

## **Cohort Analysis of Consumer Credit Card Behaviors: Will Consumers Be Ready for Retirement?**

We explored changes in rates of revolving and levels of credit card debt using data from the 1992 and 2001 Survey of Consumer Finances. We focused on behavioral differences among those in pre-retirement and newly-retired age groups, motivated by the concern that credit card debt may be crowding out savings for retirement. A multi-hurdle model was used to estimate patterns of card ownership, revolving, and amounts revolved. We observed increasing credit card debt among cohorts. To the extent that these patterns continue in younger cohorts, future generations of households may enter retirement with even higher levels of credit card debt.

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### **Introduction**

Credit markets have changed substantially over the past 20 years. The decision to grant credit has changed from a “yes or no” decision for lenders to a “yes, but at what price” decision in a risk-based pricing environment. Legislators who passed the Fair Credit and Charge Card Disclosure Act of 1988 probably never anticipated subprime credit markets, universal default, or “penalty” interest rates that can exceed 30 percent. Nor may have they anticipated levels of outstanding credit card debt growing from \$317.5 billion in 1988 to \$804.7 billion in 2005 (constant 2005 dollars, Federal Reserve Board, 2005).

Increasing levels of consumer debt – credit card debt, mortgage and home equity loan debt, or other consumer debt – are of concern to policy makers and consumer educators for a variety of reasons. Payments to creditors may be crowding out saving, whether for retirement or building home equity. Credit payments may also reduce the flexibility in family budgets and spending plans. And while the “buy now – pay later” approach may keep the economy growing, it requires that consumers be *able* to pay later.

Using data from the 1992 and 2001 Survey of Consumer Finances, the goal of this paper is to explore changes over time in consumer credit behaviors with respect to having a credit card and carrying a balance, as well as the amount of the balances carried over. We pay special attention to the credit behaviors and balances carried by various age cohorts, especially those in the pre-retirement and newly-retired age groups, with an eye toward gauging the extent to which credit card debt – and the implicit repayment – may be crowding out saving for retirement.

### **Literature Review**

The effects of changes in the credit market have been studied using the Survey of Consumer Finances. In her study, Lyons (2003) investigates changes in the access to credit between 1983 and 1998. Findings indicate improved credit access for households, especially black households and those with lower permanent earnings. While easier access to credit may be useful in helping many households smooth their consumption over time, many of these households may end up misusing this privilege and find themselves living beyond their means in an even worse financial position - carrying high balances and experiencing difficulties in making credit card payments.

Credit card use has been studied widely. Some studies have focused on particular users – for example, students (Pinto, Parente & Mansfield, 2005) or women (DeVaney, Gorham, Bechman & Haldeman, 1996). Others have studied those who revolve balances and those who do not, also referred to as convenience users (Johnson, 2004; Keen, 1998; Lee & Hogarth, 1998; Lim & DeVaney, 1999). Thus, for example, we know that about 40% of cardholders are convenience users while the remaining 60% revolve some balance (Manning, 2002).

Other studies have focused on revolvers and the amounts they revolve (Chakravorti & Emmons, 2003; Durkin, 2000; Kim & Devaney, 2001; Steiddle, 1994). Min and Kim (2003) also studied revolvers, but their work tested differing model specifications, using what they refer to as Tobit I and Tobit II. In Tobit II, analogous to a Cragg specification, the decision of whether to revolve is separated from the balance level decision.

Some studies have specifically addressed credit behaviors by age cohorts. McGhee and Draut (2004) used data from the 1992, 1995, 1998, and 2001 Survey of Consumer Finances to explore credit card debt among seniors

(households 65 and over) and “transitioners” (households 55 to 64). They noted the importance of income, assets, and gender on the levels of credit card debt held by senior households over time, and noted that transitioners held higher levels of debt than seniors for all years studied.

Finke, Huston, and Sharpe (2005) provided a descriptive analysis of the balance sheets of the baby boom cohort compared with the “pre-boomers,” also using the Survey of Consumer Finances (the 1989 through 2001 surveys). Their results show a peak for credit card debt in 1998 for both cohorts, when the boomers were aged 41-52 and the pre-boomers were aged 53-64, presenting some evidence that economic conditions may be as much a factor as age in relation to credit card use.

In these studies, age, marital status, education, income, race or ethnicity, asset levels, home ownership, risk preferences, interest rate on credit cards, and attitudes (for example, satisfaction, willingness to shop for credit products, opinions about how to use credit) were associated with whether or not households revolved and how much they revolved.

## Methodology

### Data

The data for this study are from the Federal Reserve Board’s 1992 and 2001 Survey of Consumer Finances (SCF). The SCF is a triennial survey of US families’ financial portfolios sponsored by the Federal Reserve with the cooperation of the Statistics of Income Division of the Internal Revenue Service (Kennickell, McManus, & Woodburn, 1996). It is designed to provide detailed information on US families’ balance sheets, their use of financial services, demographics, and labor participation. The 1992 and 2001 data were collected by the National Opinion Research Center at the University of Chicago. In 1992, 3,906 households were interviewed; and in 2001, 4,449 households were interviewed. Respondents were encouraged to consult their records as necessary during the interviews.

To provide information that is both representative of the total population and reliable for those assets concentrated in affluent households, the SCF employs a dual-frame sample design consisting of both a standard, geographically based random sample and an over-sample of affluent households. Weights are used to combine information from two samples. The dual sampling frame employed in the survey requires that data be weighted in descriptive analyses (see Kennickell et al., 1996; Kennickell & Woodburn, 1997 for detailed discussion of weight design).

The SCF also uses multiple imputation techniques to deal with missing data. This procedure creates five data sets (called implicate data sets) that require special handling in any multivariate analyses (Kennickell & Woodburn, 1997). In this study, we used the first implicate for the analysis. The data were weighted for descriptive analyses but the regressions were estimated unweighted.

We chose the 1992 and 2001 data to allow both a pooled cross-section time series comparison over an approximately 10-year period and a longitudinal cohort analysis. For example, the pooled cross-sectional time series comparison looks at 45 to 54 year olds in 1992 and 45 to 54 year olds in 2001 while the longitudinal cohort analysis looks at households aged 45 to 54 in 1992 and compares results with households aged 55 to 64 in 2001 (that is, the cohort has “aged” 10 years). We converted 1992 dollar values to 2001 dollars using the current methods version of the Consumer Price Indexes for Urban Consumers (CPI-U, consistent with Aizcorbe et al., 2003).

### Dependent Variable

We estimate the revolving credit card debt held using a multi-hurdle model with a focus on age cohorts. The decision to hold credit card debt can be broken down into a series of three decisions: 1) the household must decide to have a credit card, defined as a bank-type (e.g., Visa, MasterCard, Optima) or retail credit card (e.g., Penny’s, Shell Gas); 2) the household must decide whether to carry over credit card balances (that is, they did not pay off the entire balance from the prior month); and 3) they must decide how much debt to revolve.

The first decision variable – whether or not to have a card – is clearly bivariate (1/0), as is the second decision variable (whether or not to revolve). The main dependent variable of interest is the amount of credit card debt carried over from one month to the next. However, this variable is highly skewed. First, there are a substantial number of observations with a zero value (non-revolvers). Second, even after eliminating outliers, the non-zero observations are not normally distributed (see Tables A and B in the Appendix). We therefore opted to use the log of credit card balances for the non-zero observations in our empirical analysis.

### Independent Variables

We model credit card behaviors as a function of household income, assets, age of household head, gender and marital status, race, household size, educational attainment of household head, household risk tolerance, credit card shopping behavior, and number of credit cards owned. Because we are interested in changes in credit card debt over time, we included year of survey as a variable.

Age Cohorts. In our analysis, age is a categorical variable divided into seven age cohorts: 18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, and 75 and over. We realize the cohort comparisons for the 18-24 year old and the 75 and over groups are not precise; furthermore we recognize that we are setting up a 10 year comparison across 9 years of data. We believe that the one year difference will not substantially affect the results.

Income. For the first decision – whether the household has a credit card – we use the log of income. For the main part of our analysis, income is treated as a categorical variable, based on income quintiles. This method of using categories has several advantages over using a continuous variable. First, measuring income directly is problematic due to heteroscedasticity (unequal variances) problems. The usual correction is to use the natural log to reduce this problem with variances, but this still leaves a continuous variable. A categorical income variable allows us to explore differences that may not be evident in a continuous measure.

Assets. Net worth is also treated as categorical variable. We added the cardholder's credit card debt liability back into net worth to prevent confounding with the dependent variable. We used inter-quartile ranges for net worth categories: 0 to 24%, 25 to 74%, and 75% and more. A bivariate measure of home ownership was also included.

Household Characteristics. Several household characteristics have been found to affect the amount of revolving credit. Our models control for gender and marital status, race, household size, presence of children under 18, labor force attachment, and educational attainment of household head. Each of these variables is included as a set of bivariate categorical variables.

Attitudinal Variables. The household's risk tolerance is expected to be associated with the amount of credit card debt. In the SCF, households were asked how much financial risk they were willing to accept in their investment and saving decisions. Responses were categorized into a set of three bivariate variables: substantial risk, Moderate risk, and risk averse.

We also included a bivariate measure of whether households thought it was a "bad idea" to buy on installment plans. Expectations about future economic improvement were captured in a 0/1 bivariate variable.

Behavioral Variables. There were three types of behaviors we considered when modeling the household's demand for credit card debt: credit history, shopping behaviors, and number of cards held. If a household had been turned down for credit or received less credit than they applied for, they were categorized as having a poor credit history (bivariate variable). Households were asked how much shopping they did when making major decisions about credit and borrowing. Shopping was included as a set of three bivariate variables – no shopping, a moderate amount of shopping, and "a lot" of shopping. Number of cards was included as a continuous variable.

Time. Our year of survey variable captures the effects of changes over time and serves, in part, as a proxy for change in the policy and economic environment. Changes in credit card debt over time are expected, in part due to the economic environmental changes and in part due to changes in consumer attitudes and preferences.

### **Models**

There are a number of methodological issues that need to be addressed in the modeling. First, we have a sample selection bias problem – we only observe revolving behaviors and balances for those households with a credit card. Thus, we must deal with the decision to hold a card and incorporate those results into the model structure. Secondly, as already discussed, the dependent variable for the amount of credit card debt revolved has a large proportion of zeros (non-revolvers) along with a distribution of amounts revolved. This distribution of the dependent variable will require a particular estimation procedure to account for the data truncation.

#### First Hurdle: Probability of Having a Credit Card.

The focus of this paper is really the third decision – how much to revolve – that households make; therefore, we will only briefly describe our modeling of the first hurdle. Our first step was to model the probability of having a credit card, using a logistic regression. The independent variables were age, age squared, log of income, education level of head, home ownership, presence of children under 18 years of age, work status of head, household attitude toward credit, expectations about the future of the economy, and a proxy for the quality of the household's credit history.

It is important to acknowledge that some of these variables used in this first hurdle logistic regression may also influence whether the household revolves debt as well as the amount of debt revolved. Using the parameter estimates from the logistic regression, we created an estimated probability for having a credit card and used this in our subsequent analysis to control for selection bias (see Hogarth & O'Donnell, 2000). For additional information regarding this model please see Appendix Table C.

#### Second Hurdle: Credit Card Debt.

The decision to hold revolving credit card debt may be separated into two choices: first, whether or not to revolve (the participation decision); and second, how much to revolve (the consumption decision). We expect to observe zeros for some households' revolving debt and then a range of positive balances. In many cases, Tobit models are used when dealing with this type of data distribution. However, Tobit models are limited because they do not allow variables to have differing effects on the participation and consumption decisions. In essence, the Tobit model requires the signs of the regression coefficients to be the same for both the participation and the consumption decisions, which may not be a reasonable assumption for credit card balances.

The Cragg model provides a two-part, non-sequential, simultaneous participation and consumption decision making model. The model estimates whether or not an event occurs (that is, whether or not a household has a revolving balance) with a probit model; and if the event does occur, the model associates it with a positive continuous variable through a maximum likelihood model (the amount revolved). This specification allows the variables to have differing effects on the participation and consumption decisions, which we deem preferable for our analysis (Min & Kim, 2003, Sweeney, n.d.). Recall that the log of credit card balances is used as the dependent variable for the maximum likelihood portion of the estimation. The independent variables used in our model included year of survey, age, income, net worth, race, gender and marital status, household size, education, risk tolerance, shopping behavior, and number of cards; we also include the probability of having a card, as discussed above.

## **Results**

### Descriptive Analysis

In 1992, 71.9% of households reported having at least one credit card; in 2001, 76.3% of households reported having a card. The demographic, attitudinal, and behavioral profile of card-holding households in 1992 and 2001 is presented in Table 1. There was a slight drop in the proportion of those who carried a balance, from 57.5% in 1992 to 56.1% in 2001. There was also a decrease in the median number of cards held per household, from 4 in 1992 to 3 in 2001.

However, despite the slight drop in the proportion of households revolving debt and number of cards, the moderate amount revolved increased from \$2,985 in 1992 to \$4,218 in 2001 (all values are in 2001 dollars).<sup>4</sup> With only one exception (for 65 to 74 year olds), median values of outstanding balances in 2001 were higher than in 1992.

The average income of cardholders rose from \$59,990 in 1992 to \$82,901 in 2001; however the median income only increased from \$43,095 to \$50,367. There was also a significant increase in median net worth from 1992 to 2001, from \$97,915 to \$135,160.

Table 1  
 Descriptive Statistics for Credit Card User.\*

Variable	1992 (N =3,109)	2001 (N=3,167)
Carry a balance (%)	57.5	56.1
Amount revolved among revolvers (\$)		
mean	2,985	4,218
median	1,311	2,000
range	1 - 61,870	1 - 200,000
Age (years, %)		
mean	48.7	49.4
median	46	47
18-24	3.5	4.1
25-34	20.5	15.9
35-44	22.8	23.1
45-54	17.8	22.6
55-64	13.9	13.8
65-74	13.1	11.3
75 & over (reference group)	8.4	9.1
Income (\$, %)		
mean	59,990	82,901
median	43,095	50,367
Lowest quintile (0-20%)	10.6	11.5
21-40%	18.1	18.4
41-60%	20.6	22.1
61-80%	25.2	22.9
Highest quintile (81-100%; reference group)	25.5	25
Net worth (\$, %)		
mean	295,416	495,917
median	97,915	135,160
low (bottom quartile)	14.6	15.3
medium (middle two quartiles)	53.5	52.6
high (upper quartile; reference group)	31.9	32.0
Race/ethnicity (%)		
White (reference group)	82.9	82
Black	7.9	10
Hispanic	4.4	5.5
Other	4.7	2.5
Marital status & gender (%)		
married (reference group)	65.4	66.2
single male	12	12.2
single female	22.6	21.6
Family size (%)		
1 person	22.8	21.3
2 people (reference group)	33.7	38.1
3 people	18.1	16.3
4 or more people	25.4	24.3
Education (%)		
less than high school	11.9	10.8
high school/GED (reference group)	28.4	28
some college	23.5	24.8
college degree or more	36.2	36.4
Risk tolerance (%)		
substantial	2.6	4.7

	moderate (reference group)	54.8	63.7
	averse	42.7	31.6
Shop around for card (%)			
	no shopping (reference group)	13.3	16.4
	moderate shopping	48.3	59.3
	lots of shopping	38.4	24.4
Number of cards			
	mean	5.15	4.34
	median	4	3
	range	1-51	0-27

Observations are weighted for analysis

\* In 1992, 71.9% of households reported having at least one credit card; in 2001, 76.3% of households reported having a card. Statistics in the table are based on households with credit cards. All values are in 2001 dollars.

#### Credit Card Behaviors over Time by Age and Cohort

Ownership. In the cross-sectional time series comparison, we see card ownership rates increasing over time for all age groups. For example, for 45 to 54 year olds, 79% had credit cards in 1992, compared with 84% in 2001 (Table 2). We also note that the proportion of households with cards peaks at the 45 to 54 year old category for both 1992 and 2001.

The longitudinal cohort analysis of the data suggests possible lifestyle changes in credit card use. As the 18-24 year olds in 1992 take on adult responsibilities over the following years (as they enter into the 25-34 cohort in 2001), they increased ownership by 20 percentage points (from 50% to 71%). Both the 25-34 and 35-44 cohort groups in 1992 increased ownership by 10 percentage points as they become 35-44 and 45-54 year olds in 2001, respectively. The 45-54 cohort in 1992 (55-64 in 2001) increased card ownership by one percentage point; this phenomenon may be due to market saturation. Interestingly enough, however the 55-64 year olds in 1992 increased card ownership by 5 percentage points as they entered into the newly retired years. Lastly, the 65-74 year old cohort group in 1992 had a lower card ownership rate in 2001, 75% compared with 67% for 1992.

Table 2

#### Credit Card Patterns By Age Cohorts (in percentages).

Age Group	Have a card in 1992	Have a card in 2001	Revolvers in 1992	Revolvers in 2001
Overall	71.9	76.3	57.5	56.1
18-24	50.4	56.3	79.9	73.4
25-34	70.1	70.8	71.5	69.8
35-44	72.1	79.1	66.3	65.5
45-54	78.7	83.6	60.1	58.4
55-64	75.4	79.8	47.2	51.9
65-74	74.9	80.6	40.1	35.4
75 & over	63.9	67.2	28.6	26.7

Note: When making pooled cross-section time series comparisons, the comparisons are across the rows: among 35-44 year olds, 72% had credit cards in 1992 compared with 79% in 2001. When making longitudinal cohort comparisons, the comparisons are on the diagonals: while 72% of 35-44 year olds had credit cards in 1992, 83% of this cohort had cards 10 years later, when they were 45-54 years old.

Revolving behavior. The percentage of credit card revolvers peaked among the 18-24 year olds in both 1992 and 2001, then decreased steadily with age. In general, lower proportions of households at any age were revolvers in 2001, compared with 1992. The only exception was for households in the pre-retirement years (age 55-64); 47% were revolvers in 1992 compared with 51% in 2001.

Longitudinally, each cohort showed decreased proportions of revolvers over time. The decrease was the largest among retirees, moving from 40% of 65-74 year olds to 27% of those 75 and over (a 13 percentage point decrease).

Amount revolved. While the proportion of households revolving a balance declined over time, the amounts revolved increased by 50%, from a median amount of \$1,300 in 1992 to \$2,000 in 2001 (Table 3). Balances

increased for all age groups under 65 over time, with the largest increase (doubling from \$1,237 to \$2,500) among 25 to 34 year olds. The pre-retirement group (55-64 year olds in 1992) also experienced a greater than 50% increase in balances revolved, from \$1,299 in 1992 to \$2,000 in 2001.

When comparing cohorts longitudinally, median balances for the cohorts under age 45 increased from 1992 to 2001. For example, the median balance held by 35-44 year olds was \$1,732 in 1992; for this cohort in 2001 (now aged 45 to 54), the median balance was \$2,300. The largest increase was among those aged 18-24 in 1992; the median balance for this cohort rose from \$990 to \$2,500. The median balances declined over time for the three cohorts aged 45 and over in 1992.

Table 3  
Mean and Median Amount of Balance Revolved by Age Cohorts.\*

Age Group	Mean balance		Median balance	
	1992	2001	1992	2001
Overall	\$2,986	\$4,218	\$1,312	\$2,000
18-24	\$1,480	\$2,862	\$990	\$1,000
25-34	\$2,669	\$4,300	\$1,237	\$2,500
35-44	\$3,577	\$4,382	\$1,732	\$2,000
45-54	\$3,790	\$4,303	\$2,042	\$2,300
55-64	\$2,758	\$4,105	\$1,299	\$2,000
65-74	\$1,834	\$5,658	\$990	\$970
75 & over	\$2,506	\$2,026	\$681	\$700

\* calculated only for revolvers

#### First Hurdle: Probability of Having a Credit Card

To control for selection bias effects, we first modeled the probability of having a credit card (See Appendix Table C for these results). Next, we calculated the probability of having a card for each observation, and used this predicted probability in the subsequent estimations. The predicted probability of having a credit card compared favorably with the actual proportion having credit cards in the sample. In 1992, 71.9 % had a card, and our model predicted 73.1%; in 2001, 76.2% had a card and our model predicted 77.1%.

#### Second Hurdle: Credit Card Debt

Using the Qlim procedure in SAS, we estimated a Cragg model on the combined 1992 and 2001 SCF data, including a year of survey dummy variable (see Appendix Table D for these results).<sup>5</sup> The coefficient for the year of survey variable was statistically significant for the maximum likelihood portion of the estimation, allowing us to reject the null hypothesis that the pool of data in 1992 is equal to the pool of data in 2001. Since these two pools of data are statistically different, the combined model constrains the analysis and therefore the results do not accurately reflect the variation in the years.

There are two empirical options for handling these different data pools. One is to interact the year of survey with all other independent variables in the model. The second option is to estimate two separate models, one for the 1992 data and one for the 2001 data. If we were interested in the differential effects of the sets of variables over time, the interactive approach would be preferable. However, because we were primarily interested in the effects of one variable -- age cohort -- on balances revolved, our other variables function mainly as controls. Thus, we chose this second option because it offers greater clarity in reviewing the results.

The regression results suggest that the Cragg specification is preferred to a Tobit because variable sign flipping is evident in our model (see Tables 4 and 5). For example the coefficient for being in the bottom income quintile is positive for the probit portion of the models but negative for the maximum likelihood portion, and this makes sense: households in the lowest income quintile may be more likely to revolve but less likely to revolve larger amounts.

The significant variables in the probit equation, modeling whether cardholders revolve debt, proved to be fairly consistent from 1992 to 2001. Age, income, and net worth were all significant. Blacks and Hispanics were significantly different from Whites in both years (Other races were not significantly different from Whites). Household size and education were significant in both years, although they differed slightly in their effects across the years. Attitudes toward risk, shopping behaviors, and the number of cards held were also significant in both years.

There were substantial similarities between the 1992 and 2001 results for the maximum likelihood portion of the model as well. Age, income, net worth, gender and marital status, and number of cards were significant in both 1992 and 2001. However, there were also some differences. For example, race, education, and attitudes toward risk were associated with the amount revolved in 2001, but not in 1992. Shopping behavior was associated with the amount revolved in 1992 but not in 2001.

The probit and maximum likelihood coefficients are not easily interpreted, so we calculated the predicted probabilities of revolving a credit card balance and the amounts revolved. Because we are primarily interested in the cohort effects for these behaviors, we report these predicted values by age cohort (Tables 6 and 7). The predicted values more closely reflect the median value rather than the mean.

Table 4

Double Hurdle Model Results for the Log of Credit Card Balances, 1992.

Variables	Probit*		Maximum Likelihood*	
	Coefficients	Probability	Coefficients	Probability
Intercept	-1.58	.0001	5.94	.0001
Age				
18-24	1.22	.0001	.21	.5562
25-34	1.03	.0001	.26	.3998
35-44	1.04	.0001	.43	.1649
45-54	.85	.0001	.63	.0290
55-64	.56	.0001	.62	.0196
65-74	.32	.0100	.36	.1534
75 and up	Reference		Reference	
Income				
0-20%	.26	.0748	-.59	.0025
21-40%	.37	.0008	-.31	.0651
41-60%	.50	.0001	.43	.0057
61-80%	.36	.0001	.05	.6939
81-100%	Reference		Reference	
Net Worth				
Low	.85	.0001	.39	.0598
Medium	.65	.0001	.26	.1144
High	Reference		Reference	
Race				
Black	.74	.0001	-.09	.5894
Hispanic	.61	.0001	.17	.3651
White	Reference	Reference		
Other	-.05	.6646	-.15	.3903
Marital Status				
Single male	-.09	.4238	.65	.0001
Single female	.05	.6326	.11	.4164
Married	Reference		Reference	
Household Size				
1	-.05	.6118	-.24	.1018
2	Reference		Reference	
3	.25	.0011	.20	.0913
4 or more	.26	.0003	.32	.0065
Education				
< high school	.002	.9841	-.01	.94
High school	Reference		Reference	
Some college	-.04	.6717	-.05	.63
College/Graduate	-.35	.0001	.14	.24
Risk Tolerance				
Substantial	-.16	.1965	.18	.40
Moderate	Reference		Reference	



Risk averse	.13	.0345	.10	.25
Shopping Behavior				
Limited	Reference		Reference	
Moderate	-.03	.0001	.20	.0830
Extensive	-.13	.0001	.06	.6155
Number of cards	.03	.0001	.08	.0001
Probability of having a card	.06	.8330	--	--

\* The probit portion of the model captures whether or not the household revolves, while the maximum likelihood portion captures the log of the amount revolved.

Table 5  
Double Hurdle Model Results for the Log of Credit Card Balances, 2001.

Variables	Probit*		Maximum Likelihood*	
	Coefficients	Probability	Coefficients	Probability
Intercept	-1.96	.0001	6.29	.0001
Age				
18-24	.73	.0001	.18	.5439
25-34	.86	.0001	.48	.0543
35-44	.93	.0001	.37	.1338
45-54	.77	.0001	.46	.0550
55-64	.68	.0001	.40	.0946
65-74	.29	.0179	.31	.2191
75 and up	Reference		Reference	
Income				
0-20%	.27	.0522	-.71	.0001
21-40%	.47	.0001	-.43	.0052
41-60%	.46	.0001	-.32	.0215
61-80%	.38	.0001	-.05	.7107
81-100%	Reference		Reference	
Net Worth				
Low	1.21	.0001	.55	.0043
Medium	.70	.0001	.35	.0121
High	Reference		Reference	
Race				
Black	.70	.0001	-.21	.0919
Hispanic	.33	.0079	-.11	.4624
White	Reference		Reference	
Other	.08	.5652	.19	.4068
Marital Status				
Single male	.03	.7993	.35	.0203
Single female	.07	.4375	.17	.1528
Married	Reference		Reference	
Household Size				
1	-.11	.2651	.23	.0927
2	Reference		Reference	
3	.13	.0830	.09	.4068
4 or more	.08	.2592	.15	.1359
Education				
< high school	-.01	.0001	-.31	.0305
High school	Reference		Reference	
Some college	.12	.7084	.08	.4252
College/Graduate	-.29	.0032	.12	.2528
Risk Tolerance				
Substantial	.04	.7084	.33	.0516

Moderate Risk averse	Reference .19	.0032	Reference -.18	.0563
Shopping Behavior Limited	Reference .34	.0001	Reference .02	.8636
Moderate Extensive	.19	.0154	.11	.4283
Number of cards	.06	.0001	.12	.0001
Probability of having a card	-.14	.6154	--	--

\* The probit portion of the model captures whether or not the household revolves, while the maximum likelihood portion captures the log of the amount revolved.

There was little change in the probability of revolving by age groups in the pooled cross section time series (Table 6): for example, the predicted probability of revolving was about 62% for those in the pre-retirement years (55-64) both in 1992 and 2001. The predicted proportion of revolvers was slightly higher for 18-24 year olds in 2001 than in 1992, while the predicted proportion of revolvers for 25-34 year olds, 45-54 year olds, and 65-74 year olds was slightly lower in 2001 than in 1992. Looking longitudinally at the cohorts, we see that younger households (those 18-24 in 1992, then 25-34 in 2001) are predicted to have a higher proportion of revolvers. Conversely, those 45-54 years old and those in the pre-retirement and newly retired years had declining rates of revolving: for example, we predicted 61.3% of the 55-64 year olds revolved in 1992, but by 2001 the predicted rate for this cohort was 59.6%; there was a similar decline for those 65-74 years old.

Table 6  
Predicted and Simulated Proportion of Revolvers by Age Cohorts.

Age Group	Predicted to revolve a balance in 1992	Predicted to revolve a balance in 2001	Simulated to revolve a balance in 2001 calculated with 1992 coefficients
Overall	61.7	61.2	61.4*
18-24	60.4	61.4	60.2*
25-34	62.2	61.4	61.4
35-44	62.3	62	61.8*
45-54	62.9	61.9	62.5*
55-64	61.3	61.5	61.1*
65-74	60.6	59.6	60*
75 & over	58.7	58.2	58.6*

\* differences between predicted and simulated are significant 0.005 level or better (t-test)

Turning to the amounts revolved, we see that for all ages in the pooled cross section time series, the predicted amounts revolved in 2001 are greater than the amounts predicted for 1992 (Table 7). For example, the predicted balance for 25-34 year olds was \$1,205 in 1992 and \$1,838 in 2001 – more than a 50% increase. Predicted balances rose by nearly 20% for those 65 to 74 (from \$867 in 1992 to \$1,025 in 2001) and by more than 10% for those in their pre-retirement years (from \$1,388 in 1992 to \$1,555 in 2001). Longitudinally, the three cohorts over 45 in 1992 all had lower predicted balances by 2001. For example, for the 45 to 54 year olds, the predicted balances dropped from \$1,778 in 1992 to \$1,555 in 2001 (when the cohort is aged 55-64). However, the three younger cohorts all had higher predicted balances in 2001 than in 1992. The increase was the greatest for the 18-24 year olds, with a predicted balance of \$892 in 1992, more than doubling to \$1,838 in 2001, when they were 25-34 years old.

Table 7  
Predicted and Simulated Credit Card Balances by Age Cohorts.

Age Group	Predicted balance in 1992	Predicted balance in 2001	Simulated balance in 2001 calculated with 1992 coefficients*
Overall	\$1,279	\$1,606	\$1,220
18-24	\$892	\$1,130	\$872
25-34	\$1,205	\$1,838	\$1,052
35-44	\$1,454	\$1,797	\$1,347
45-54	\$1,778	\$1,853	\$1,566
55-64	\$1,388	\$1,555	\$1,391
65-74	\$867	\$1,025	\$867
75 & over	\$538	\$697	\$589

\* differences between predicted and simulated are all significant at 0.0001 (t-test)

### Simulation of Cohort Behaviors

Simulating the revolving behaviors allows the researcher to ask “how would the sample in 2001 behave if they had the same characteristics as the 1992 sample?” In other words, just how different are these two groups? To carry out this simulation, we used the coefficients from the regression estimates on the 1992 data and applied them to the observations in the 2001 data. We then calculated another set of predictions and used t-tests to determine if the differences between the simulated and predicted values were statistically different (see the last columns in Tables 6 and 7).

The simulated results for revolving behaviors by age are varied. Overall, if households in 2001 had the same sets of characteristics as in 1992, we would expect to see 61.4% revolving; instead we see 61.2% -- a lower proportion, which is probably “good news” to those concerned about credit card debt. For the 18-24, 35-44, and 55-64 age groups, the predicted 2001 values are higher than the simulated values. In other words, these age groups are behaving differently – some might say worse – than their predecessors in 1992 because higher proportions are revolving. However, for the 45-54, 65-74, and 75 and over age groups, the predicted 2001 values are lower than simulated values, which again is “good news.”

However, despite this “good news” about the proportions of revolvers for some age groups, when we look at the results for amounts revolved, the simulated values are consistently lower than the predicted values. For example, if those in the pre-retirement years (age 55-64) in 2001 had the same characteristics as 55-64 year olds in 1992, we would expect their balance to be about \$1,400; instead we find it is over \$1,550. For those in the newly retired years (65-74), instead of balances around \$870, we find balances of over \$1,000. And for those 75 and over, instead of balances of about \$590, we find balances of nearly \$700.

### **Discussion and Conclusions**

Using data from the 1992 and 2001 Survey of Consumer Finances, the goal of this paper was to explore changes over time in consumer credit behaviors with respect to having a credit card and carrying a balance, as well as the amount of the balance carried over. Modeling consumer credit card revolving behaviors is complex. The dynamics of the Cragg model enabled us to deal with not only censoring but also unrestricted sign flipping, because the participation and consumption decisions were calculated independently. We focused on differences in behavior by age cohorts, especially those in the pre-retirement and newly-retired age groups, motivated by the concern that credit card debt – and the implicit repayment – may be crowding out saving for retirement.

This research confirms and provides additional evidence of the changes in consumer credit behavior. In the peak income-earning years of the 40’s and 50’s, and into the early 60’s, we see a pattern of increasing credit card debt. And looking at younger cohorts -- the 18-25 and 25-34 year olds – we see a doubling of the average amount of revolving debt from 1992 to 2001 (see Table 3). Those in the newly retired years (65-74) in 2001 were starting out retirement with substantially more credit card debt, on average, than 65-74 year olds in 1992. Similarly, pre-retirees (55-64) in 2001 had higher credit card debts than 55-64 year olds in 1992. To the extent that these patterns continue in younger cohorts, we could see future generations of households entering retirement with even higher levels of credit card debt. As a follow-up to this research, a longitudinal cohort study on other forms of debt, such as home equity debt (see Dey & Dunn, 2004), as well as savings may provide additional depth of understanding of the extent of the crowding out issue with respect to savings and asset accumulation.

In addition to whatever cohort effects there may be in consumer credit behaviors, we must also acknowledge that changes in the economic and financial environment from 1992 to 2001 may have contributed to the growth of consumer debt. Changes in the sophistication and structure of financial markets over this period increased the variety of and access to consumer credit for households (Dynan et al., 2003). Credit markets moved towards a greater democratization of credit and lenders began offering risk-based pricing to facilitate this shift. In addition, the late 1990's was a time of substantial national prosperity, and consumption was probably driven by an enhanced (but, in hindsight, perhaps unrealistic) expectation about the future ability to repay.

In our analysis, we encountered the long, and apparently growing, upper tail of the credit card debt distribution, indicating that some revolvers seem to take on increasingly higher levels of consumer debt. An in-depth exploration of these high revolvers could provide financial educators key insights into this particular consumer-debt-prone population. Furthermore, an analysis of this high revolving group may provide the credit industry with guidance for a more rigorous and careful review of credit underwriting standards.

For consumer and financial educators, one message from this study is a cautionary note about households' time horizons. Given each cohort's apparent willingness to approach retirement with more and more debt, it seems that many households are thinking about the here and now, as opposed to the "there and then." Although a lot of education has been done to help consumers understand the time value of money and present versus future trade-offs, these efforts need to continue to drive home the message of the need to prepare for one's financial future.

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## Appendix Tables

Table A  
Actual Amount of Balance Revolved, by Age -- 1992.

Age Cohort	Bottom 25%	25%-75%	75%-95%	Top 5%
All Ages range spread	\$1 – \$500 \$499	\$500 – \$3,600 \$3,100	\$3,600 – \$11,760 \$8,160	\$11,760– \$61,870 \$50,110
18-24 range spread	\$60 – \$500 \$440	\$500 – \$1,860 \$1,360	\$1,860 – \$5,320 \$3,460	\$5,320 – \$6,810 \$490
25-34 range spread	\$12 – \$500 \$488	\$500 – \$3,100 \$2,600	\$3,100 – \$9,400 \$6,300	\$9,400 – \$40,800 \$31,400
35-44 range spread	\$1 – \$620 \$619	\$620 – \$4,450 \$3,830	\$4,450 – \$12,400 \$7,950	\$12,400– \$61,870 \$49,470
45-54 range spread	\$1 – \$680 \$679	\$680 – \$5,200 \$4,520	\$5,200 – \$14,000 \$8,800	\$14,000 – \$51,000 \$37,000
55-64 range spread	\$25 – \$620 \$595	\$620 – \$2,700 \$2,080	\$2,700 – \$13,000 \$10,300	\$13,000 – \$37,300 \$24,300
65-74 range spread	\$50 – \$330 \$280	\$330 – \$2,000 \$1,670	\$2,000 – \$8,700 \$6,700	\$8,700 – \$31,000 \$22,300
75 and up range spread	\$12 – \$140 \$128	\$140 – \$1,600 \$1,460	\$1,600 – \$16,500 \$14,900	\$16,500 – \$22,300 \$5,800

This table illustrates the distribution of national revolving credit balances. The general pattern of revolving balances is concave with the peak balances occurring among the 35-44 and 45-55 age cohorts. As can be seen in the upper 25% and 5%, the high revolvers tend to have a significantly higher variation of balances.

Table B  
Actual Amount of Balance Revolved, by Age -- 2001.

Age Cohort	Bottom 25%	25%-75%	75%-95%	Top 5%
All Ages range spread	\$1 – \$600 \$599	\$600 – \$5,000 \$4,400	\$5,000 – \$15,200 \$10,200	\$15,200 – \$200,000 \$184,800
18-24 range spread	\$1 – \$400 \$399	\$400 – \$3,500 \$3,100	\$3,500 – \$12,500 \$9,000	\$12,500– \$17,800 \$5,300
25-34 range spread	\$20 – \$610 \$590	\$610 – \$5,700 \$5,090	\$5,700 – \$15,000 \$9,300	\$15,000 – \$50,000 \$35,000
35-44 range spread	\$20 – \$600 \$580	\$600 – \$5,000 \$4,400	\$5,000 – \$16,600 \$11,600	\$16,600 – \$69,170 \$52,570
45-54 range spread	\$1 – \$800 \$799	\$800 – \$5,200 \$4,400	\$5,200 – \$18,000 \$12,800	\$18,000 – \$193,440 \$175,440
55-64 range spread	\$1 – \$680 \$679	\$680 – \$5,700 \$5,020	\$5,700 – \$12,570 \$6,870	\$12,570 – \$64,000 \$51,430

65-74 range spread	\$11 – \$310 \$299	\$310 – \$2,500 \$2,190	\$2,500 – \$21,000 \$18,500	\$21,000 – \$200,000 \$179,000
75 and up range spread	\$1 – \$300 \$299	\$300 – \$2,000 \$1,700	\$2,000 – \$7,400 \$5,400	\$7,400 – \$20,500 \$13,100

Table C  
Logit Regression on Having a Credit Card.

Variable	1992	2001
Intercept	-5.21*	-5.74*
Age – head of household	0.04*	0.08*
Age squared	-0.0004*	-0.0007*
Log of income	0.48*	0.49*
High school education or less	-1.45*	-1.26*
Own a home	1.24*	1.29*
Have children under 18	-0.26*	-0.48*
Currently working or retired	1.10*	0.82*
Think it's a bad idea to buy on installment plan	-0.22*	-0.66*
Expect economy to improve in future	0.13*	-0.14*
Problems with credit history	-0.31*	0.03

\* significant at the 0.01 level

Calculated probability of having a credit card =  $1/(1+(e^{-z}))$ , where  $z = a + \beta x$

$Z_{1992} = -5.209 + .0421 \text{ Age} - .00043 \text{ Age}^2 - 1.4543 \text{ Education} + .4793 \text{ Log of income} - .2237 \text{ Attitude} + .1278 \text{ Economic expectation} + 1.2362 \text{ Home ownership} - .2572 \text{ Children} + 1.0995 \text{ Work status} - .3060 \text{ Credit history}$

$Z_{2001} = -5.7410 + .0750 \text{ Age} - .00076 \text{ Age}^2 - 1.2593 \text{ Education} + .4942 \text{ Log of income} - .6627 \text{ Attitude} + .1405 \text{ Economic expectation} + 1.2881 \text{ Home ownership} - .4754 \text{ Children} + 1.8249 \text{ Work status} - .0276 \text{ Credit history}$

Table D  
Double Hurdle Model Results for the Log of Credit Card Balances, 1992 and 2001 Combined.

Variables	Probit		Maximum Likelihood*	
	Coefficients	Probability	Coefficients	Probability
Intercept	-1.726002	.0001	6.10	.0001
Age				
18-24	.94	.0001	.21	.3491
25-34	.93	.0001	.34	.0855
35-44	.97	.0001	.38	.0541
45-54	.81	.0001	.52	.0062
55-64	.64	.0001	.49	.0076
65-74	.30	.0004	.34	.0552
75 and up	Reference		Reference	
Income				
0 - 20%	.25	.0112	-.68	.0001
21 - 40%	.42	.0001	-.39	.0008
41 - 60%	.47	.0001	-.36	.0006
61 - 80%	.38	.0001	-.04	.6006
81 - 100%	Reference		Reference	

Net Worth				
Low	1.03	.0001	.40	.0090
Medium	.68	.0001	.26	.0225
High	Reference		Reference	
Race				
Black	.72	.0001	-.17	.0948
Hispanic	.43	.0001	.002	.9880
Other	.02	.8027	-.04	.8042
White	Reference		Reference	
Marital Status				
Single male	-.04	.6544	.48	.0001
Single female	.05	.4489	.14	.1215
Married	Reference		Reference	
Household Size				
1	-.08	.2431	-.24	.0713
2	Reference		Reference	
3	.19	.0002	.15	.0044
4 or more	.16	.0007	.22	.0908
Education				
< High school	-.01	.8581	-.17	.0908
High school	Reference		Reference	
Some college	.05	.4001	.01	.8448
College/Graduate	-.32	.0001	.15	.0615
Risk Tolerance				
Substantial	-.04	.5908	.27	.0384
Moderate	Reference		Reference	
Risk averse	.16	.0002	-.04	.4630
Shopping Behavior				
Limited	Reference		Reference	
Moderate	.18	.0007	.08	.3552
Extensive	.04	.4701	.06	.4971
Number of cards	.04	.0001	.09	.0001
Probability of having a credit card	-.07	.6932	-	-
Year = 2001	-.03	.4418	.35	.0001

\* The probit portion of the model captures whether or not the household revolves, while the maximum likelihood portion captures the log of the amount revolved.

## Endnotes

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<sup>4</sup> The most extreme change in average revolving amount occurred among the 65-74 age cohort, increasing from \$1,834 in 1992 to \$5,658 in 2001.

<sup>5</sup> We also tested a Tobit specification, but the model performed poorly when predicting the probability of revolving and the amount revolved.