Risk-Based Pricing and Credit Cards: What Consumers Need to Know

Using the 2007 Survey of Consumer Finances, we explored the relationships between risky financial behaviors and credit card interest rates. Further, we identified behavior changes that could lead to lower rates. We found that consumers are best served by: (1) paying bills on time, (2) paying off the balance on their credit cards more frequently, and (3) not missing payments or filing for bankruptcy. With these behavioral changes, consumers could expect a decrease in credit card rates and to save money.

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Introduction

While credit scoring has existed since the mid-20th century, it did not become the widespread industry standard until the late 1980s and early 1990s (Board of Governors of the Federal Reserve System, 2007). Risk-based pricing methodshave formed the backbone of consumer loan pricing structures in the credit card industry for two decades (Furletti, 2003). However, manyconsumers still do not fully understand what is considered risky behavior and therefore how they can obtain the most favorable interest rate (Foster et al., 2010).

Lenders using this pricing structure continue to discover and utilize new methods to track consumer default risk and price loans accordingly. Definitions of risky behavior and the pricing models applied based on those definitions are constantly evolving and continually baffling for those consumers without the proper financial tools to evaluate their individual situations.

The goal of this paper is to examine the extent to which risk-based prices are correlated with risky behaviors. Using data from the 2007 Survey of Consumer Finances (SCF), we attempt to identify specific behavioral changes that consumers can implement to decrease the APR on their credit cards and demonstrate the significant savings that these behavioral modifications will have over time. Our intent is to update a studythat used the 2004 SCF (Hazembuller et al., 2007) to determine how, if at all, the results have changed between the 2004 and 2007 SCF and what these changes mean for consumers.

Background and Previous Studies

Since the 1990's, the financial industry has been pricing loans based on individual consumer risk as opposed to a single rate approach (still used in many other countries), in which all customers were charged a comparatively high interest rate for a given financial product (McCorkell, 2002). While the exact pricing models change continually, it is safe to say that risk-based pricing in some form will remain the U.S. industry standard for some time. In its simplest and most basic form, risk-based pricing allows lenders to charge higher interest rates to those borrowers considered more likely to default on credit obligations. This has created a scenario in which even those customers who pose a greater risk and have traditionally been underserved in the credit markets can obtain access to credit, albeit at a higher cost than their less risky counterparts (Johnson, 2005).

The accuracy, equity, and reliability of these credit-risk modelscontinue to be debated. Critics contest that credit default risk analysis, most commonly through the use of a credit score, is an inherently flawed system in which mistakes or lack of data lead to a misrepresentation of consumer risk. This may be especially true for younger or inexperienced credit users with so-called "thin files." These misrepresentations can then be amplified and projected into the future prices in credit markets as the use of credit scoring becomes more common (Avery et al., 2004). Some even argue that this system could have aggravated the subprime crisis (Spader,2010). On the other hand, the link between credit scores and loan approvals at given rates has been examined and there appears to be a strong connection between the two, providing further evidence that risk-based pricing is the new standard (Holmes et al., 2007).

Despite the possible existence of these flaws, many hold that credit scoring is more objective and fair than past lending practices (McCorkell, 2002). A report by the Federal Reserve Board stated that credit scoring seems to be an accurate method of predicting default risk (Federal Reserve Board, 2007). The report also found that no variables used to create a credit score seemed to be proxies for race, age, or gender (the "prohibited bases" under the Equal Credit Opportunity Act). It did note, however, that there are large credit score disparities between racial

backgrounds that could not be reconciled (Federal Reserve Board, 2007). Additionally, some credit scoring modelshave served those who traditionally have been denied access to credit; these models continue to adapt to further serve this population (Maas, 2008).

There is no question that a good credit score is crucial to receive the best possible rate on a credit card. Generally, credit scores are comprised of five factors: payment history, amount owed relative to credit limit (or utilization ratio), length of credit history, new or recent credit activity, and types of credit obligations (Consumer Federation of America & Fair Isaac, 2005; Fair Isaac, 2010). Focusing on risky behaviors associated with each of these five areas should help to identify ways to improve one's credit score.

Methods

Data

Data are from the Federal Reserve Board's 2007 SCF; comparison data from the 2004 SCF are also included. The SCF is carried out every three years by the Federal Reserve Board in conjunction with the Department of the Treasury and with additional cooperation from the Statistics of Income Division (SOI) of the Internal Revenue Service. It assesses the financial situations and balance sheets of U.S. households and families in great detail. The National Organization for Research at the University of Chicago (NORC) collected all data for both the 2004 and the 2007 SCF.

It is important to note that much of the data for the 2007 SCF was collected before most households felt the effects of the financial crisis. In 2009, the Board again collected data from the same participants of the 2007 survey; these data provide interesting points of comparison (Bricker et al., 2011).

Two sampling methods are employed to form the final sample for the SCF. Approximately two-thirds of the final sample comes from an area-probability sample developed by NORC that is representative of the population as a whole. The final third of the sample is from an intentional over-sampling of affluent households, determined with the help of the SOI(Kennickell, 2007). Additionally, multiple imputation procedures are used to correct for missing data within the original sample (Kennickell, 1998). The full public dataset includes five complete implicate datasets that require special statistical techniques to obtain accurate results. All five datasets, called implicates, were used for both descriptive and regression analysis.For descriptive statistics purposes, though not for regression analysis, the data are weighted tocontrol for the over-sampling of wealthy households.

Model

As with the Hazembuller et al. (2007) study, the dependent variable in our model is the interest rate (APR) of the primary household credit card. For the purposes of this study, the primary card was considered to be the card with the largest balance or the most recently attained credit card. Our working hypothesis remains the same: "that APR is associated with credit risk measures, holding other socioeconomic, demographic, and expectational and motivational characteristics constant" (Hazembuller et al., 2007).

APR on primary credit card = f(credit risk measures | socioeconomic, demographic, expectational and motivational characteristics)

All analysis was performed both on the sample of all households with credit cards and on the subsample of all households that are revolvers. This was done primarily to keep results as true to the original study as possible for comparative purposes but also because there is strong evidence that convenience and revolving users of credit often display different attitudes and behaviors towards credit, and should therefore be analyzed separately (Rutherford &DeVaney, 2009). For our purposes, revolvers are defined as any household that reports that they had an outstanding balance on any credit card after paying last month's bill.

Independent Variables

Credit Risk Measures.We compiled variables to serve as proxies for measures of credit score. The variables intended to serve in this capacity are grouped under the following headings: payment history, credit utilization, length of credit history, new credit obligations, and mix of credit. Additional variables intended to further capture credit risk were included to remain consistent with the Hazembuller et al. analysis, including level of shopping effort for credit, information search, and risk tolerance. We also added a variable for smoking as a proxy for risk tolerance.

Socioeconomic and Demographic Characteristics. Variables representing income, financial assets, education, marital status/gender, race/ethnicity, and work status were included to control for socioeconomic or demographic characteristics.

Expectations and Motivations. Although the Hazembuller et al. study found little explanatory power in most attitudinal variables, they were included in this study both for consistency and to determine if there was a significant change between 2004 and 2007 with respect to household expectations and motivations. As with the original study, we included variables on the financial planning horizon of the household, as well as expectations of the following: interest rates rising in the next 5 years, incurring a major expense in the next 5-10 years, and income increasing relative to prices over the last year.

Regression Method
When dealing with datasets that contain multiple implicates, such as the SCF, there are two frequently used methods for obtaining regression results: repeated imputation inference (RII) and what we will refer to as the "brute force" method (Lindamood et al., 2007). Each method runs a separate regression for each implicate and averages the values of the coefficients. This average value is used as the parameter estimate for the overall regression. The difference between the two methods lies in calculating the t-statistics and resulting p-values. The "brute force" method simply averages the t-statistics and computes the p-values accordingly. RII uses a weighting mechanism to find the t-statistics and resulting p-values.

RII was chosen as the superior method for obtaining the most accurate t-statistics. Two widely available pieces of Stata code can perform RII on a given dataset. One, named "StataMIcode.do," is provided in the codebook to the 2004 and 2007 Surveys of Consumer Finances. The other, written by David T. Robinson and Dan Blanchette, comes in the form of an .ado file (rii.ado), which is available at http://ideas.repec.org/c/boc/bocode/s457050.html. Each of the three methods (rii.ado, StataMIcode.do, and brute force) yielded the same parameter estimates. Both rii.ado and StataMIcode.do yielded the same p-values. Although each method was applied to check for consistency, rii.ado was ultimately chosen.

RII does not provide statistics from the F-test for overall fit or an R^2 statistic. As a result, these were extracted from each regression run using the brute force method. The minimum to maximum values of each statistic are shown on the tables below (Tables 5 and Appendix). Assessing by the F-statistics for these regressions, each model has a good overall fit that is statistically significant.It should also be noted that, while all descriptive statistics are weighted, regression analysis is performed using unweighted data.

Results

Descriptive Analysis
Although there were fewer total households with credit cards in 2007 than in 2004, ahigher number of households were revolvers. The median interest rate for all households with credit cards in 2007 was 12.5%, compared to 12.0% for the revolvers (Table 1).Each of these variableswas 100 basis points higher than the medians in 2004.

Table 1
2007 and 2004 Descriptive Statistics: Dependent Variable

Variable	Measurement	2007		2004	
		Households with Credit Cards	Households that Revolve	Households with Credit Cards	Households that Revolve
Number of observations	Unweighted, all 5 implicates	17,646	8,214	18,100	8,159
APR on primary card					
	Mean	12.89%	12.60%	11.49%	11.75%
	Median	12.50%	12.00%	11.50%	11.00%

Credit Risk Measures. Consistent with the analysis of the 2004 data, households that revolve seem to exhibit riskier characteristics than the sample as a whole (Table 2). Revolvers seem more likely to have less favorable payment histories, higher utilization rates, more credit cards, and higher total credit card balances than the overall sample. They appear to be younger, inplying shorter credit histories. Revolvers also appear to dedicate more effort to shopping for credit and utilize more experienced sources. Compared with the 2004 data, 2007 respondents seem to have become more likely to have missed payments and less likely to pay off their balances in full. The 2007

respondents also carried higher balances, although they had fewer new charges in the previous month and approximately the same number of credit cards as the 2004 respondents.

Table 2
2007 and 2004 Descriptive Statistics: Credit Risk Measures

Variable	Measurement	2007		2004	
	Credit Risk Measures Related to Credit Scores				
Payment history					
No late payments	1 if never got behind or missed payments	79.69%	69.36%	85.21%	77.45%
Good credit history	1 if never behind in payments 2 months or more and never filed for bankruptcy	86.86%	81.57%	86.50%	81.40%
Payment behaviors					
Hardly every pay off (base)	1 if hardly ever pay off total balance on credit card	25.25%	40.44%	24.32%	40.22%
Sometimes pay off	1 if sometimes pay off total balance on credit card	19.61%	29.94%	20.31%	32.23%
Always/almost always pay off	1 if always/almost always pay off total balance on credit card	55.14%	29.61%	55.37%	27.55%
Credit utilization					
Utilization rate	Ratio of outstanding credit to credit limit	26.43%	43.37%	27.81%	47.24%
Credit limit	In dollars, combined for all cards				
	Mean	$29,041	$26,826	$25,750	$23,190
	Median	$18,000	$15,000	$14,269	$13,172
Have card balance	1 if report having a balance still owed	60.93%	100.00%	58.88%	100.00%
Card balance	In dollars, combined for all cards				
	Mean	$4,562	$7,487	$3,428	$5,822
	Median	$500	$3,000	$472	$2,612
New charges last month	Dollars, combined for all cards				
	Mean	$1,218	$796	$1,344	$1,012
	Median	$300	$200	$384	$285
Number of cards	Mean	4.44	4.67	4.429	4.602
	Median	3	4	3	4
Length of credit history					
Age	Years				
	Mean	51.14	47.42	50.359	46.55468
	Median	50	47	49	45
18-34	1 if respondent is 18-34	18.64%	22.12%	18.77%	22.19%
35-49	1 if respondent is 35-49	29.67%	35.00%	32.57%	39.07%
50-64(base)	1 if respondent is 50-64	29.55%	29.93%	27.26%	25.82%
65 & over	1 if respondent is 65 or older	22.14%	12.95%	21.39%	12.91%
Number of Years with current employer	Years	10.28	9.44	10.31	9.38
New credit obligations					

Variable	Measurement	2007		2004	
Approved for credit	1 if applied and approved for credit in last 5 years	56.60%	58.81%	58.26%	57.54%
Rejected	1 if applied for credit but completely rejected	14.21%	20.22%	15.35%	21.77%
Approved for lower amount	1 if rejected for full amount but approved for lower and accepted lower amount	1.16%	1.65%	1.19%	1.73%
Approved for lower amount, then reapplied and approved for full amount	1 if approved for lower amount but ultimately approved for full amount	1.79%	2.44%	1.81%	2.58%
Approved for lower amount and redenied for full amount	1 if approved for lower amount and ultimately denied for full amount	0.64%	0.82%	0.70%	1.05%
Did not apply for credit (base)	1 if did not apply for credit	25.60%	16.06%	22.68%	15.34%
Loan from friends	1 if could get loan of $3000 or more from friends or relatives	74.35%	72.00%	72.82%	69.36%
Mix of credit					
Home owner	1 if own home	78.93%	75.72%	79.03%	74.10%
Other lines of credit	Dollars, Mean dollars	$534	$339	$809	$397
	Median dollars	$0	$0	$0	$0
Other Credit Risk Measures					
Level of shopping effort for credit					
Low (base)	1 if report less than a moderate amount of shopping for credit	21.63%	17.53%	21.49%	19.02%
Medium	1 if report a moderate amount of shopping for credit	36.95%	39.99%	37.33%	39.71%
High	1 if report more than a moderate amount of shopping for credit	41.42%	42.48%	41.18%	41.26%
Information search (weighted measure based on number and expertise of information sources)					
Low (base)	1 if use few, non-expert sources	12.52%	9.22%	17.06%	14.22%
Medium	1 if use multiple, mixed expertise sources	55.36%	58.26%	57.89%	60.58%
High	1 if use more, expert sources	32.13%	32.52%	25.05%	25.20%
Attitude toward credit	1 if respondent says it's a bad idea for people to buy things on the installment plan	33.04%	29.53%	30.09%	24.86%
Risk tolerance					
Low (base)	1 if not willing to take any financial risks	33.71%	34.83%	33.91%	37.47%
Moderate	1 if willing to average or above average financial risks	62.87%	61.61%	62.66%	58.75%
Substantial	1 if willing to take substantial financial risks	3.42%	3.56%	3.43%	3.79%
Smoker	1 if respondent or spouse smokes	20.90%	25.01%	22.89%	26.39%

Socioeconomic and Demographic Characteristics. Again consistent with the previous study, we found that revolving households were less wealthy and had lower incomes than the sample as a whole (Table 3). They appeared slightly less educated and more likely to be non-white. Compared with the 2004 respondents, the 2007 respondents seemed wealthier and had higher incomes.

Table 3
2007 and 2004 Descriptive Statistics: Socioeconomic & Demographic Characteristics

Variable	Measurement	2007		2004	
		Households with Credit Cards	Households that Revolve	Households with Credit Cards	Households that Revolve
Income	Dollars				
	Mean	$104,104	$77,910	$93,900	$72,210
	Median	$60,674	$58,617	$59,825	$55,310
Financial assets	Dollars				
	Mean	$296,975	$122,527	$269,777	$99,932
	Median	$47,900	$27,250	$43,356	$20,087
Checking account	1 if have checking account	92.26%	93.60%	90.87%	91.63%
Saving account	1 if have saving account	53.62%	56.72%	53.57%	54.66%
Money market account	1 if have money market account	25.99%	17.50%	26.40%	18.73%
Education	Mean years	13.91	13.69	13.93	13.65
	Median years	14.00	14.00	14.00	14.00
Less than high school	1 if less than high school education	7.54%	7.39%	7.63%	8.37%
High school/GED (base)	1 if high school diploma or GED	30.27%	32.94%	28.59%	31.51%
Some college	1 if some college	24.55%	28.32%	25.65%	29.56%
College degree	1 if bachelor's degree	22.60%	20.32%	22.94%	19.91%
Post graduate	1 if some post-graduate study or graduate degree	15.04%	11.03%	15.18%	10.65%
Marital status/gender					
Married (base)	1 if household is married couple	64.20%	65.68%	63.44%	62.90%
Single male	1 if household is headed by single male	11.88%	10.26%	12.89%	11.38%
Single female	1 if household is headed by single female	23.92%	24.06%	23.67%	25.72%
Race/ethnicity					
White	1 if respondent is White	79.04%	74.11%	80.05%	74.07%
Black	1 if respondent is Black	9.21%	12.85%	9.42%	13.44%
Hispanic (base)	1 if respondent is Hispanic	6.99%	9.13%	6.63%	8.99%
Other races	1 if respondent is of another race	4.76%	3.91%	3.90%	3.51%
Work Status					
Working	1 if respondent is working	61.85%	69.90%	61.71%	71.12%
Self-employed	1 if respondent is self-employed	11.31%	10.53%	13.40%	11.66%
Student	1 if respondent is a student	6.52%	7.48%	0.86%	0.89%
Homemaker	1 if respondent is a homemaker	6.71%	4.28%	0.71%	0.42%
Retired	1 if respondent is retired	19.73%	11.64%	18.17%	10.14%
Unemployed, looking for a job	1 if respondent is unemployed but looking for a job	2.28%	2.69%	2.08%	2.53%
Unemployed, not looking for a job (base)	1 if respondent is unemployed but not looking for a job	3.22%	3.71%	2.49%	2.73%

Expectations and Motivations. Respondents in 2007 were less likely than those in 2004 to believe that interest rates would rise over the next 5 years (Table 4). They were also slightly less likely to believe that their incomes rose more than prices over the past year (respondents in 2007 were asked about incomes in 2006). There

was no change in the financial planning horizon between 2004 and 2007; in both surveys, revolvers were more likely to report a shorter planning horizon.

Table 4
2007 and 2004 Descriptive Statistics: Expectations & Motivations

Variable	Measurement	2007		2004	
		Households with Credit Cards	Households that Revolve	Households with Credit Cards	Households that Revolve
Interest rates will rise over next 5 years	1 if expect interest rates will rise over next 5 years	64.46%	67.06%	82.59%	81.16%
Major expense in next 5-10 years	1 if expect major expense in the next 5 to 10 years	52.45%	56.04%	53.68%	56.20%
Income rose more than prices last year	1 if believe that household income rose more than prices last year	20.15%	18.61%	22.09%	20.91%
Financial planning horizon					
Short term (<= 1 year; base)	1 if report planning horizon of 1 year or less	28.64%	31.01%	28.15%	32.91%
Medium term (2-10 years)	1 if report planning horizon between 2 and 10 years	55.44%	55.38%	56.31%	53.14%
Long term (10+ years)	1 if report planning horizon of more than 10 years	15.93%	13.62%	15.54%	13.96%

Regression Analysis

Credit Card Holders.Controlling for socioeconomic, demographic, and motivational characteristics, several of the credit risk variables proved to be statistically significant (Table 5). Having no late payments and having a good credit history each were associated with more than a 100 basis-point drop in APR. Paying off credit card balances more frequently and paying balances off all the time decreased interest rates by 181 and 76 basis points, respectively. Having a higher credit limit was associated with having a lower interest rate, as was carrying a balance. Compared with consumers aged 50 to 64, younger consumers (age 18-34) had lower interest rates by 94 basis points. Being rejected for credit was linked to an increase of 107 basis points, while being approved for a low amount, then reapplying and receiving the full amount was associated with a decrease of 179 basis points in interest rates.

Among the socioeconomic, demographic, and motivational characteristics, only five were statistically significant at the 10 percent level. Income was significant, but its positive correlation with interest rate was contraryto expectations. Having a savings account was associated with a 58 basis point reduction in APR. The effect of having some college education compared with high school or a GED was statistically significant, although other levels of education were not significant.Being white was associated with an interest rate that was 135 basis points lower than that for Hispanics. Finally, retired individuals were expected to have an APR that was 140 basis points lower than the unemployed population that was not looking for a job.

Revolvers.Among revolvers, having no late payments decreased interest rates by 124 basis points. A good credit history was associated with a reduction in interest rate of 116 basis points. Paying off one's balance more frequently was associated with a 158 basis point drop in APR. The age variable, intended to represent the length of credit history, was significant for the 18-34 year-old bracket, with a lower interest rate than the 50-64 year-old bracket by 119 basis points.

Income, race, and work status remained significant for revolvers. Having a higher income was associated with higher credit card interest rates. Compared with Hispanics, being white or black was associated with lower interest rates by more than 150 basis points. Being retired was associated with interest rates that were nearly 200 basis points lower than for those unemployed but not looking for a job.

Table 5
RII Regression Results for Credit Card APR, 2007 SCF

Variable	Households with Credit Cards		Households that Revolve	
	Parameter estimate	Prob. sig.	Parameter estimate	Prob. sig.
Intercept	18.37	0.00	16.70	0.00
Credit Risk Measures Related to Credit Scores				
Payment History				
No late payments	-1.17	0.01	-1.24	0.01
Good credit history	-1.21	0.01	-1.16	0.03
Payment behaviors				
Hardly ever pay off	Base	Base	Base	Base
Sometimes pay off	-1.81	0.00	-1.58	0.00
Always/almost always pay off	-0.76	0.09	-0.68	0.17
Credit Utilization				
Credit limit (natural log)	-0.27	0.02	-0.54	0.00
Have a credit card balance	-1.61	0.00	N/A	N/A
Utilization ratio	0.30	0.13	0.14	0.51
New charges last month (natural log)	0.08	0.18	0.02	0.75
Number of cards	-0.01	0.69	-0.04	0.49
Length of Credit History				
Age				
18-34	-0.94	0.03	-1.19	0.06
35-49	-0.31	0.39	-0.72	0.12
50-64	Base	Base	Base	Base
65 & over	-0.28	0.51	0.02	0.98
New Credit Obligations				
Approved for credit	-0.14	0.66	-0.30	0.59
Rejected	1.07	0.03	1.07	0.11
Approved for lower amount	0.48	0.70	-0.12	0.94
Approved for lower amount, then reapplied and approved for full amount	-1.79	0.09	-1.66	0.24
Approved for lower amount and redenied for full amount	1.31	0.43	1.52	0.46
Did not apply for credit	Base	Base	Base	Base
Loan from friends	-0.36	0.26	-0.42	0.34
Mix of Credit				
Home owner	-0.21	0.56	0.02	0.97
Other lines of credit	0.03	0.65	0.13	0.29
Other Credit Risk Measures				
Level of shopping effort				
Low	Base	Base	Base	Base
Medium	-0.04	0.89	0.24	0.63
High	-0.49	0.11	-0.33	0.51
Information search				
Low	Base	Base	Base	Base
Medium	0.17	0.64	-0.21	0.75
High	0.20	0.61	-0.21	0.77
Attitude toward credit	-0.01	0.96	-0.14	0.72
Risk tolerance				
Low	Base	Base	Base	Base
Moderate	-0.25	0.42	-0.54	0.22
Substantial	-0.48	0.39	-1.31	0.17
Smoker	0.26	0.45	0.65	0.14

Variable	Households with Credit Cards		Households that Revolve	
	Parameter estimate	Prob. sig.	Parameter estimate	Prob. sig.
Socioeconomic & Demographic Characteristics				
Income (natural log)	0.36	0.01	0.77	0.00
Financial assets (natural log)	0.04	0.64	-0.01	0.91
Checking account	-0.15	0.70	0.00	1.00
Saving account	-0.58	0.04	-0.61	0.11
Money market account	0.01	0.96	0.16	0.76
Education				
Less than high school	-0.84	0.16	-1.17	0.14
High school/GED	Base	Base	Base	Base
Some college	-0.82	0.03	-0.68	0.18
College degree	-0.58	0.12	-0.68	0.22
Post graduate/graduate degree	-0.38	0.32	-1.01	0.11
Marital status/gender				
Married	Base	Base	Base	Base
Single male	-0.17	0.65	-0.12	0.85
Single female	0.34	0.35	0.77	0.11
Race/ethnicity				
White	-1.35	0.04	-1.52	0.05
Black	-1.13	0.15	-1.86	0.05
Hispanic	Base	Base	Base	Base
Other races	-0.01	0.99	-0.21	0.85
Work Status				
Working	-1.16	0.11	-1.43	0.14
Self-employed	-0.93	0.23	-1.11	0.30
Student	-0.58	0.78	0.55	0.84
Homemaker	-1.33	0.37	-3.91	0.17
Retired	-1.40	0.07	-1.98	0.08
Unemployed, looking for a job	-0.40	0.74	0.40	0.79
Unemployed, not looking for a job	Base	Base	Base	Base
Expectations & Motivations				
Interest rates will rise over next 5 years	0.31	0.20	0.12	0.75
Major expense in next 5-10 years	0.03	0.90	0.32	0.39
Income rose more than prices last year	0.14	0.61	-0.12	0.81
Financial planning horizon				
Short term (<= 1 year)	Base	Base	Base	Base
Medium term (2-10 years)	-0.18	0.57	-0.29	0.48
Long term (10+ years)	-0.57	0.13	-0.88	0.13
F value (Min, Max)	4.73 - 5.43		3.61 - 4.32	
Adjusted R^2 (Min, Max)	0.05 - 0.06		0.08 - 0.10	

Comparison with 2004. The 2004 data (see Appendix A) showed that revolvers had a higher base APR (intercept) than all households with credit cards, while the 2007 data shows the opposite. The 2007 results are consistent with the theory that consumers who revolve shop for lower interest rates on their cards. A greater number of the credit risk variables were significant in 2004 than in 2007. It may be that the 2007 data reflect changes in credit card underwriting during the economic transitions that occurred in the second half of the year.

Discussion

The goal of this paper was to understand specific risk factors affecting credit card interest rates. In the process, we have updated the previous analysis of the 2004 SCF data. The changes to the economic environment between 2004 and 2007 are subtle, due to the timing of the 2007 data collection. Nonetheless, several shifts are

evident in the data across the two surveys: mean and median interest rates were higher in 2007 than in 2004. Fewer credit risk variables were significant in 2007 compared with 2004. Race and ethnicity were significant in 2007, raising the question of how minorities were treated in subprime markets. While these data are not proof of discrimination *per se*, they do suggest a closer examination of the underwriting process for credit cards.

Money-saving Behavior Changes

In the revolver regression, three behaviors had a significant effect on interest rates – paying on time, keeping a "clean" credit record (not behind in payments, not filing for bankruptcy), and paying off balances. In much of the consumer testing the Board has done for credit card and mortgage disclosures, many consumers underestimate the impact that even a few basis points can make on the total amount paid back to lenders. To illustrate the potential impact of significant behavior changes, we developed an example based on the median balance revolved ($3,000) and the "intercept" interest rate of 16.7%. We assume that consumers do not charge any more to their credit card, that a single rate applies to the full balance, the rate does not change during the payoff period, there are no additional fees or penalties, and consumers pay all of the finance charges plus 3% of the balance with a minimum total payment of $20. This "Sample Consumer" would end up paying $2,254.47 in interest over the life of the debt as they pay down the balance to zero (Table 6).

Pay bills ontime. Paying a bill late may have two implications for consumers: first, they may face a late payment fee (although this fee must be "reasonable and proportional" under Federal Reserve rules that went into effect in August 2010); second, the credit card company may raise their interest rate. While consumers can have this penalty rate lowered if they make minimum payments on time for 6 months in a row, the penalty rate during the 6-month period can result in substantially higher interest costs. In 2007, paying bills on time (shown on the tables as "no late payments") was associated with a 124 basis point decrease in the APR.Many other authors have cited paying on time as a primary factor in improving credit scores and decreasing interest rates. (Hazembuller, et al., 2007; Edelman, 2008; Lea, 2010). If our Sample Consumer paid their credit card bill on time, their interest rates would be 15.46%, resulting in a saving of $288.18 in interest over the base price.

Keep your credit record clean. Beyond paying on time, credit records include information on being 30, 60, or 90 days late in paying bills. They also include information on bankruptcy filings. Missing payments or bankruptcy filings were associated with a 116 basis-point reduction for revolvers.

If our Sample Consumer kept their credit record clean, their interest rate would be 15.54% (compared with 16.7%) and they would save $270.60 in interest.

Pay off credit card balances.Depending on the amount of the balance carried, it is understandable that consumers may not be able to pay off the entire balance on their credit cards. But they may be able to increase the amount they pay each month to systematically reduce their balance. As this pattern continues, they could eventually pay off their balances, and may be able to maintain this payment pattern. Paying off credit card balances more frequently was associated with an interest rate decrease of 158 basis points.

A dollar savings for this behavioral change is difficult to calculate because of the compounding effects of paying down the credit card balance along with the interest rate change. However, if the interest rate remained constant and the sample consumer pays off 4% of their balance instead of 3%, the resulting interest would be $1,452 instead of $2,254, a savings of $802. And if the interest rate were reduced to 15.12%, they would save $361. Therefore, the approximate total potential savings would be $802 + $361 or $1,163.

Table 6
Behaviors that Lower Rates and Save Money*

	Rate	Interest Paid	Potential Savings
Base	16.70%	$2,254.47	---
Pay on time	15.46%	$1,966.29	$288.18
Establish good credit	15.54%	$1,983.87	$270.60
Pay off full balance more frequently	15.12%	$1,893.06	$361.40**

*Assumptions: Balance=$3,000 completely paid off
Consumers do not add to balance
Single interest rate applies to entire balance
No changes in interest rate during payoff period
No additional fees or penalties incurred
Minimum Payment: all finance charges + (max: 3% of balance or $20)
** Based on interest rate change only; additional savings accrue due to shorter term of repayment

In 2004, some additional variables were significantly associated with lower interest rates, leading to additional tips for saving. These included: decrease credit utilization; become more financially educated; and shop more for credit. While these are still important consumer behavior strategies, we did not find any statistical support for them in the 2007 data.

Conclusion

Even small changes in financial behavior can lead to hundreds of dollars in savings. The Hazembuller et al. paper noted the importance of actively monitoring one's interest rate for changes and asking credit card companies for a lower rate. As part of the new Credit CARD Act rules, credit card companies must give consumers a 45-day advance notice of changes in interest rates, and must re-evaluate interest rates every 6 months, with appropriate adjustments. Both of these provisions should make it easier for consumers to deal with risk-based pricing structures in today's financial marketplace.

Appendix A 2004 Regression Results
(using same model as regression with 2007 data)

Variable	Households with Credit Cards		Households that Revolve	
	Parameter estimate	Prob. sig.	Parameter estimate	Prob. sig.
Intercept	17.34	0.00	21.75	0.00
Credit Risk Measures Related to Credit Scores				
Payment History				
No late payments	-1.56	0.00	-1.70	0.00
Good credit history	-0.60	0.16	-0.57	0.24
Payment behaviors				
Hardly ever pay off	Base	Base	Base	Base
Sometimes pay off	-1.41	0.00	-1.04	0.01
Always/almost always pay off	-1.30	0.00	-1.16	0.01
Credit Utilization				
Credit limit (natural log)	-0.41	0.00	-0.84	0.00
Have a credit card balance	-0.97	0.01	N/A	N/A
Utilization ratio	0.46	0.01	0.18	0.32
New charges last month (natural log)	-0.02	0.67	-0.14	0.06
Number of cards	0.02	0.56	0.05	0.40
Length of Credit History				
Age				
18-34	-0.27	0.53	-0.93	0.09
35-49	-0.12	0.74	-0.99	0.01
50-64	Base	Base	Base	Base
65 & over	-0.74	0.08	-2.00	0.00
New Credit Obligations				
Approved for credit	-0.03	0.94	-0.49	0.35
Rejected	0.92	0.07	0.69	0.23
Approved for lower amount	-0.74	0.50	-1.10	0.39
Approved for lower amount, then reapplied and approved for full amount	-1.18	0.24	-1.57	0.18
Approved for lower amount and redenied for full amount	-1.29	0.43	-1.20	0.48
Did not apply for credit	Base	Base	Base	Base
Loan from friends	0.15	0.64	0.14	0.71
Mix of Credit				
Home owner	-0.57	0.11	-0.79	0.06

Variable	Households with Credit Cards		Households that Revolve	
	Parameter estimate	Prob. sig.	Parameter estimate	Prob. sig.
Other lines of credit	-0.02	0.76	-0.11	0.38
Other Credit Risk Measures				
Level of shopping effort				
Low	Base	Base	Base	Base
Medium	-0.37	0.37	-0.56	0.28
High	-0.96	0.04	-1.73	0.00
Information search				
Low	Base	Base	Base	Base
Medium	0.36	0.30	0.38	0.45
High	0.40	0.29	0.61	0.32
Attitude toward credit	0.42	0.12	0.36	0.34
Risk tolerance				
Low	Base	Base	Base	Base
Moderate	-0.65	0.05	-0.62	0.12
Substantial	-0.91	0.18	-1.59	0.05
Smoker	0.12	0.69	0.33	0.44
Socioeconomic & Demographic Characteristics				
Income (natural log)	0.20	0.25	0.17	0.42
Financial assets (natural log)	-0.02	0.81	-0.08	0.39
Checking account	0.09	0.82	0.36	0.58
Saving account	0.00	0.99	-0.23	0.51
Money market account	0.10	0.74	0.00	0.99
Education				
Less than high school	0.17	0.81	0.37	0.61
High school/GED	Base	Base	Base	Base
Some college	-0.22	0.52	-0.39	0.36
College degree	-0.45	0.21	-0.82	0.10
Post graduate/graduate degree	-0.13	0.76	-0.46	0.41
Marital status/gender				
Married	Base	Base	Base	Base
Single male	-0.60	0.10	-1.04	0.06
Single female	0.16	0.67	-0.24	0.61
Race/ethnicity				
White	-0.36	0.52	-0.35	0.58
Black	-0.04	0.95	-0.22	0.76
Hispanic	Base	Base	Base	Base
Other races	-0.07	0.93	0.19	0.85
Work Status				
Working	0.42	0.63	1.74	0.09
Self-employed	0.49	0.62	2.27	0.04
Student	-1.23	0.59	0.52	0.83
Homemaker	0.13	0.94	1.79	0.51
Retired	0.96	0.34	2.23	0.05
Unemployed, looking for a job	-0.63	0.68	0.22	0.89
Unemployed, not looking for a job	Base	Base	Base	Base
Expectations & Motivations				
Interest rates will rise over next 5 years	0.57	0.12	0.85	0.07
Major expense in next 5-10 years	-0.07	0.79	-0.21	0.53
Income rose more than prices last year	0.40	0.15	0.61	0.13
Financial planning horizon				
Short term (<= 1 year)	Base	Base	Base	Base

Variable	Households with Credit Cards		Households that Revolve	
	Parameter estimate	Prob. sig.	Parameter estimate	Prob. sig.
Medium term (2-10 years)	-0.23	0.49	-0.15	0.69
Long term (10+ years)	-0.14	0.68	0.61	0.26
F value (Min, Max)	4.55 – 5.33		5.97 – 6.61	
Adjusted R2 (Min, Max)	0.05 - 0.06		0.14 – 0.16	

Appendix B

Methodological Differences betweenHazembuller et al., 2007 and Current Study

        Those familiar with the Hazembuller et al., 2007 study may notice some differences in the descriptive statistics and regression results given for the 2004 data in this study and those provided in the original study. There are several reasons for these differences.

        1. Different Programs. The original study used SAS to compute the descriptive statistics and regression results. The revised study used Stata. Minor differences in how the programs store data and, where applicable, round numbers can account for small differences between the two studies' results.

        2. Different Regression Methods. The original study randomly chose the third implicate and performed regression analysis on that implicate only. The revised study used repeated imputation inference to run the regression on all implicates. This causes some differences between the original and revised results.

        3. Different Calculations of Variables. There were some instances where the formulas used to calculate certain variables were changed for the revised study. For example, the original study described "Good Credit History" as "Never behind in payments 2 months or more and never filed for bankruptcy," yet it was calculated using different variables – specifically, "Have you ever been denied for credit in the last 5 years?" and "Have you ever refrained from applying for credit within the last 5 years because you thought you would be denied?". The formula was reworked in the revised paper so that it actually used the variables listed in the description. All attempts were made to do the most logical correction for each given situation.

        4. Real vs. Nominal Data. For all variables expressed in dollar amounts, the 2004 descriptive statistics are given in this paper in real form – that is, it has all been converted from 2004 dollars to 2007 dollars using CPI data from the Bureau of Labor Statistics. Descriptive statistics using nominal data are shown below (only different values are displayed).

Nominal Values for 2004 Descriptive Statistics

Credit limit	In dollars, combined for all cards	Households	Revolvers
	Mean	$25,750	$23,190
	Median	$14,269	$13,172
Card balance	In dollars, combined for all cards		
	Mean	$3,428	$5,822
	Median	$472	$2,612
New charges last month	Dollars, combined for all cards		
	Mean	$1,344	$1,012
	Median	$384	$285
Other lines of credit (Dollars)	Mean	$809	$397
	Median	$0	$0
Income(Dollars)	Mean	$93,900	$72,210
	Median	$59,825	$55,310
Financial assets (Dollars)	Mean	$269,777	$99,932
	Median	$43,356	$20,087

        5. Unknown Error/Calculation Method. Some of the differences, most notably the difference in financial assets among all households with credit cards, could not be aligned. In all instances, every attempt was made to ensure that the revised method was correct. The revised calculation code was compared with the original code (albeit in a different language – SAS vs. Stata). The revised results were also compared to the SCFp, a dataset with

some macros already calculated, in all cases where the SCFpincluded the relevant variable. Once all possible variations had been eliminated and every attempt was made to understand the original calculation methodology, the revised method was assumed to be correct to allow for consistency between revised 2004 and 2007 results. It should be noted that in no instance were the results from the revised methodology significantly different (as in more than rounding) from the SCFpresults, providing further evidence in favor of the revised method's superiority.

Acknowledgements

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