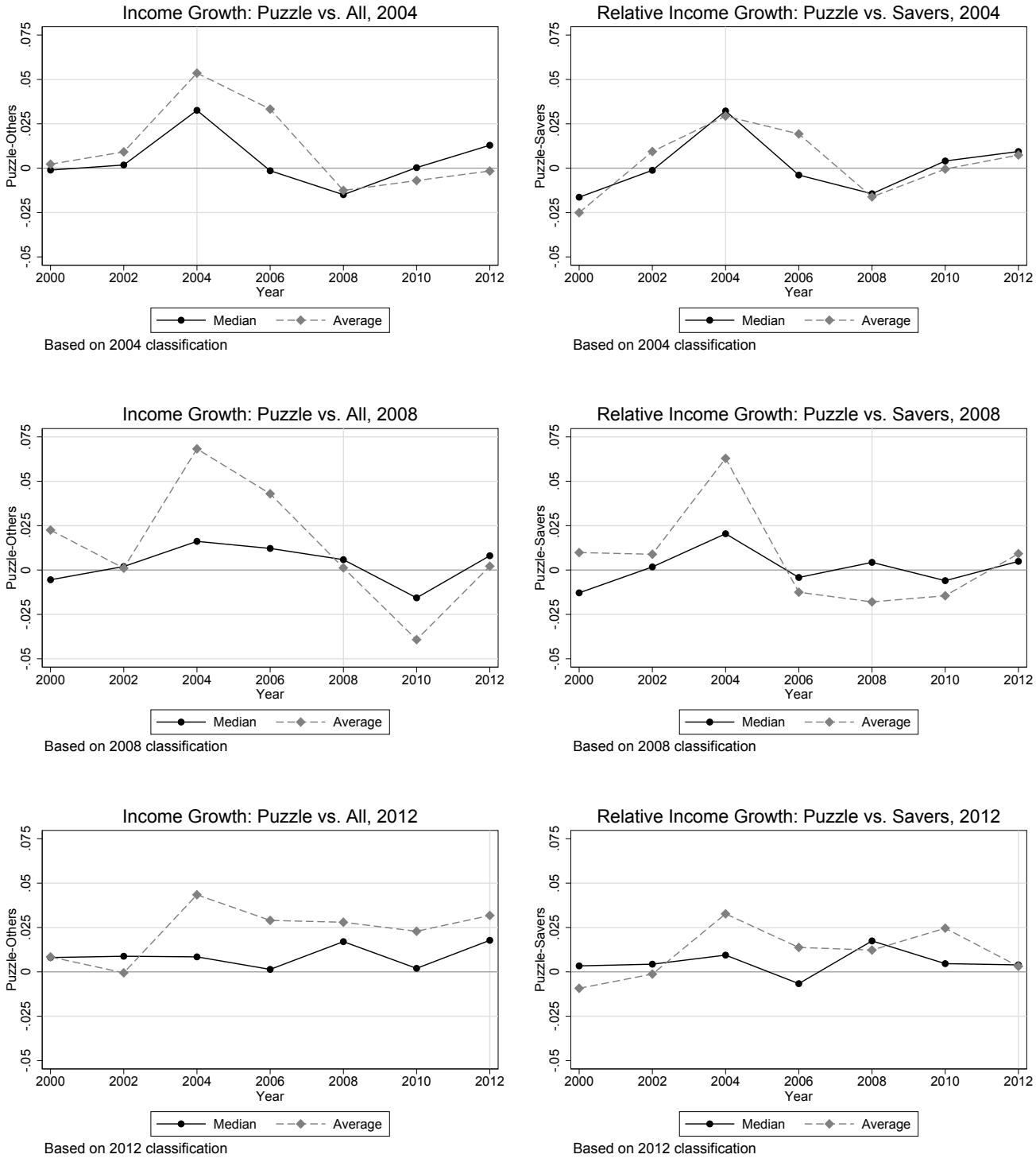
Notes: Linear regressions. The LHS for the *Backward Income Growth* columns is the average of backward-looking arc income growth from $t-2$ to t and from $t-4$ to $t-2$. The LHS for the *Forward Income Growth* columns is the average of forward-looking arc income growth from t to $t+2$ and from $t+2$ to $t+4$. Controls: education dummies, an age polynomial, race, gender, marital status, presence of kids, year dummies and state dummies. Standard errors clustered at the state level.
The symbols ***(**)[*] indicated significance at the 1(5)[10] percent level.

Figure C.1: Comparing Income across Groups



Source: Authors' calculations using the NLSY79

Figure C.2: Comparing Income Growth across Groups



Source: Authors' calculations using the NLSY79