Rationality, Revolving, and Rewards: An Analysis of Revolving Behavior on New Credit Cards[1]

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Long the foundation of economic analysis, the theory of rational choice holds that consumers are rational utility maximizers. Subject to a budget constraint, and given prices in the market, consumers will make choices that systematically increase their utility. Although few, if any, would deny that consumers make mistakes, rational choice theorists maintain that mistakes are not systematic or persistent. Different consumers make different mistakes, and any mistakes are likely to be corrected promptly as consumers discover that a better alternative exists. Thus, consumer choices as revealed in the market are compelling evidence that particular choices enhance consumer welfare, as long as we take the consumer's preferences as given.

Beginning at least with the work of Tyversky and Kahneman (1974), economists, psychologists, and other social scientists (including lawyers) have proposed that real people do not always make decisions in accordance with the predictions of the rational choice model, especially when risk and uncertainty are involved. These behavioralists have used laboratory experiments to identify certain biases in human decisionmaking. The experimental results suggest that at least some people make certain decisions in ways that make them worse off. Based on these results, some argue that observed choices are not the reliable indicator of true consumer preferences that is traditionally assumed.

For example, some behavioralists have used these experimental results to argue that consumer choice with respect to credit card usage results in higher levels of debt than consumer preferences would indicate. These behavioralists claim that, as a result, credit cards have not, on balance, made consumers better off, and that many consumers cannot be trusted to use them wisely. Looking over three decades worth of laboratory experiments, they believe people's decisions about debt can be expected to deviate from the rational choice model for a variety of reasons. Cass Sunstein (2006) has grouped these reasons into five categories: Myopia and self-control problems, Cumulative cost neglect, Procrastination and inertia, Unrealistic optimism, and Miswanting and relative position.

> *Myopia and self-control problems* reflect the phenomenon of hyperbolic discounting. Some consumers can be expected to emphasize short-term gains at the expense of long-term costs, leading to short-term decisions that generate long-term distress. Such choices are distinct from short-term decisions that simply allocate utility over time. Viewed through the lens of myopia or hyperbolic

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discounting, excessive borrowing on revolving lines of credit is a member of "the same general family with insufficient savings, . . . insufficient exercise, obesity, poor diet, and excessive smoking and drinking."

Cumulative cost neglect applies to the borrowing that results from a long series of small purchases. Consumers who would not choose to acquire $20,000 in revolving debt at a relatively high interest rate in a single purchase find themselves facing the same outcome by ignoring the effect of a long series of purchases over time.

Procrastination and inertia describes people who end up paying interest charges or late fees simply because they neglect to pay their bills on time, even though they have sufficient funds available.

Unrealistic optimism describes consumers who fail to assess accurately the likelihood they will be able to repay current obligations. Like young smokers who believe, wrongly, that they are soon likely to quit smoking, excessively optimistic borrowers fail to appreciate the difficulty associated with future payment obligations.

Miswanting and relative position describe borrowing to finance purchases of things that do not promote welfare, but may reflect people's competition with others for relative position. To the extent that people use credit to fund miswanted purchases, they end up incurring debts without any offsetting increase in utility.

This paper seeks to test the behavioralist predictions in the market for new credit cards. As discussed in the next section, rational choice and the behavioralist approach predict different effects for consumer behavior with respect to cards with and without a rewards feature (such as cash back or airline miles). Moreover, they predict different effects for changes in balances over time. Using a unique set of panel data collected for Visa, we seek to test these hypotheses to determine whether the conventional rational choice model or the behavioralist alternative can best explain the observed patterns of revolving behavior. We find that revolving behavior is consistent with the predictions of the rational choice model, and, on the two key variables, contradicts the predictions of the behavioralist approach.

Section I explores the differences between the behavioral model and the rational choice model in their predictions regarding revolving behavior on rewards card. Section II presents our data, variable definitions, and empirical results. Section III offers some conclusions.

I. Rationality and Revolving Behavior

Over the course of their lifetimes, rational, utility maximizing consumers would likely find it optimal to borrow to smooth consumption over time. When they decide to borrow, they would choose the lowest cost source of funds. Consumers may borrow

against assets (*e.g.*, a home equity loan or a pawnbroker), against future income (*e.g.*, a personal loan), or as part of an existing relationship with a credit card issuer.

For many, the cheapest and most convenient borrowing alternative is credit cards. Even if better interest rates are available elsewhere, which is not always the case, alternatives such as bank loans often involve significant transactions costs. As Brito and Hartley (1995) show, even low transactions costs can make credit cards a more attractive source of borrowing than other alternatives. Credit on a card is available whenever the consumer wants it, with no additional costs beyond those inherent in the transaction itself. Indeed, over time, credit card debt has displaced non-revolving forms of borrowing, such as installment or personal loans (Zywicki 2004). Although in 2004, 56 percent of consumers report they pay their credit card bills in full and do not carry a balance (Federal Reserve), the credit function is important. Consumers who use credit cards for borrowing and therefore carry a balance are, in the industry terminology, "revolvers." Among households with a balance, the median balance in 2004 was $2,200 (Federal Reserve).

In addition to serving as an attractive source of borrowing, credit cards appeal to consumers for other reasons. In 2004, 71.5 percent of US households had at least one general purpose card, and charged more than 24 billion transactions, totaling over $1.6 trillion in 2005 (Card Industry Directory).[4] One increasingly popular characteristic of many credit cards is rewards features. The rewards may be cash back, airline miles, a contribution to a favorite charity, or some other compensation of value to the consumer. Typically, consumers receive rewards as a percentage of purchases made using the card.

Rewards cards have been the subject of criticism from a behavioral economics perspective. In particular, behavioralists have claimed that, because the rewards reduce the effective cost of current purchases, consumers who exhibit hyperbolic discounting may increase current purchases, resulting in more future debt (Bar-Gill, 2004). Because credit cards reduce the pain of paying, they may lead to overindebtedness (Lowenstein and O'Donoghue, 2006) or systematic overuse of credit cards (Mann, 2005). Rewards cards, which literally pay consumers for current transactions, should be particularly prone to this bias. Thus, behavioral economics implies that consumers who obtain a new rewards card should be more likely to carry a balance on the card than those who obtain new cards that lack the rewards feature. Moreover, they should accumulate more debt over time as they succumb to the temptations of current consumption. Thus, the behavioral hypothesis implies that consumers who obtain a new rewards card should be more likely to carry a balance than those who obtain a card without a rewards feature, and that this tendency to carry a balance should increase over time.

Rational choice has no such implications. According to this model, consumers may well choose to carry a balance on any new card. A new card may be the lowest cost

[4] The *Card Industry Directory* is a publication of SourceMedia, Inc., a firm that provides market information, including news, analysis and insight to the financial services industry. The *Directory* is published annually.

source of additional credit. Moreover, consumers may obtain a new card to increase the amount of credit available. But there is no reason to expect consumers would be systematically more likely to carry a balance on rewards cards. Indeed, to maximize rewards, consumers should maximize the volume of transactions through the rewards card. Carrying a balance, however, would reduce the possible volume of transactions. Thus, rational choice suggests that those who obtain a new rewards card should be less likely to carry a balance than those who obtain other new cards.

Similarly, rational choice provides no reason to believe the likelihood of carrying a balance would increase over time. In fact, obtaining a new card to obtain additional credit would suggest that the likelihood of carrying a balance would decline over time, as consumers pay off the additional loan. Moreover, there is no rational choice reason to think that rewards cards would differ systematically in this respect from other new cards.

To date, limited work has been done to test empirically the contrasting implications of behavioral economics and rational choice. In *Paying with Plastic: Maybe Not So Crazy*, Tom Brown and Lacey Plache (2006) used micro-level consumer data to examine certain behavioralist claims. They identified several testable hypotheses to examine whether the hyperbolic discounting theory explains consumer behavior with respect to credit cards. Specifically, they looked at whether certain so-called seductive features of credit cards, such as teaser rates/high long term interest rates, rewards programs, and low annual fees, coincided with consumers' carrying balances on those cards. They also looked at whether consumers shifted spending from credit cards when they acquired a pay-now device such as a debit card. Their results tended not to support the predictions of the hyperbolic discounting theory of the behavioralists.

The Brown-Plache analysis is a first step toward testing the merits of the behavioralist theories. In this paper, we seek to continue these efforts and further our understanding of consumer behavior with respect to credit cards by examining more closely the revolving behavior of consumers who obtain new credit cards. Because consumers may rationally use credit cards as a source of credit, we control for revolving behavior before the consumer obtained the new card. Behavioral economics predicts that if the new card is a rewards card, consumers should be more likely to carry a balance, other things equal. Rational choice predicts consumers should be less likely to carry a balance on a rewards card. Behavioral economics predicts that the likelihood of carrying a balance should increase over time as consumers are seduced by the rewards feature of their cards. Rational choice provides no reason to expect such an increase over time.

We examine one other feature of credit cards that has been the subject of criticism from a behavioralist perspective, the shift of many issuers to cards with no annual fee. According to some (Bar-Gill, 2004), the absence of an annual fee is just another way to reduce the immediate pain of paying, and should be associated with an increased likelihood of revolving. From a rational choice perspective, however, consumers who plan to revolve should choose cards with higher annual fees and lower interest rates, because that combination is likely to reduce the overall costs of borrowing. Thus, higher fees should be associated with a greater likelihood of revolving. Even holding interest

rates constant, there is no reason to expect the absence of a fee would increase borrowing under the rational choice model.

II. Empirical Tests

A. The Panel Data

Our empirical analysis utilizes data from the Payment System Panel Study, a long-running survey of consumer finances commissioned by Visa USA.[5] Panels of approximately 1,600 consumers are recruited from a nationally representative sample. To be eligible to participate in a panel, respondents must be at least 18 years old, have a household income of at least $10,000, and have at least one payment card (either credit or debit). Panels are surveyed once each quarter, and consumers remain in the study as long as they are still willing to complete the questionnaire. In addition to basic demographic information, the questionnaire seeks information about the terms of each payment card the household owns, including the annual percentage rate ("APR"), the annual fee, any rewards feature, and whether the card is a gold or platinum card. Consumers report the balance on each card after their last payment, using a series of balance categories. Finally, consumers complete a diary detailing each transaction and the payment method used for that transaction. We utilize data from 1994, when the panels began, through 2003.[6]

Our sample consists of consumers who obtained a new general purpose credit card while they were part of the panel. A new card is one that did not appear in the household's list of cards in any previous quarter. Although there are gaps for some consumers who do not participate every quarter, we utilize data only for consumers who participated in the panel either in the quarter immediately before the card was obtained, or in the quarter before that. Thus, all new cards in the sample were obtained less than six months ago. Each new card is treated as an observation. Thus, a consumer who obtains additional cards during the sample period may appear in our sample more than once.

We follow new cards for up to two years (eight quarters) after they are obtained. Table 1 shows the distribution of the regression sample over time, both by cards and by the number of observations. By cards, the table indicates the last observed quarter for each new card. Thus, for example, the first like of the table indicates that we have data only on the quarter of acquisition, with no subsequent observations for that card, for approximately 20 percent of cards. We have data after two years for just over 28 percent of all cards, and 25 percent of rewards cards. Note that we do not necessarily have data for all eight quarters for these observations, because missing variables or nonparticipation may mean that we lack data for an intermediate quarter. By observations, the table shows

[5] This database is the same one used by Brown and Plache (2006).

[6] The panel study is ongoing, and data are available after 2003. Because of changes in data format, however, we have not yet integrated subsequent data into our analysis.

the number of observations in each quarter. Although only about eight percent of the observations are in the eighth quarter after acquisition, these observations account for about 25 percent of the new cards in the sample. Whether by cards or by observations, the distributions are quite similar for rewards cards and all cards. Rewards cards account for 38 percent of all cards in the sample, and 36 percent of all observations.

B. Variables and Definitions

Using logistic regression analysis, we analyze the probability that the consumer carries a balance on a new card in any given quarter. A critical variable is whether a consumer carries credit card debt before acquiring the new card. We consider a consumer to be a "pre-revolver" if they carried a balance on *any* card in either of the two quarters before they acquired the new card. Thus, "non-revolvers" prior to acquisition did not have any credit card debt on any card.[7]

Table 2 displays the simple cross tabulations of revolving behavior for rewards cards and for all cards. Consumers who acquired a new rewards card were less likely to be revolvers in the quarter before they acquired the card (57 percent versus 69 percent for all cards).[8] We consider consumers post acquisition to be revolvers in each of the quarters we observe in which they carried a balance on the new card. Given pre-acquisition status, consumers with new rewards cards differ little from consumers with other new cards. Among revolvers who acquire a rewards card, 72 percent remain revolvers, compared to 75 percent for all cards. Among non-revolvers, only 14 percent of those who acquire a new rewards card become revolvers, compared to 17 percent for all cards. The simple cross tabulations do not support for the behavioral prediction of increased revolving behavior.

In addition to whether a card has a rewards feature, we control for two other terms of the card, APR, and the annual fee.[9] APR is a continuous variable, but annual fee is categorical. We can identify cards with no annual fee (the omitted category), cards with an annual fee under $20, and cards with annual fees over $20. We expect that higher interest rate cards reduce the probability of carrying a balance. Given the APR, higher fees should increase the likelihood of revolving on the card, because one component of the cost of the card is independent of whether there is an outstanding balance.

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[7] We examined the previous two quarters primarily to reduce the loss of data because of lack of information on the previous quarter. To be included in the sample, an observation must have data on one of the two quarters before the acquired the new card, but not necessarily both quarters. If both prior quarters are available, however, a consumer is a "pre-revolver" if he or she revolved in either quarter.

[8] Our definition of revolving yields more revolvers than appear in the Survey of Consumer Finances, where 56 percent report that they usually pay their bills in full. That question asks consumers to generalize across both time and different cards to report their behavior. Our definition, in contrast, classifies a consumer as a revolver if they revolved on any card in either of two quarters. It is thus not surprising that we have more revolvers than the Survey of Consumer Finances would suggest.

[9] We experimented with using the initial APR on the card as the measure of the cost of credit, but the actual APR consistently performed better in the regressions.

We control for a number of demographic variables that are likely to influence the demand for credit. Household size is likely to influence the demand for credit, with larger households (given income) likely to have higher credit demands, and hence a higher likelihood of carrying a balance on a new card. Similarly, younger households (measured by the age of the head of household) are likely to have a higher demand for credit to shift expected future income increases into current consumption, and are more likely to carry a balance. We also control for home ownership. Households that own a home both likely have more assets, reducing the demand for other credit, and likely have better alternative sources of funds other than credit cards. Both factors would reduce the likelihood of revolving.

We observe household income as the household's income quintile. Because increases in income are likely to reduce the demand for credit, they should also reduce the likelihood of revolving behavior.[10] We also include the household's total spending. Given income, increased spending should increase the demand for credit. On the other hand, our income measure is imprecise, and total spending may be more precise measure of expected permanent income. If so, then more spending would be associated with a reduced demand for credit and a reduced likelihood of carrying a balance.

The analysis also controls for household employment status, using a set of dummy variables for the status of the respondent and another adult member of the household. These variables control for respondents who are employed part time employment, not employed, and retired. The omitted category is households where the respondent is employed full time. For a second adult, we also add a separate dummy variable for households where the second adult is employed full time. The omitted category is households with no second adult. We have no clear expectations for these variables. If unemployment or part time employment is involuntary, we would expect it to be associated with an increased demand for credit. If employment decisions reflect voluntary choices, however, we have no clear expectations. Consumers who plan for reduced income through unemployment or part time employment should also plan for reduced expenditures, which would reduce the likelihood of revolving. Retirement, which is presumably planned, should reduce the demand for borrowing against future income, but may increase the demand for borrowing against assets.

Finally, we considered several quarter-to-quarter changes in demographics that may influence the demand for credit. In the results reported below, we include purchasing a new home, an increase in household size, and a decrease in household size. Anyone who has purchased a home would predict that doing so increases the demand for credit entirely apart from the mortgage, which in turn would increase the probability of revolving. We expect increases in household size (*e.g.*, a new baby) to increase the demand for credit above and beyond the effect of the change in household size itself, and decreases in household size to reduce the demand for credit (with corresponding changes in the likelihood of revolving). Although events such as purchasing a new home or

[10] In some early models, we also included credit limit as a variable. Once income is entered in the analysis, however, credit limit was no longer significant, and it is not included in the results reported below.

having a baby may be planned, the increased current spending they require is likely to increase the demand for credit even with planning.

We also explored a number of other demographic changes that did not prove to be significant and are not further reported. These include getting married, getting separated or divorced or having a spouse die, moving (to either another zip code or another state), increasing income, decreasing income, and male or female head of household losing a job.

C. Results

The results of the logistic regressions predicting the probability of carrying a balance in the current quarter are reported in Table 3. The first regression presents the results analyzing rewards cards only. This formulation allows all variables to have a different effect on revolving if the card is a rewards card, but it does not allow a straightforward test of differences between rewards cards and other cards. The second regression analyzes all new cards in the sample, allowing only the intercept term to differ for rewards cards. Although there are some exceptions, discussed below, the signs and magnitudes of the coefficients are generally consistent whether we consider all cards or rewards cards only.

In both models, the consumer's status as a revolver before acquiring the new card is by far the most important variable in predicting the likelihood of revolving. Consumers who revolved on at least one other card are quite likely to revolve on a new card as well, whether it is a rewards card or not. For rewards cards, the predicted probability of revolving for a pre-revolver is 65 percent; for someone who was not a revolver before the new card, the probability is 12 percent.[11] In the all cards regression, the corresponding probabilities for non-rewards cards are 74 percent and 18 percent.

The results for the number of quarters since the card was acquired are inconsistent with the behavioral hypotheses that consumers are seduced into debt over time. In both models, the coefficient on the number of quarters since the card was acquires is negative and statistically significant. Thus, the longer a consumer has had a card, the less likely they are to carry a balance on that card. That result holds for rewards cards alone, and it holds as well for all cards. For pre-revolvers, the calculated probability of revolving in the eighth quarter falls from 64 percent in the quarter of acquisition to 58 percent for the rewards card model, and from 74 percent to 63 percent for a non-rewards card in the all card model.

The all cards model allows us to test whether the probability of carrying a balance is different for rewards cards and other cards. It is, but not in the direction the behavioral

[11] The calculated probability is evaluated in the quarter of acquisition at the mean for the all cards sample for transactions and APR, for a homeowner in the middle income quintile, age 46 (approximately the sample mean) in a household with 3 members, employed full time, with no quarter to quarter changes in demographics and no annual fee on the card. These values are either integer approximations of the mean (age and household size) or the sample modal values.

hypothesis predicts. The coefficient on the rewards card variable is negative and statistically significant. Thus, given their prior behavior, consumers are less likely to revolve on a new rewards card than they are on another new card. This result is the opposite of the behavioral prediction that consumers are more likely to revolve on a rewards card.

Considering card features, the higher the APR, the less likely consumers are to revolve. Contrary to the behavioral prediction, consumers are more likely to revolve on a card with annual fees. Coefficients for both fee categories are positive and statistically significant. In the all cards regressions, the likelihood of revolving is greater for cards with greater annual fees, and the difference in the coefficients is statistically significant.[12] In the model with rewards cards only, the pattern is perverse: both coefficients are positive, but the likelihood of revolving is highest for cards with a smaller annual fee (less than $20). The difference, however, is not statistically significant.[13] In either case, the results are not consistent with the notion that the absence of an annual fee is itself a seduction feature that increases the likelihood consumers will revolve. Consumers with cards with no annual fee (the omitted category) have the lowest probability of revolving, a difference that is statistically significant for either annual fee category.

Rather than influencing the probability of carrying a balance, it is possible rewards cards have an effect consistent with the behavioralist predictions on the size of the balance consumers maintain. Table 4 reports our test of this possibility. Because we know balance information only in categories (the lowest category is zero balance), we use an ordered logistic model to predict the eight balance categories.[14] Other than the dependent variable, we employ the same variables that are included in the binary logistic model predicting the probability of any balance. As before, we estimate the model for rewards cards separately, and again for all new cards.

Our central results are unchanged with the balance category as the dependent variable. Prior revolving status remains the most important variable. In either sample, the longer it has been since the customer acquired the card, the lower the balance category. In the all cards sample, the probability of revolving on a new rewards card is significantly lower than on another new card. APR is negative and significant, and both annual fee variables are positive and significant. In both samples, however, the coefficients for annual fees over $20 and under $20 are almost identical. Again, the difference is not statistically significant.[15]

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[12] In the all cards regression without the interaction term, the difference in the coefficients is .2394. The standard error of the difference is .0845, significant at one percent.

[13] The difference is -.0813; the standard error is .1339.

[14] Alternatively, we could collapse the balance categories to an estimated dollar value using the midpoint of each balance category. We have not explored this possibility.

[15] For rewards cards, the difference is .0004, and the standard error is .11. For all cards, the difference is -.01, with a standard error of .06.

Although not central to our test of the behavioral hypotheses, other results are also of interest. Among the demographic variables, higher income households, homeowners, and older households are significantly less likely to revolve, whether we use the rewards card sample or all cards, and whether we consider the probability of revolving or the balance category as the dependent variable.[16] Similarly, larger households are more likely to revolve in all estimates. Higher total spending reduces the probability of revolving. In the balance category models, the coefficient remains negative but is not significant.

The employment dummy variables are interesting, and consistent with the notion that households are choosing credit demand and employment status jointly. Households where the respondent is employed full time (the omitted category) are those most likely to revolve (and have a higher balance), and the presence of a second adult employed full time increases both the probability and the balance. Compared to full time employment, households where the respondent is employed part time or retired are less likely to revolve, suggesting they have planned for part time employment and the resulting lower income. Similarly, the presence of another adult who is employed part time or retired reduces the probability of revolving and the balance category. The effect for retired respondents, however, is only weakly significant in the all cards sample with balance category as the dependent variable. The coefficient for respondents who are not employed is never significant and had opposite signs in the all cards and rewards card samples. The presence of a second adult who is not employed reduces the likelihood of revolving and reduces the balance category as well. From a rational choice perspective, either these households have planned for unemployment, or they have adjusted their spending to the fact of unemployment. Our finding no significant effect of becoming unemployed (not reported in detail) is also consistent with this inference. It seems difficult to reconcile the results with the notion that unemployment is on average an unforeseen and unplanned event that would provoke an increase in demand for credit.

The variables capturing quarter-to-quarter changes in demographics are more inconsistent in their performance. Decreases in household size are always negative, but only significant in the all cards sample. As expected, the effect of buying a house is positive, but the results are stronger in the rewards card sample. Increases in household size are positively and significantly related to either revolving or balance category for rewards cards, but in the all cards sample the two estimates are insignificant and have opposite signs.

To check the sensitivity of our key results under alternative specifications, we estimated three alternative specifications using the all cards sample. We estimated these

[16] Intrigued by the finding of Agarwal et al. (2007) that errors in financial decisions exhibit a U-shaped pattern with respect to age, with a trough in the early 50s, we included a quadratic term in the all cards sample with revolving as the dependent variable. The linear term was positive but not significant, with age squared negative and significant at one percent. The estimated probability of revolving peaks at age 19.6. Moreover, the dummy variable for retired respondents was no longer significant. Revolving may decline more rapidly with age than the linear model suggests, but we do not find a U-shaped pattern.

specifications using the simple logistic model to predict the probability of revolving; they were not estimated with balance category as the dependent variable. Table 5 reports the results. All three models include a dummy variable for rewards cards to let the probability of revolving differ for rewards and other cards. We report only the results for prior revolving status and card features; other coefficients are largely unchanged.

We first allowed the effect of quarters since acquisition to differ for rewards and other cards. The coefficient on the rewards times quarters interaction term is positive, but it is not statistically significant,[17] and the coefficient on the rewards card dummy variable increases. Thus, we find no significant difference between rewards cards and other cards. For any card, the probability of carrying a balance declines over time, contrary to the hypothesis that consumers are seduced into debt. Rewards cards are not significantly different, again contrary to the hypothesis that the rewards feature is particularly seductive. Eight quarters out, the end of our sample period, the estimated probability of revolving on a rewards card is still significantly less than the probability of revolving on a non-rewards card.[18]

Second, we allowed the influence of prior revolving behavior to differ for rewards cards and other cards by including an interaction between prior status and the rewards feature. The coefficient on the interaction term is positive, but again is not statistically significant. Thus, habit persistence for holders of new rewards cards is no different than holders of other cards. The coefficient on the rewards dummy variable remains negative and significant. The net effect is that the lower probability of revolving on rewards cards persists, given prior status. For prior revolvers, the calculated probability of revolving on a regular card is 74 percent, compared to 66 percent for a rewards card. For prior non-revolvers, the probability is 19 percent for regular card, and 12 percent for a rewards card.

Third, we entered separate dummy variables for each quarter after the card was acquired, thus allowing a more flexible relationship between the probability of revolving and the passage of time than the simple linear constraint in the prior models. The coefficient for the first quarter after acquisition is positive and statistically significant, but the other coefficients are negative and significant for quarter 3 and beyond. The positive coefficient in the first quarter after acquisition could be consistent with the behavioral hypothesis, but it is clearly not a persistent effect. If consumers are seduced in the first quarter, they have corrected their behavior by the second, and significantly reduced the probability of revolving by the third.

Overall, the pattern of the dummy variable coefficients is approximately linear, although there is some suggestion of a smaller incremental effect of the last two quarters.

[17] The coefficient is significant at the 13 percent level. There is little meaningful change in any of the other coefficients in the model.

[18] After 8 quarters, the log odds ratio for a rewards card is different from a non-rewards card by 8*(the interaction coefficient) + the rewards card coefficient, or -.33. The standard error of this estimate is .05.

A simple linear regression of the coefficients on the quarter is statistically significant at less than one percent, with a slope coefficient of -.08 and R^2 of .86.

Finally, we estimated a reduced model that excluded all of the demographic variables that may affect the decision about whether to choose a rewards card or another type of card. These models used the all cards sample, and included only prior revolving status, quarters since acquisition, and the card feature variables. With either the probability of revolving or the balance category as the dependent variable, our essential results are unchanged. Revolving is less likely on a rewards card, less likely the longer the consumer has had the card, and less likely on a card with no annual fee.

III. Conclusion

Even if the laboratory foundations of behavioral economic propositions are sound, they are not necessarily applicable to real consumers in real markets. Hyperbolic discounting and cumulative cost neglect may be clearly demonstrable in the laboratory, but are these phenomena predictive of actual behavior in the market? Our results say that, for revolving behavior on rewards cards, the answer is no.

Hyperbolic discounting, the overemphasis on short term benefits and neglect of long term costs, implies that consumers with new rewards cards should be particularly likely to revolve. They are not. Consumers with new rewards cards are significantly *less* likely to revolve than consumers who acquire other kinds of cards.

Cumulative cost neglect implies that, as consumers neglect or discount the future consequences of their actions, they should become increasingly likely to revolve on a new credit card over time. They do not. The longer they have had a new card, the less likely they are to revolve on the card, whether or not it is a rewards card.

Together, cumulative cost neglect and hyperbolic discounting imply that consumers should be particularly likely to increase revolving behavior over time on rewards cards. They are not. The time trend of revolving behavior is not significantly different for rewards cards and other cards, although the direction is consistent with the behavioral prediction.

Of course, to some extent our results could be due to the fact that we do not model explicitly the consumer's decision to choose a rewards card as opposed to another card. It may be that systematic differences in who chooses rewards cards could explain some of our results, even if the behavioral hypotheses are in fact correct. We do not think so, in part because our essential results are unchanged whether or not we control for demographic factors that likely influence the choice of card type. More importantly, from a policy perspective, even if our results are entirely due to selection effects, the implications are the same. If the only people who choose rewards cards are consumers who will use them wisely, there is little need for restrictions on rewards to protect consumers from their behavioral biases.

The ultimate test of the validity of a model, particularly a model that appears to have policy implications, is the validity of its predictions. Our results demonstrate that the rational choice model makes better predictions about the probability of revolving behavior on rewards card than does the behavioral economics model. In this area, the rational choice model should guide policy decisions.

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