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Effects of Credit Scores on Consumer Payment Choice

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Abstract:

This paper investigates the effects of credit scores on consumer payment behavior, especially on debit and credit card use. Anecdotally, a negative relationship between debit card use and credit score has been reported; however, it is not clear whether that relationship is related to other factors, such as education or income, or whether it is a mere correlation. We use a new consumer survey dataset to examine whether this negative relationship holds after controlling for various consumer characteristics, including demographic and financial characteristics, consumers' perceptions toward payment methods, and card reward status. The results based on a single-year survey as well as on panel data suggest that there is a significant negative relationship between debit card use and credit score even after controlling for various characteristics. We supplement the analysis with evidence from Equifax data. The results indicate that an increase in consumers' cost of debit cards—in response to regulatory changes, for example—would have an adverse effect on low-credit-score consumers (typically those with lower incomes and less education).

We then investigate what credit score implies. If credit score significantly influences consumer access to credit cards, credit limits, or the cost of credit cards, then the negative relationship likely results from supply-side constraints. If a lower credit score is associated with differences in underlying preferences, then the negative relationship is likely due to demand-side effects. Preliminary evidence strongly suggests that supply-side factors play an important role in the cost of credit and in access to credit.

Keywords: credit scores, debit cards, payment behavior

JEL Classifications: D12, D14, G21

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CONSUMER PAYMENTS Research Center

1. Introduction

Over the last decade, debit card use has grown rapidly, and debit cards are now the most commonly used noncash method of payment in the United States. According to the 2010 Federal Reserve Payments Study (FRPS), 37.9 billion debit card transactions were made in 2009 in the United States, representing 35 percent of total noncash retail payments. Between 2000 and 2009, debit card use has grown at an average annual rate of 18 percent. In contrast, credit card use has grown at a much slower pace (3.7 percent at a compound annual rate) and has accounted for 20 percent of total noncash retail payments in 2009 (Federal Reserve System 2010).

The rapid growth of debit cards has stimulated several studies on consumer payment choice. Previous studies highlighted several important demand-side factors that influence consumer payment choice, such as consumer characteristics, transaction characteristics, payment method attributes, and price or reward of payment methods. Most of these studies did not include factors that would limit available payment methods to consumers, because very few datasets contain information necessary to examine the effects of such factors. There are a few exceptions. Rysman (2007) and Ching and Hayashi (2010) took account of merchant acceptance of payment methods when analyzing consumer payment choice. Zinman (2009) found that the closer the credit limit and the balance on credit cards, the more likely consumers are to use a debit card rather than a credit card.

The main goal of this paper is to investigate the effects of credit scores on consumer payment choice, especially on debit card use. Anecdotally, a negative relationship between debit use and credit score has been observed (Lightspeed 2009); however, it is not clear whether it is a mere correlation. We first examine whether this negative relationship holds even after controlling for various factors, such as consumer characteristics, payment method attributes, and price or rewards associated with payment methods. We use a unique consumer survey dataset: the 2008 and 2009 Survey of Consumer Payment Choice, or SCPC, a consumer survey conducted by the Federal Reserve Bank of Boston. We further investigate what credit score implies. If the credit score significantly influences consumer access to credit, credit limits, or the cost of credit, then the negative relationship likely results from supply-side effects: consumers with a lower credit score cannot access credit by using their credit card, or accessing credit via credit card is too costly for them, and thus they use their debit card instead. Our dataset provides other variables that are indicative of consumers' current credit conditions, such as credit card balance and financial difficulties, which help to disentangle supply- and demand-side effects.

Our results suggest that there is a negative relationship between debit card use and credit score even after controlling for various consumer characteristics, payment method attributes, and rewards on payment cards. A new rule starting on October 1, 2011, on debit card interchange fees[1] has reduced the interchange fees charged on debit card transactions on the cards that are issued by large financial institutions. Some large financial institutions have reacted to this rule by announcing higher debit card fees to recover their lost interchange fee revenues.[2] Because consumers with low credit scores, such as the FICO score developed by the Fair Isaac Corporation, are the ones who use debit cards more intensively, they are likely to be especially adversely affected if their banks introduce debit card fees.[3] Based on our data, younger, less educated, and lower-income consumers would be more likely to be affected than other demographic groups, especially if their access to alternative means of payment is limited.

Because the SCPC provides only self-reported credit scores, we extend our analysis by using the Equifax dataset, which includes an external measure of credit score, closely correlated with a FICO score. While we cannot merge the SCPC and the Equifax data precisely, we extract the Equifax credit score for each finely decomposed socio-economic group and compare that external measure with the SCPC data.

The paper is organized as follows. Section 2 provides background and the main hypothesis of this study, and reviews related literature. Section 3 describes the data used for this study (SCPC) and compares the SCPC with other datasets in terms of credit scores. Section

[1] A debit card interchange fee is paid to the card issuer by the merchant who accepts a debit card for the payment. For details, see http://www.federalreserve.gov/newsevents/press/bcreg/20110629a.htm

[2] For example, Bank of America announced a $5 monthly fee to start in 2012, and Wells Fargo and Chase tested a $3 monthly fee on any customers using their debit card. The banks later retracted this policy.

[3] Low-FICO-score consumers may be able to avoid debit card fees by switching to financial institutions that do not charge debit card fees. Merchants may also start offering discounts to their customers who pay with a debit card, because the merchants' costs of accepting debit cards are reduced.

4 focuses on the factors affecting FICO scores. Model and estimation results of adoption and use of payment cards are included in Section 5. Section 6 discusses the causes and implications of the FICO score effect, distinguishing between supply-side and demand-side effects. Section 7 concludes.

2. Background and hypothesis

2.1 Credit scores

Credit scores summarize consumers' credit history, and are used by various lenders and financial institutions to evaluate consumers' creditworthiness. A *higher* credit score indicates that a person is expected to have a *lower* probability of defaulting on his or her loan obligations. Even though most lenders—especially mortgage lenders—tend to use the same credit scores, a lot of confusion exists concerning how these scores are calculated. This is so because the formula that credit companies use to calculate credit scores is complex and proprietary, and also because a given consumer's credit score can change over time even when the consumer does not alter his or her behavior. Credit scores always correspond to assessed riskiness in a monotonic way, that is, a person with a higher credit score is always expected to have a lower probability of default than a person with a lower score, but any given value of credit score can be associated with a higher or lower probability of default over time.

The first model of credit scoring was developed by the Fair Isaac Corporation in 1956, although the models have evolved over time. By some estimates, more than a hundred different models of credit scoring have been developed. Credit scores are now calculated by the Fair Isaac Corporation, as well as by other companies, and are available through the major credit bureaus in the United States: Equifax, Experian, and TransUnion. FICO credit score ranges from 300 to 850, with 60 percent of scores falling between 650 and 799. Every person with a credit record has three credit scores for the FICO scoring model, as each of the three major credit bureaus (Experian, Equifax and TransUnion) has its own database. Data about an individual consumer can vary from bureau to bureau, even though each is designed to measure the risk of default and incorporates various factors in a person's financial history. The newer models tend to have greater score dispersion and comparisons across the models should not be made.

Although the exact formulas for calculating credit scores are secret, FICO has the following components:

- Payment history (35 percent of the score): late payments on bills, such as a mortgage, credit card or automobile loan, can cause a FICO score to drop. Paying bills on time improves a FICO score.
- Credit utilization (30 percent of the score): The ratio of current revolving debt (such as credit card balances) to the total available revolving credit or credit limit. FICO score can be improved by paying off debt and lowering the credit utilization ratio, or sometimes—but not always—by applying for and receiving the credit limit increase. Closing existing accounts will typically raise the utilization ratio and therefore lower the FICO score.
- Length of credit history (15 percent of the score): Longer credit histories are typically associated with higher FICO scores.
- Types of credit used (10 percent of the score): Having a variety of different types of credit (installment, revolving, consumer finance, mortgage) can lead to a higher FICO score.
- Recent search for credit (10 percent of the score): Opening new accounts is associated with greater credit risk, and new accounts lower credit scores. Credit inquiries, which occur when a person is seeking new credit, can hurt the consumer's FICO score. Although all credit inquiries are recorded, credit inquiries that are made either by an individual himself (to check his credit), or by his employer (for employee verification), or by companies initiating prescreened offers of credit or insurance have no impact on the credit score.

A more complete set of variables included in the FICO score is listed in the appendix. Even though the models used to calculate credit scores differ across the companies that calculate them, the steps involved are the same for all of them. They start by using the data on each consumer in their models to predict a likelihood that a person will default on his or her credit obligations within the next two years. Next, they group the consumers with others who exhibited similar credit history events. Finally, each person's probability of default calculated in the first step is mapped to a credit score, based on where the person is grouped in the second step. The process yields score-probability relationships, which then allow prospective lenders to make their decisions whether or not to lend to each consumer. As mentioned above, the information is updated all the time, and so the score changes over time.

2.2 Literature

The literature on consumer payment choice has been growing since the late 1990s, but most of the previous studies focused on the effects of consumer characteristics, payment method attributes, and prices or rewards of payment methods. Consumer characteristics, such as demographic and financial characteristics, and tendencies to adopt new technologies are correlated with the adoption and use of payment methods (for example, Kennickell and Kwast 1997, Stavins 2001, and Hayashi and Klee 2003). Mantel (2000), Jonker (2005), Klee (2006), and Schuh and Stavins (2010) found that payment method attributes as perceived by consumers are strongly correlated with consumer payment choice. Prices or rewards offered on payment methods are also highly correlated with the use of payment cards (for example, Borzekowski et al. 2008, Ching and Hayashi 2010, Simon et al. 2010).

A few studies included factors that would limit available payment methods to consumers in their analyses. Rysman (2007) and Ching and Hayashi (2010) took account of merchant acceptance of payment methods. Rysman found that a consumer's favorite card network is positively correlated with the number of local merchants who accept that network's cards. In the Ching and Hayashi model, a consumer's choice set consists of payment methods that the consumer believes are accepted at a given type of store. Zinman (2009), on the other hand, analyzed how a consumer's credit limit and balance on a credit card would influence his choice of debit or credit cards. He found that the closer the credit limit is to the balance on credit cards, the more likely consumers are to use a debit card rather than a credit card. A few other studies also found a negative relationship between credit card balance and credit card use (for example, Ching and Hayashi 2010 and Simon et al. 2010) or a positive relationship between credit card balance and debit card use (Lee et al. 2007, and Sprenger and Stavins 2010).

Our study is closely related to Zinman (2009). Unlike Zinman's, our dataset does not contain each consumer's credit limit. However, our dataset does include credit scores as well as other variables that are indicative of consumers' current credit situations. These variables are used to disentangle supply- and demand-side effects on consumer payment choice. When estimating the effect of credit scores on consumer payment choice, we also control for consumer characteristics, perceived payment method attributes, and prices or rewards of payment methods. Avery et al. (2010) examines a relationship between credit scores and demographics, but does not deal with payment behavior.

2.3 Do credit scores imply supply-side or demand-side effects?

A negative relationship between debit card use and credit score could imply supply-side effects, demand-side effects, or a combination of both. As explained above, credit scores are used by various lenders, including credit card issuers, to evaluate consumers' creditworthiness. Since a lower credit score indicates that a person is expected to have a higher probability of defaulting on his or her credit card loan obligations, credit card issuers may provide relatively lower credit limits to those consumers with lower credit scores than to those with higher credit scores. Or credit card issuers may not issue a credit card to a consumer whose credit score is below a certain threshold, or they may make credit cards more costly to low-score consumers, by offering them credit card plans with higher fees or higher interest rates. These are potential supply-side constraints that might force consumers to use debit cards more heavily, even if they preferred to use credit cards.

Thus, supply-side effects of consumers' credit scores on consumer payment choice include the limitations on consumers' ability to conduct credit card transactions—credit card issuers may have failed to approve their credit card applications or may have set their credit limits too low to allow consumers to make their desired number of credit card transactions, or may have set the cost higher than that offered to people with high scores. The supply-side effects of credit score may limit payment methods available to some consumers to debit cards, cash, and checks, instead of credit cards.

On the other hand, a negative relationship between debit card use and credit score could be explained by demand-side factors. A lower credit score may be associated with different tastes and preferences, resulting in different payment behavior. For example, consumers with lower credit scores may be more sensitive to credit card interest charges than consumers with higher credit scores, even if both types of consumers are charged the same interest rate. Lower-score consumers may also choose to use debit instead of credit to help them with budgeting and control their spending. As a result, consumers with lower credit scores may actively *choose* to pay with a debit card to lower their payment costs.

3. Data

3.1 SCPC

Our main data set is the 2009 Survey of Consumer Payment Choice (SCPC). The SCPC is a nationally representative survey that asks consumers about their payment behavior. The survey instrument was developed by the Consumer Payments Research Center (CPRC) of the Federal Reserve Bank of Boston, and administered by the RAND Corporation. In this section, we provide a brief description of the survey and its 2009 results. For more detailed information about the survey instrument or about the results, see Foster et al. (2009) and (2011).

The 2009 SCPC was administered online to a random sample of 2,174 U.S. consumers by the RAND Corporation as a module of the American Life Panel (ALP), and weighted to match national population estimates from the Census Bureau's Current Population Survey. Out of that total sample, 872 respondents were also included in the previous (2008) version of the survey. We use the 2008–'09 panel for some of our empirical analysis below.

The SCPC is a rich source of information about consumer payment behavior. The survey asks respondents about their adoption (holding, extensive margin) and use (intensive margin) of nine payment instruments, including paper (cash, checks, money orders, and traveler's checks), cards (credit cards, debit cards, and prepaid cards), and electronic payment instruments (online banking bill payments[4] and bank account number payments[5]). The survey asks consumers about their payment use by purpose, including retail transactions conducted at the point of sale, online purchases, and bill payments. Based on the responses about the number of transactions, it is possible to compute shares of transactions conducted with each payment instrument. The advantage of using shares rather than the absolute number of transactions as a measure of payment use is that respondents may underestimate the number of payments, due to recall problems, and shares are less likely to be biased. In addition to the adoption and use of payments, the SCPC includes a set of questions about consumers' perceptions of the characteristics of payment instruments. Ching and Hayashi (2010) and Schuh and Stavins (2010) showed that perceptions are an important factor affecting consumer payment choice. The survey contains detailed demographic and income information, including a self-reported FICO score. It also contains information about financial difficulties, such as past bankruptcy filings and foreclosures.

No other publicly available data contain as much information about consumer payment use. The Survey of Consumer Finances (SCF) has detailed information about household asset holdings, including bank accounts, but has very limited information about household payment behavior. The SCF includes adoption information for only three noncash payment instruments: credit cards, debit cards, and checks. Check adoption is inferred from adoption of a checking account, without asking directly about check use. The SCF does not ask about payment use, with the exception of credit card charges. A direct comparison between the SCPC and the SCF is difficult, because the SCF is conducted every three years, with 2007 data being the latest available. However, the annual SCPC estimates of consumer adoption of payment instruments for 2006 (an earlier version of the survey implemented by the AARP) are qualitatively similar to the lower-frequency estimates from the SCF. The SCF does not include any measures of payment use or number of payments, except for credit card charges (an average of $889 per household per month in 2007).

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[4]An electronic payment made directly from a bank's online banking website, without providing a bank account number to a third party.

[5] A payment made by providing a bank account number to a third party, such as a utility company. The bank account number can be provided online, on paper forms, etc., without visiting a bank's website to initiate payments.

Table 1 shows the average rates of adoption of payment instruments in the 2009 SCPC by demographic cohort. Cash is held uniformly by all consumers, but adoption of noncash payment methods varies by demographic characteristic. Check adoption increases with age, with education, and with income. Credit card holding also increases with age, and even more dramatically with education and income. Debit card adoption is highest for the youngest consumers, but the rate does not decrease monotonically with age. Debit card adoption does, however, increase with education and with income, although not as markedly as credit card adoption does. Both electronic payment methods increase with education and with income. Table 2 shows the average use (measured as shares of all transactions) of payment instruments, conditional on adoption, also broken down by demographic cohort. Check and credit card use increases with age, and credit card use also increases with education and with income. In contrast to credit, debit card use drops with age, and to some extent with education as well (beyond some college). Electronic payment deductions—both bank account number payments and online banking bill payments—still constitute only a small fraction of all transactions.

3.2 Credit score comparison between SCPC and other data sets

The SCPC asks respondents to report their FICO scores. The survey provides six FICO ranges and asks respondents to select the range in which their FICO score falls, or to select "I don't know." The question is formulated as follows:

Please estimate your most recent **credit rating**, as measured by a FICO score:

1 Below 600
2 600-649
3 650-699
4 700-749
5 750-800
6 Above 800
7 I don't know

A substantial number of respondents did not know their score. Table 3 shows the average FICO scores, as well as the percentage of respondents reporting their FICO scores, by demographic cohort. Overall, 38 percent of the sample did not know their FICO score. The youngest respondents, those with the lowest level of education or the lowest household income were less likely to know their score than the rest of the sample. Consumers with high education or income were more likely to know their scores.[6] A much higher fraction of the unbanked did not know their score, compared to respondents with a bank account.

Because FICO scores were reported in ranges only, we use the mid-point for each range and assign that as a value for each respondent who reported his or her FICO score. The FICO score increases with respondents' age, education, and income. It is higher for married people than for those who are single or separated, and highest for those who are widowed, likely because the scores of older individuals are generally much higher than the scores of younger people. Asian and white consumers had higher scores than black or Latino consumers. We find a negative relationship between debit card use and credit score, and a positive relationship between credit card use and credit score, both in the 2008 SCPC (Figure 1A) and in the 2009 SCPC (Figure 1B). Below we apply econometric regression estimation to test whether the effect of FICO scores on debit and credit use holds when we control for other consumer and payment attributes.

The SCPC includes only self-reported FICO scores. For an external and objective validation, we compare those scores with credit scores included in the Equifax data.[7] Equifax, one of the three largest credit reporting agencies in the U.S., provided the Federal Reserve System with credit histories of a 5-percent sample of all individuals in the U.S. who have a credit history. This paper utilizes data on individuals observed in 2009 from that quarterly panel data. The credit score included in the Equifax data is not identical to FICO, but the Equifax credit score is objective rather than self reported (see Section 2.1 for an explanation of how credit scores are calculated), and is likely to be closely correlated with the FICO score. The Equifax data do not include demographic variables (except for age), and therefore we cannot calculate average credit scores by demographics for a direct comparison with the SCPC. However, we merge the Equifax data with the Census data by Census tracts. We then calculate a fraction of people in each Census tract that corresponds to each demographic cohort. For

[6] Below we address a potential sample selection bias by comparing credit and debit adoption and use for those consumers who report their FICO scores and those who do not report their FICO scores.
[7] The Equifax score is called "risk score," but we refer to it as credit score to avoid confusion.

example, for each Census tract we calculate a fraction of people who are white, a fraction of people who have high school education, a fraction of people who are between 55 and 64, and so on for each cohort. We then obtain correlation coefficients between a given fraction and the mean Equifax credit score for that Census tract. Those correlation coefficients are shown on the left side of Table 4. For example, the correlation coefficient between the fraction of whites in a Census tract and the average credit score for a Census tract is 0.37. The correlation coefficient between the fraction of blacks in a Census tract and the average credit score for a Census tract is -0.33. On the right side of the table, we show the corresponding correlation coefficients for the 2009 SCPC data. For example, in the SCPC, the correlation coefficient between being white and FICO score is 0.24. The correlation coefficient between being black and FICO score is -0.14. While it is not possible to compare the correlation coefficients exactly between the Equifax data and the SCPC, because the level of observation in the Equifax data is the Census tract and the level of observation in the SCPC is an individual respondent, the table indicates that the Equifax objective credit scores are consistent with the SCPC self-reported FICO scores.

4. What affects FICO scores?

Before examining the effects of credit score on consumer payment choice, we investigate what consumer characteristics affect each consumer's credit score in this section. Understanding the relationship between consumer characteristics and credit score is important in order to avoid misinterpreting the effects of credit score on consumer payment choice. Although we do not have access to the full set of variables that comprise the FICO score (see the list in the appendix), we do have data on several financial difficulty questions that feed into the FICO score, and we use them here.

We use an ordered probit model, with the credit score "index" as a dependent variable. As explained in the previous section, the survey respondents report their credit score in a range, such as below 600, between 600 and 650, and so on. We define the credit score index in the following way: the credit score index is 1 if the credit score is below 600; 2 if the credit score is between 600 and 649 (inclusive); 3 if between 650 and 699; 4 if between 700 and 749; 5 if between 750 and 800; and 6 if above 800. In addition to the consumer demographic characteristics, such as race, age, income, and education level, discussed in Subsection 3.2, the independent variables include other demographic characteristics, such as household size, marital status, work status, and access to new technologies. We also include credit and debit card status, such as whether rewards are provided, and whether the credit card(s) is (are) used for revolving. Most importantly, we include variables that indicate current and past financial difficulties experienced by the consumers.

The results of the ordered probit model are presented in Tables 5 and 6. For Table 5, all consumers who reported their credit score in the 2009 survey are included. Specification 1 uses only demographic characteristics as independent variables, specification 2 uses financial difficulty variables in addition to demographic characteristics, and specification 3 is the full specification, which adds card status (rewards and revolving) variables.

Demographic characteristics are highly correlated with credit score even after controlling for financial difficulty variables and card status. Older consumers and higher-income earners tend to have a higher credit score. Consumers with lower educational level than a college degree tend to have a lower credit score; however, after controlling for financial difficulty variables and card status, the effects of less than high school and high school dummies become insignificant. Contrary to the finding in Avery et al. (2010), black consumers tend to have a lower credit score. The discrepancy may arise from the fact that the SCPC contains some—but not all—financial difficulty variables that comprise the FICO score, and the possibility that race may serve as a proxy for the omitted variables. Consumers who were separated or divorced have a lower credit score than married consumers. Consumers with a larger household size are more likely to have a lower credit score. Having Internet access at home is positively correlated with credit score. Most of the results are consistent with the findings in Board of Governors of the Federal Reserve System (2007).

All financial difficulty variables are negatively correlated with credit score. Consumers who experienced overdraft from bank accounts, lost job, bankruptcy, foreclosure, or closure or freeze on a credit card account have a lower credit score. These variables indicate the consumer's financial difficulties in the past 12 months (prior to the survey date, the fourth quarter of 2009). Later in this section, we will examine whether the consumers' longer-term history of financial difficulties (in the past 10 years) rather than the more recent financial difficulties (in the past 12 months) has more influence on credit score.

Credit card status—whether the consumer receives rewards on credit cards and whether the consumer revolves credit cards—is highly correlated with credit score. Consumers with a reward credit card tend to have a higher credit score, and consumers who carry a balance on their credit cards tend to have a lower credit score. Debit card status—whether the consumer receives rewards on debit cards—is not correlated with a credit score.

For Table 6, only consumers who responded to both the 2008 and 2009 surveys (that is, only panel consumers) are included. The 2008 survey did not include all of the financial difficulty questions that were included in the 2009 survey (lost job, bankruptcy, foreclosure, and closure or freeze on credit card account were not included in the 2008 survey). Instead, the 2008 survey asked a single composite financial difficulty question about the past 10 years: “During the past 10 years, did you have any of these financial difficulties: bankruptcy, loan or credit card default, foreclosure, repossession, or account referred to a collection agency?” Table 6 compares the full specification (specification 3) and a specification that includes this composite history of financial difficulties instead of the separate questions (specification 3A).

A few observations are apparent. First, the results of specification 3 for both samples (all 2009 respondents in Table 5 and only panel respondents in Table 6) are quite similar. All financial difficulty variables except the bankruptcy dummy remain statistically significant and negatively correlated with a credit score (and the effect of bankruptcy is likely picked up by the foreclosure dummy). Second, the dummy indicating the consumer’s history of financial difficulties in the past 10 years has more explanatory power than four dummies that explain the current financial difficulties. The log likelihood of the specification that includes a dummy variable indicating financial difficulties in the past 10 years (3A), is -776, while the log likelihood of specification 3 is -792. This last result is surprising, because credit scores tend to discount older delinquencies—recent delinquencies are much more important. It is possible that the respondents had obtained the FICO score reported in the survey before they experienced financial difficulties in the past 12 months. As a result, a consumer’s credit score may reflect past financial difficulties to a greater extent than the consumer's more recent financial difficulties.

5. Adoption and use of payment cards

5.1 Adoption

In this paper, we model payment adoption (extensive margin) and payment use (intensive margin) by consumers for both credit cards and debit cards, to test whether FICO scores affect adoption and use of debit and credit cards when controlling for other observable characteristics. We estimate adoption and use simultaneously, using the Heckman (1976) selection model, which controls for potential selection bias in payment use. Our estimation technique is similar to that used in Schuh and Stavins (2010), but our analysis extends the previous paper in several ways. Even though the 2009 survey used in this paper is similar in content to the 2006 survey used in Schuh and Stavins (2010), there are several important improvements that allow for better estimation. In particular, in the 2006 survey, only adopters of payment instruments were asked about their perceptions of those payments, preventing us from including the perceptions in the payment adoption regressions. In contrast, the 2009 survey asked all the respondents about their perceptions of payment characteristics, allowing us to estimate the effect of perceptions on payment adoption and on payment use. The 2009 survey is much richer in information than the earlier survey. In particular, the FICO score is included in the 2009 survey but not in the 2006 survey. Also, the 2009 sample is larger than the earlier sample.

To the best of our knowledge, this is the first paper to include FICO scores in the Heckman regressions of payment behavior. First, we test whether credit scores affect consumer adoption and use of credit and debit cards. We then analyze whether the effects of credit scores imply supply-side or demand-side effects by testing various hypotheses in the following section.

To identify the Heckman 2-step model, exclusion restrictions are necessary. Namely, some of right-hand-side variables from the adoption stage (step 1) should be excluded for the use stage (step 2). In the first stage of the Heckman regressions, we estimate adoption of payment method *j* by consumer *i* using the following probit specification:

$$\Pr(A_{ij} = 1) = A(DEM_i, Y_i, Z_i, FICO_i, \overline{PERC_{ij}}) + \varepsilon_{ij}^{A}, \quad (1)$$

where

$$A_{ij} \equiv \begin{cases} 1 & \text{if consumer } i \text{ has adopted payment instrument } j \\ 0 & \text{otherwise} \end{cases},$$

j = credit cards or debit cards.

The independent variables are defined as follows: DEM_i is a vector of demographic variables that includes age, gender, race, education, marital status, a set of dummy variables for the geographic Census regions, a dummy variable indicating whether consumer *i* resides in an urban or rural area, and a dummy variable indicating whether the respondent was born abroad; Y_i is a set of income, net worth, and employment status variables; Z_i is an additional set of control variables excluded from the use stage, namely, number of children, homeownership status, and a dummy variable indicating whether the respondent ever defaulted or declared bankruptcy; $FICO_i$ is the self-reported FICO score for consumer *i*; $\overline{PERC_{ij}}$ is a vector of relative perceptions of payment *j* (as described in Section 5.3) for respondent *i*.

5.2 Use

In the second stage of the model, we estimate consumers' intensity of use, conditional on adoption. Although in reality the adoption decision can be made in conjunction with the use decision—for example, a person can sign up for online banking and then immediately pay a bill online—adoption is a necessary prerequisite for use, and therefore in our model the two decisions are made sequentially. In the case of credit card and debit card, consumers have to apply and receive a card before being able to use it, so our assumption about the sequence of events seems to be correct.

As in Schuh and Stavins (2010), we measure use of a given payment instrument by a consumer as a share of all transactions conducted by the consumer in a given month. Because a self-reported survey might suffer from poor recall issues, shares are more likely to be unbiased than the absolute number of transactions, as long as respondents consistently underreport across all the payment instruments they use. We estimate the use of each payment instrument *j* by consumer *i* as follows:

$$U_{ij} = U(DEM_i, Y_i, NUM_i, W_i, FICO_i, \overline{PERC}_{ij}, MR_i^{-1}) + \varepsilon_{ij}^{U} , \qquad (2)$$

where $U_{ij} \equiv \left(n_{ij} / N_i\right)$ is the ratio of the number of payments consumer *i* made using payment *j* over the total number of payments made by consumer *i* in a month, and $N_i \equiv \sum_j n_{ij}$ is the total number of payments made by consumer *i* using all payment instruments (even though here we estimate payment use for credit and debit cards only, the shares are computed based on all transactions conducted by consumer *i* with all payment instruments); DEM_i, Y_i, $FICO_i$, and $\overline{PERC}_{ij}$ are the same as in the adoption model; NUM_i is a set of dummy variables indicating how many other payment instruments consumer *i* has adopted (included to control for the consumer's choice set); a vector of relative perceptions of payment *j* by consumer *i*; W_i is a set of dummy variables indicating whether a consumer has a reward credit card and whether a consumer has ever used money order; MR_i^{-1} is the inverse Mills Ratio from the first-stage Heckman probit model to control for simultaneity of the payment adoption and use decisions. If the coefficient on the inverse Mills ratio is significant, there is likely to be a simultaneity bias of joint adoption and use decisions. In that case, the coefficients estimated in an OLS model are likely to be biased, and Heckman estimation is needed to correct the bias.

5.3 Relative perceptions

As mentioned in Section 2.2, previous studies have found that payment perceptions are significant factors affecting consumer payment behavior, even when controlling for demographic and income attributes. Therefore, we include consumers' perceptions of payments in the regressions.

Our set of perceptions includes cost (including fees and rewards), convenience, security, and acceptance. Consumers assessed the perceptions on an absolute scale of 1 to 5 for each payment instrument, where 1 was the least desirable (for example, least convenient or most expensive) and 5 was the most desirable (most convenient or cheapest). Because seven payment methods (cash, checks, credit cards, debit cards, bank account number payments, online banking bill payments, and stored-value cards) and four perceptions were included in the survey, we did not include all the measures in the baseline specification. Instead, we used those assessments to compute a perception measure relative to all other payment methods. We applied the following transformation:

$$PERC_{ki}(j, j') \equiv \log\left(\frac{PERC_{kij}}{PERC_{kij'}}\right),$$

where k indexes the perceptions, j is the payment instrument in question, and j' is every other payment instrument besides j. For our baseline specification, we constructed the average relative perception for each payment perception k:

$$\overline{PERC_{ki}}(j) \equiv \frac{1}{6}\sum_{j' \neq j} PERC_{ki}(j, j'),$$

for each payment instrument j for consumer i. For example, $\overline{PERC}$ for cost in the credit card equation is the average of the log ratios of credit card cost to the cost of each of the other payment instruments. Note that we constructed the perceptions relative to *all* payments, regardless of whether the consumer had adopted them.

We also included each consumer's cost rating of credit cards relative to debit cards (in the credit card adoption and use regressions) or debit cards relative to credit cards (in the debit card adoption and use regressions). Including this variable may potentially isolate one of the supply-side effects of FICO scores: If the cost of credit cards is higher for low-FICO-score consumers than for high-FICO score consumers, then the consumers' cost perception—especially of credit cards relative to debit cards or vice versa—may reflect that.

5.4 Results

Table 7 shows the results of the first-stage (adoption) regressions. The coefficient on the FICO score is positive and statistically significant in the credit card adoption regression, and negative and statistically significant in the debit card adoption regression, even when controlling for demographic, financial, and perception variables. The result confirms that higher-score (lower-risk) consumers were more likely to hold a credit card and less likely to hold a debit card.

The coefficients on other variables are consistent with the results from the previous studies. Older consumers were less likely to adopt a debit card. Consumers with a college degree were more likely to adopt a credit card than consumers without such a degree. Convenience is a significant determinant of card adoption, and cost is significant in the debit card adoption, both relative to the cost of credit cards and relative to all other payment methods.

As easily predicted, "bankruptcy (defaulted)" has a negative and statistically significant effect on credit card adoption, while it has little effect on debit card adoption. It is noteworthy that FICO score is statistically significant even after controlling for "bankruptcy (defaulted)" in the credit adoption regression.

Table 8 shows the results of the second-stage (use) regressions. Note that the inverse Mills ratio is statistically significant in both the credit card and the debit card regressions. This indicates that there is a simultaneity bias of joint adoption and use decisions, and that the two-step estimation taken here is more appropriate than a simple OLS estimation.

As in the adoption regressions, the coefficient on the FICO score is positive and statistically significant in the credit card use regression, and negative and statistically significant in the debit card use regression, even when controlling for age, education, income, and other variables. Higher-score consumers were not only more likely to hold a credit card and less likely to hold a debit card, but conditional on their holding each card, they were also more likely to use a credit card for transactions, and less likely to use a debit card.

Consistent with the previous studies, we find that consumers who got rewards on their credit cards had a higher share of credit card transactions, and a lower share of debit card transactions (Ching and Hayashi 2010 and Simon et al. 2010). In Section 4.1 we showed that consumers who get credit card rewards are likely to have higher FICO scores, but here we find that even when we hold the FICO score constant, receiving rewards affects payment use. Cost of credit cards affects the use of debit cards and vice versa. In addition, convenience affects the use of credit cards, and security affects the use of debit cards.

5.5 Reporting FICO and payment behavior

If not reporting a credit score is associated with significant differences in payment behavior, our results may potentially contain a sample selection bias. To test this, we estimated the adoption and use of debit and credit cards model described in equations (1) and (2) above, but instead of including the FICO score on the right-hand side, we included a dummy variable equal to 1 if the FICO score was missing, and equal to 0 if the FICO score was reported. Those with missing FICO scores had a lower rate of adoption of credit or debit (possibly because the unbanked were much more likely not to report their credit score). However, the coefficient is not statistically different from 0 in the debit or credit use regressions, indicating that there are no differences in card use between those who reported their FICO scores and those who did not.

5.6 Panel data analysis

To check for robustness of our results, we provide results based on the 2008–2009 panel data sample. The RAND Corporation doubled the SCPC sample in 2009 to more than 2,000 U.S. consumers, by administering the 2009 survey to all of the 2008 respondents and adding about 1,000 more respondents to that pool. As a result, about 40 percent of the 2009 SCPC respondents also took the 2008 SCPC. These continuing SCPC participants were used here to construct a panel.

The usable panel sample comprises 849 consumers. About 60 percent of the panel respondents remained in the same FICO score range in 2009 as in 2008. For 19 percent of the respondents, credit scores increased from one FICO cohort to another, and for 21 percent of respondents credit scores decreased from one FICO cohort to another. By comparison, a website creditkarma.com reports that between 2008 and 2009, credit scores went up for 37 percent of consumers, went down for 31 percent, and remained the same for 32 percent.[8] Since our data on FICO scores are specified in ranges rather than exact scores, the fraction of consumers for whom the score "remained the same" in our sample is much greater than in the national data.

We estimated the 2-step Heckman regression model for the panel sample. As Tables 9 and 10 show, the results for the 2008–2009 panel sample are qualitatively the same as for the 2009 sample. Consumers with higher FICO scores were more likely to adopt and use credit cards, and less likely to adopt and use debit cards, although the estimated effect of FICO on debit card use was not statistically significant.

6. Supply-side versus demand-side effects

In this section, we try to isolate supply-side and demand-side effects by testing various hypotheses.

6.1 Access to credit

As seen in the previous section, lower-FICO-score consumers were less likely to hold a credit card than higher-FICO-score consumers. Both supply- and demand-side factors could explain this. No credit card issuers may have offered credit cards to consumers with a lower FICO score. Even if lower-FICO-score consumers actively chose not to adopt a credit card, their reasons could have been related to supply-side factors, such as higher cost or insufficient credit limit offered. Or their reasons could have been related to their tastes and preferences, such as aversion to debt.

Our dataset (the 2009 SCPC) does not allow us to examine whether consumers actively chose not to adopt a credit card or whether they were not offered a credit card. We are not aware of any other sources providing evidence that credit card offers to lower-FICO-score consumers are more limited than those offered to higher-FICO-score individuals. However, as

[8] http://www.creditkarma.com/about/credit_karma_launches_credit_score_climate_report

we show later in this section, supply-side factors—such as higher costs of accessing credit for and/or lower credit limits offered to lower-FICO-score consumers—could at least partly explain their credit card holding behavior.

6.2 Cost of accessing credit

Both demand- and supply-side factors could affect the cost of accessing credit. It is possible that lower-FICO-score consumers are more price sensitive than higher-FICO-score consumers, and as a result, even if both types of consumers are charged the same fees and interest rates for credit cards, lower-FICO-score consumers are more likely to use alternatives to a credit card, such as a debit card, to avoid credit card fees and interest rates. However, if the cost of credit cards (including interest rates and other fees) is higher for low-FICO-score consumers than for high-FICO-score consumers, then the FICO effect on payment behavior is likely to be at least partly supply-side driven.

There is some evidence of supply-side effects. Although we do not have data on the exact interest rates or fees charged to each consumer, we do have each respondent's rating of the cost of each payment instrument. Under the cost difference scenario, consumers with low FICO scores should view credit cards as more costly than those with high FICO scores do.

We calculate the cost rating of credit cards relative to the cost rating of debit cards for every respondent. The average relative cost rating by FICO range is shown in Table 11, for both reward and non-reward cardholders. All respondents rate credit cards as more costly than debit cards (the difference is negative). Among credit card reward receivers, credit cards get progressively better (relatively less costly) as FICO score increases. In other words, lower-FICO people assess credit cards as more costly than higher-FICO people. The pattern is not as clear among non-reward consumers, suggesting that some of the difference in perceived cost among low-FICO-score and high-FICO-score people may arise from differences in rewards received, rather than from differences in fees or interest rates paid on credit card debt.

To test whether the relationship between cost rating and FICO score can be explained by other factors, we regress the cost rating of credit relative to debit on the FICO score, controlling for many exogenous variables: age, education, marital status, race, income, and net worth. We find that consumers who receive rewards on their credit cards rate the relative cost of credit cards more highly (less costly) than consumers without rewards, but that the rating increases with FICO score for all consumers (Figure 2). We therefore find that there are cost differences related to the FICO score, and thus confirm that supply-side factors are important in generating differences in payment behavior associated with credit scores.

Other studies confirm that credit score affects the cost of credit. Han, Keys, and Li (2011) analyzed credit card mailings and found that the higher the credit score (measured as the VantageScore developed by VantageScore Solutions LLC, a joint venture of the three consumer credit reporting agencies), the higher the probability of having an offer of a credit card, of getting pre-approved for a credit card, receiving higher credit limits, lower interest rates, rewards, and no annual fees, even when controlling for whether the consumer had filed for bankruptcy. Cohen-Cole, Duygan-Bump, and Montoriol-Garriga (2009) also find a negative relationship between the cost of credit and credit scores.

6.3 Credit limits and credit utilization

Another supply-side restriction is setting credit limits on credit cards. If issuers provide lower credit limits to lower-FICO-score consumers and—as a result—lower-FICO-score consumers cannot make as many credit card transactions as they wish, their payment use is supply-side driven. However, demand-side factors may also play a role. It is possible that lower-FICO-score consumers are more likely to have experienced various demand shocks, such as job loss, unexpected medical expenses, etc., and to smooth out their consumption they may have revolved on credit cards. Thus, even if credit card issuers provide the same credit limits to low- and high-FICO-score consumers relative to their income or net worth, lower-FICO-score consumers may have used up more of their credit limits to meet their liquidity needs. As a consequence, the remaining credit limits may not be sufficient to make as many credit transactions as they want. Or lower-FICO-score consumers may want to retain their available credit limit in case they need liquidity in the future, even if they have not experienced any demand shocks.

We obtain mixed evidence of supply- and demand-side effects. First, we use the Equifax data to obtain each consumer's total credit limit, summed up over all his or her cards, as well as the average credit limit per card. For both 2008 and 2009, we find a positive correlation between credit limit and credit score (Table 12), and even a stronger positive correlation between the average credit limit per card and credit score, indicating that consumers with a lower credit score were provided lower credit limits than those with a higher credit score. Because the Equifax data do not include information on consumers' income and net worth, whether consumers with lower credit scores are provided lower credit limits *relative to* their income or net worth is not observable. Nevertheless, we cannot reject the possibility of supply-side effects on consumer payment choice—the possibility that more frequent use of debit cards among low-credit-score consumers is due to lower credit limits.

Second, based on the same Equifax data we find a negative correlation between credit utilization (percent of credit limit used) and credit score that is even stronger than the correlation between credit limit and credit score: low-score consumers have much higher credit utilization rates than those with higher scores. The causality may run the other way: high credit card utilization rates may cause low scores. Nevertheless, the finding—consumers with higher credit utilization rates used debit cards more frequently—could imply credit limitations for consumers with a lower credit score, due to lower credit limits, greater liquidity needs in the past, or both.

Another finding from the Equifax data is that the amount of credit card debt—measured here as percentage of credit limit that is past due—is also negatively correlated with the credit score, or low-score consumers carry more credit card debt. However, as the SCPC data show, the relationship between credit score and credit card debt is not monotonic: both the probability of revolving and the amount of debt carried on credit cards drops only above a FICO score of 750 (see Table 13). For consumers with FICO scores below 750, there is no clear relationship between revolving and credit scores. While the higher rates of adoption and use of debit cards among lower-FICO-score consumers could also be caused by behavioral factors—they may turn to debit cards as a self-restraining tool to help them lower their debt (Sprenger and Stavins 2010), we cannot reject the possibility that the relationship is caused by supply-side credit constraints.

6.4 Lost job and credit card use

As discussed above, consumers who experience a demand shock may use credit cards to smooth out their consumptions. Consumers who recently lost their job might need to increase their reliance on credit cards. If a consumer lost his job recently, credit score agencies and issuing banks may lack that information (if a consumer lost his job after applying for any loans or credit cards). Therefore, we can test whether losing a job during the previous 12 months explains changes in payment card use.

Survey results do not support our prior: We find that even when controlling for demographic and financial variables, consumers who had lost their job in the previous 12 months had a higher share of debit card transactions relative to the rest of the sample, and there was no significant effect on the use of credit cards. Instead of relying more heavily on their credit cards, recently laid-off workers used debit cards more frequently. This may imply that consumers do not necessarily increase the credit card revolving amount due to a demand shock, such as a job loss. The payment behavior of those who lost their jobs recently could be explained by another demand-side factor, such as avoiding the possibility of going into debt. However, supply-side factors could also lead to such behavior. Consumers may expect that their credit limits will be lowered as a result of losing their jobs and that the possibility of going into debt will be even higher unless they change their payment behavior.

6.5 Revolving and debit card use

Several previous studies of consumer payment choice have found that revolving on credit cards and debit card use are highly correlated.[9] This relationship could be explained by demand-side factors, such as cardholders who revolve their credit card debt turning to debit cards in order to improve their budgeting and control their spending (Sprenger and Stavins 2010), or supply-side factors discussed above, such as higher cost, or insufficient credit limit, or

[9] See, for example, Zinman (2009), Sprenger and Stavins (2010).

both. Because revolvers have lower FICO scores other things being equal, it is possible that the effect of FICO score on debit card use reflects the effect of revolving. We test this hypothesis by including in the card use regression a dummy variable equal to 1 if a respondent revolves his credit card debt.

While including the revolving dummy makes the FICO score insignificant in the credit card use regression, it does not eliminate the effect of FICO score on debit card use. This shows that while revolving may explain credit card use, it does not fully explain debit card use. Because the sample in the debit card use regression also includes credit card non-adopters, we further control for credit card adoption. Controlling for credit card adoption makes the FICO score insignificant in the debit card use regression, while both the revolving and credit card adoption dummies are significant (Table 14). Among debit card adopters, consumers who also adopted a credit card used a debit card less frequently than consumers who did not adopt a credit card, and consumers who revolved on credit cards used a debit card more frequently than consumers who adopted a credit card but did not revolve on the card. Thus, some of the negative relationship between FICO score and debit card use likely reflects the effects of revolving and of credit card (non-) adoption on debit card use.

6.6 Regional differences associated with supply-side related variation

Regional differences could be associated with supply-side-related variation in the terms of banking or credit, such as interest rates on deposit accounts or on credit card loans, potentially affecting consumers' payment behavior. Merchant acceptance of credit and debit cards may also vary by region, which likely limits payment methods available to consumers. Although it is possible that consumer preferences for payment methods vary by region, the regional differences likely underscore the importance of supply-side factors and network effects.[10] We test whether the effect of credit score on payment behavior disappears with regional or state fixed effects.[11]

[10] A few previous studies, such as Stavins (2001), Hayashi and Klee (2003), and Borzekowski et al. (2008), found that consumer payment choice varies by region.

[11] In this part of the analysis, we did not control for revolving or credit card adoption.

Our results are inconclusive. When we include nine Census region fixed effects, the estimated coefficients on FICO score remain unchanged, indicating that regional differences cannot explain the effect of FICO score on payment behavior. When we include state fixed effects, all the FICO coefficients remain the same, but the effect of FICO score on credit card use is no longer statistically significant (the results are available from the authors).

7. Conclusions

Using a new, representative survey of U.S. consumers conducted in 2008 and 2009, we estimate the effect of self-reported credit scores on consumer payment behavior. Anecdotal evidence has shown that consumers with higher credit scores are less likely to use debit cards and more likely to use credit cards. We estimate the effect of credit scores on both adoption and use of debit and credit, and find that even when controlling for several variables that affect payment behavior, higher credit score indicates a higher probability of holding a credit card, and a lower probability of holding a debit card. Moreover, conditional on adoption of either credit or debit, cardholders with higher FICO scores were found to use credit cards for a higher share of their payments, and use debit cards less, controlling for several socio-demographic attributes. The results are robust to several specifications, including a regression using panel data of consumers who participated in both the 2008 and 2009 surveys, to isolate consumer-specific attributes from time-varying effects.

A recently implemented rule on debit card interchange fees has reduced the interchange fees charged on some debit card transactions, causing some large banks to announce fees for debit card use to recover the banks' lost interchange fee revenues. Although the banks later retracted that policy, it remains to be seen whether banks try to recover their lost revenues in the future through means that affect the cost to consumers of using debit cards. Because consumers with low FICO scores use debit cards more intensively than those with high FICO scores, they are likely to be especially adversely affected if their banks raise debit card fees. In other words, younger, less educated, and lower-income consumers are more likely to be adversely affected than other socio-demographic groups, especially if their access to alternative means of payment is restricted.

In this research, we have tested various hypotheses related to the cause of the relationship between credit scores and payment behavior and have found support for supply-side factors related to credit constraints on consumers with low credit scores. The next phase of this research will focus on further separating demand-side and supply-side factors that influence the effect of credit scores on payment behavior.

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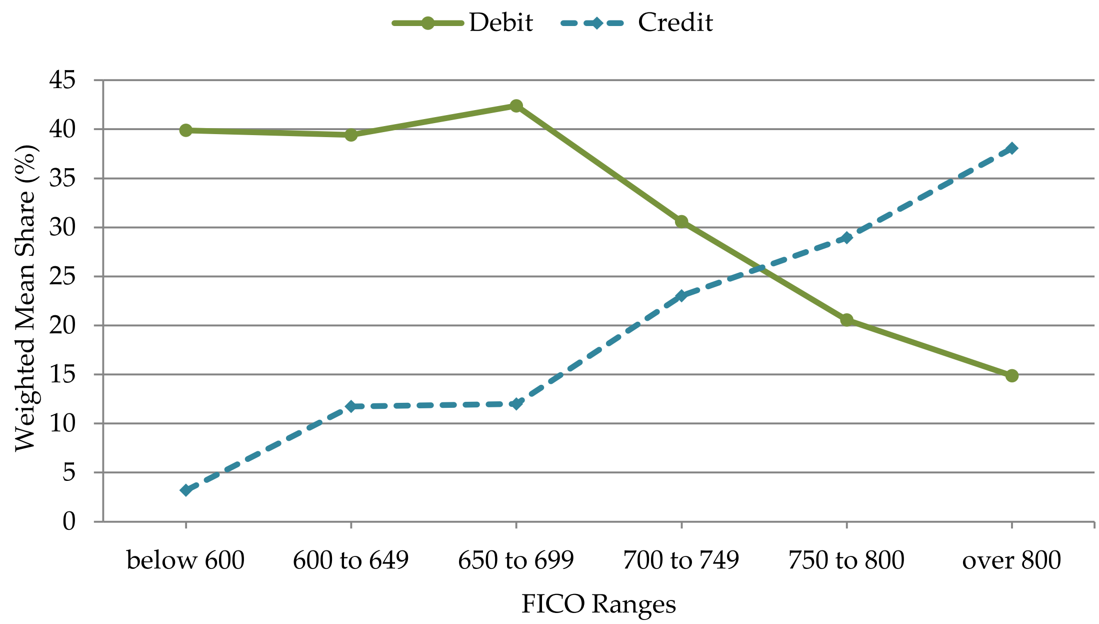
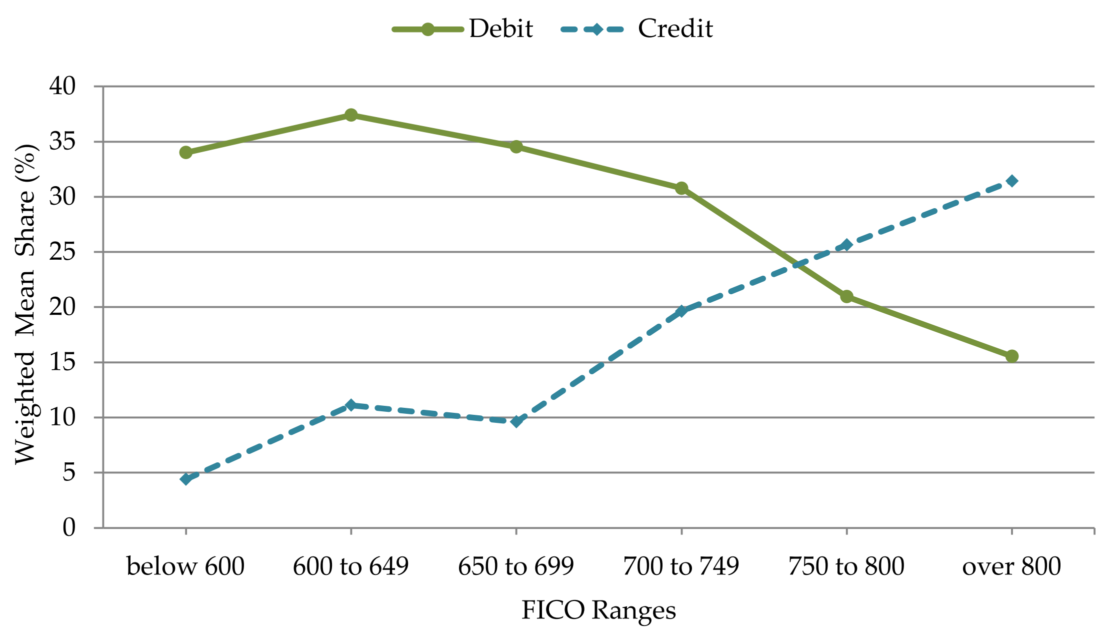
Figure 1A: FICO score and card use (2008)



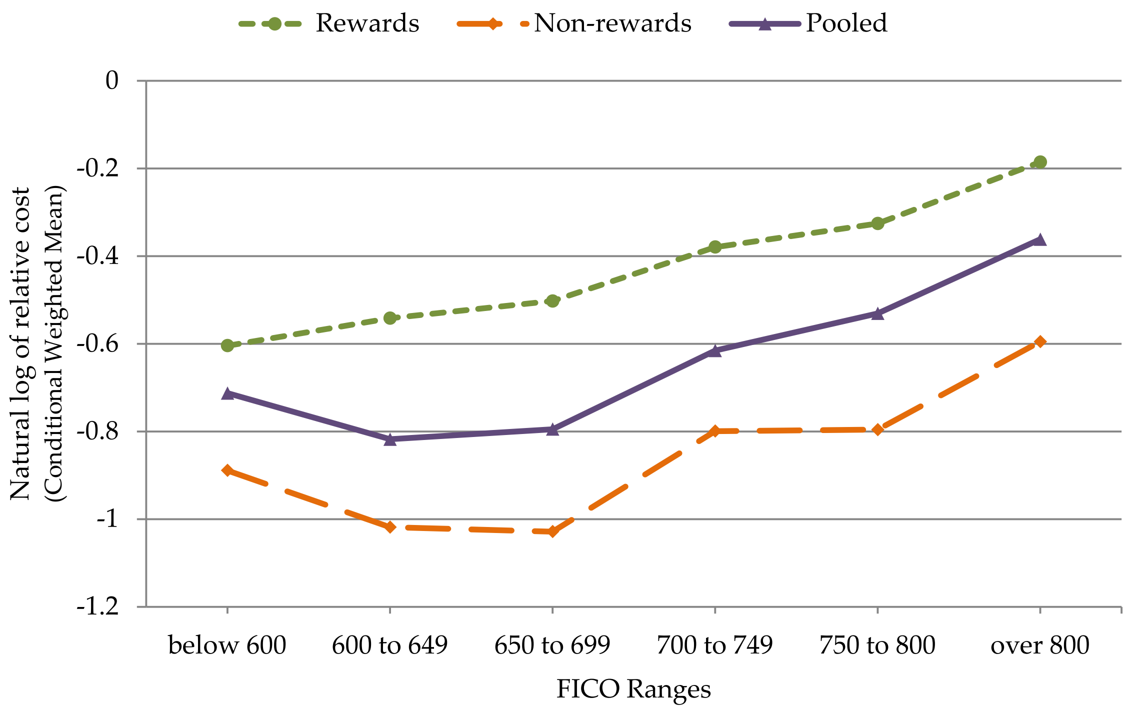
Source: 2009 Survey of Consumer Payment Choice

Figure 1B: FICO score and card use (2009)



Source: 2009 Survey of Consumer Payment Choice

Figure 2: Rating of Cost of Credit Cards Relative to Cost of Debit Cards, by FICO Ranges



Source: 2009 Survey of Consumer Payment Choice

Note: Relationship between cost rating and FICO, after controlling for age, education, marital status, race, income, and net worth.

Table 1: Percentage of Adopters of Payment Instruments by Demographic Attributes

	Cash	Check	Credit Card	Debit Card	BANP	OBBP	Prepaid Card	Money Order
Total	**100**	**93**	**85**	**78**	**62**	**53**	**32**	**20**
Age								
Under 25	100	67	47	86	44	50	39	28
25 to 34	100	69	54	72	55	50	33	36
35 to 44	99	85	77	84	61	62	35	27
45 to 54	100	95	78	81	65	47	34	27
55 to 64	100	94	84	74	57	48	26	19
Over 65	100	98	89	66	51	35	27	12
Education								
Less than high school	100	69	35	58	34	26	32	50
High school	100	80	63	73	50	40	30	24
Some college	99	86	73	85	60	52	36	28
College	100	96	90	82	64	63	30	21
Graduate School	100	98	98	74	72	62	35	16
Gender								
Male	100	83	70	77	53	50	33	23
Female	100	87	75	78	59	47	32	27
Status								
Married	100	90	78	78	61	53	30	21
Separated	100	85	71	77	56	47	34	31
Widowed	100	94	80	73	53	35	29	13
Single	100	68	52	75	44	41	39	36
Ethnicity								
Latino	100	74	55	75	54	56	32	34
Non-latino	100	87	75	77	57	48	32	24
Race								
White	100	90	77	77	57	49	32	18
Black	100	67	49	76	52	35	34	57
Asian	100	94	91	80	63	60	44	22
American Indian	87	62	76	92	62	53	59	27
Other Race	100	70	57	76	54	56	22	38
Income								
Less than $25,000	100	63	42	66	36	31	37	45
$25,000 to $49,000	100	84	68	79	55	44	34	27
$50,000 to $74,000	100	92	78	79	63	53	26	20
$75000 to $99,000	100	96	94	84	62	61	33	9
Greater than $100,000	100	99	96	81	71	70	33	16
$N =$ 2,169								

Notes: BANP - Bank account number payment; OBBP - Online banking bill payment

Source: 2009 Survey of Consumer Payment Choice

Table 2: Use of Payment Instruments Among Adopters (% share of all transactions) by Demographic Attributes

	Cash	Check	Credit Card	Debit Card	BANP	OBBP	Prepaid Card
Total	**23**	**17**	**21**	**25**	**6**	**6**	**1**
Age							
Under 25	37	4	9	37	6	3	2
25 to 34	39	6	9	30	4	5	3
35 to 44	26	12	17	29	6	7	1
45 to 54	24	17	15	29	7	6	1
55 to 64	23	21	19	24	5	5	1
Over 65	24	23	25	16	6	4	1
Education							
Less then high school	37	12	4	26	3	3	3
High school	34	14	12	28	6	4	1
Some college	27	13	13	32	6	6	2
College	20	16	23	26	6	7	1
Graduate School	18	16	33	18	7	7	1
Gender							
Male	31	13	16	27	6	5	1
Female	26	16	16	28	6	5	1
Status							
Married	25	15	18	28	6	6	1
Separated	27	18	13	28	6	5	2
Widowed	26	23	19	20	6	4	1
Single	41	7	11	28	6	2	3
Ethnicity							
Latino	39	7	9	28	6	6	3
Non-latino	27	15	17	27	6	5	1
Race							
White	25	16	17	28	6	5	1
Black	39	10	7	27	4	4	2
Asian	22	14	35	18	6	6	0
American Indian	36	8	3	27	12	9	8
Other Race	43	5	10	26	6	5	2
Income							
Less than $25,000	41	13	8	23	3	3	4
$25,000 to $49,000	32	15	12	29	5	4	1
$50,000 to $74,000	22	15	17	30	8	7	1
$75000 to $99,000	19	14	23	29	6	7	0
Greater than $100,000	21	13	28	23	6	8	1

N = 2,169

Notes: BANP - Bank account number payment; OBBP - Online banking bill payment

Source: 2009 Survey of Consumer Payment Choice

Table 3: FICO Scores and Percentage Reporting by Demographic Attributes

	Average FICO Score	Percent Reporting
Total	**694**	**62**
Age		
Under 25	614	38
25 to 34	632	62
35 to 44	679	75
45 to 54	710	64
55 to 64	726	70
Over 65	775	56
Education		
Less than high school	596	39
High school	682	58
Some college	673	62
College	735	70
Graduate School	744	76
Gender		
Male	695	62
Female	693	62
Status		
Married	703	67
Separated	674	64
Widowed	763	59
Single	643	43
Ethnicity		
Latino	622	57
Non-latino	705	63
Race		
White	709	64
Black	645	50
Asian	742	60
American Indian	616	89
Other Race	614	60
Income		
Less than $25,000	609	43
$25,000 to $49,000	671	58
$50,000 to $74,000	706	66
$75000 to $99,000	736	75
Greater than $100,000	752	78

N = 2,169

Source: 2009 Survey of Consumer Payment Choice

Table 4: Correlations Between Credit Scores and Demographic Attributes

2009 Equifax			2009 SCPC		
Median Credit Score		Correlation Coefficient	Self-Reported FICO Score		Correlation Coefficient
Fraction of Race	*Whites*	0.37	Indicator for Race	*White*	0.24
	Blacks	-0.33		*Black*	-0.14
	Asian/Pacific Islanders	0.06		*Asian*	0.08
	Native American/Others	-0.26		*Native American/Others*	-0.24
Fraction of Latinos		-0.24	Indicator for Latino		-0.25
Fraction of Males		0.15	Indicator for Male		0.01
Fraction of Age Group	*Under 25*	-0.26	Indicator for Age Group	*Under 25*	-0.20
	25 to 34	-0.27		*25 to 34*	-0.26
	35 to 44	0.04		*35 to 44*	-0.07
	45 to 54	0.25		*45 to 54*	0.07
	55 to 64	0.22		*55 to 64*	0.13
	65 to 74	0.16		*65 to 74*	0.25
	Over 75	0.14		*Over 75*	0.15
Fraction of Household Incomes	*Under 25K*	-0.32	Indicator for Household Income Level	*Under 25K*	-0.29
	25K to 49K	-0.32		*25K to 49K*	-0.14
	50K to 75K	0.05		*50K to 75K*	0.06
	75K to 99K	0.28		*75K to 99K*	0.16
	100K to 124K	0.34		*100K to 124K*	0.13
	Over 125K	0.35		*Over 125K*	0.16
Fraction of Individuals with Education	*Less than high school*	-0.34	Indicator for Education Level	*Less than high school*	-0.17
	High school	-0.16		*High school*	-0.08
	Some College	-0.03		*Some College*	-0.11
	College	0.36		*College*	0.18
	Post-graduate degree	0.35		*Post-graduate degree*	0.16

Notes:

The level of observation in the Equifax correlations is census tract while the level of observation in the SCPC is individual respondent.

The SCPC self-reported score is reported within ranges. For these correlations the self-reported range has been replaced with the middle value of the reported range.

The median credit score by census tract ranged from 312 to 838 while the 2009 SCPC self-reported score ranged from 475 to 825.

Sources: Equifax Credit Bureau Data, 2009 Survey of Consumer Payment Choice

Table 5: Ordered Probit Model of Credit Score : 2009 Sample

	Specification					
Variable	1		2		3	
Age	0.015***	(0.00)	0.013***	(0.00)	0.013***	(0.00)
Income group	0.200***	(0.02)	0.161***	(0.02)	0.126***	(0.02)
Male	-0.005	(0.06)	-0.001	(0.06)	0.009	(0.06)
Less than high school	-0.708***	(0.28)	-0.724***	(0.28)	-0.520*	(0.28)
High school	-0.209**	(0.10)	-0.217**	(0.10)	-0.159	(0.10)
Some college	-0.384***	(0.07)	-0.328***	(0.08)	-0.249***	(0.08)
Graduate school	-0.028	(0.08)	-0.003	(0.08)	-0.044	(0.08)
Black	-0.668***	(0.12)	-0.506***	(0.12)	-0.489***	(0.12)
Asian	0.044	(0.22)	0.154	(0.22)	-0.002	(0.23)
Other races	-0.167	(0.18)	-0.256	(0.19)	-0.227	(0.19)
Latino	-0.364**	(0.16)	-0.221	(0.16)	-0.258	(0.16)
Immigrant	-0.041	(0.13)	-0.081	(0.13)	-0.040	(0.13)
Single	-0.005	(0.11)	0.005	(0.11)	-0.011	(0.11)
Widowed	0.146	(0.15)	0.200	(0.15)	0.205	(0.15)
Separated	-0.298***	(0.09)	-0.266***	(0.09)	-0.250***	(0.09)
Household size	-0.117***	(0.03)	-0.080***	(0.03)	-0.066***	(0.03)
Employed	0.057	(0.09)	0.058	(0.09)	0.068	(0.09)
Retired	0.318***	(0.12)	0.197*	(0.12)	0.119	(0.12)
Cell phone	0.019	(0.12)	0.182	(0.12)	0.163	(0.12)
Internet at home	0.506***	(0.17)	0.394**	(0.18)	0.389**	(0.18)
Internet at work	0.014	(0.07)	-0.018	(0.07)	-0.018	(0.07)
Credit card reward					0.706***	(0.07)
Debit card reward					-0.070	(0.07)
Credit card revolving					-0.348***	(0.06)
Overdraft			-0.649***	(0.07)	-0.561***	(0.07)
Lost job			-0.326***	(0.08)	-0.316***	(0.08)
Bankruptcy			-0.716***	(0.24)	-0.704***	(0.24)
Foreclosure			-0.582**	(0.26)	-0.591**	(0.27)
Closure or freeze on credit card account			-0.855***	(0.10)	-0.823***	(0.10)
Log likelihood	-2162.1		-2030.2		-1969.5	

Notes: The number of observations is 1410. Credit score is grouped as follows: 1 - Below 600; 2 - 600-649; 3 - 650-699; 4 - 700-749; 5 - 750-800; 6 - Above 800. Age and Income group are continuous, and the other variables are dummy. Default education level is College. Default race is White. Default marital status is Married. Definition of Income group: 1 - if household income is less than $25,000; 2 - $25,000-$49,999; 3 - $50,000-$74,999; 4 - $75,000-$99,999; 5 - $100,000-$124,999; 6 - greater than $125,000.

***,**,*, : Significant at the .01, .05, and .10 level, respectively.

Source: 2009 Survey of Consumer Payment Choice

Table 6: Ordered Probit Model of Credit Score: 2008 - 2009 Panel Sample

	Specification			
Variable	3		3A	
Age	0.011**	(0.005)	0.007	(0.005)
Income group	0.139***	(0.039)	0.140***	(0.038)
Male	-0.152	(0.095)	-0.202**	(0.095)
Less than high school	-1.523***	(0.568)	-1.670***	(0.602)
High school	-0.015	(0.162)	0.124	(0.163)
Some college	-0.284**	(0.117)	-0.288**	(0.117)
Graduate school	-0.066	(0.127)	-0.093	(0.127)
Black	-0.639***	(0.203)	-0.572***	(0.204)
Asian	-0.032	(0.298)	-0.186	(0.295)
Other races	-0.235	(0.427)	-0.376	(0.412)
Latino	-0.171	(0.275)	-0.071	(0.273)
Immigrant	0.016	(0.195)	0.084	(0.196)
Single	-0.203	(0.172)	-0.197	(0.171)
Widowed	0.045	(0.232)	0.147	(0.233)
Seperated	-0.380***	(0.145)	-0.177	(0.147)
Household size	-0.047	(0.039)	-0.042	(0.040)
Employed	0.063	(0.169)	0.227	(0.168)
Retired	0.173	(0.207)	0.386*	(0.206)
Cell phone	-0.043	(0.189)	-0.239	(0.190)
Internet at home	-0.119	(0.280)	0.106	(0.279)
Internet at work	-0.023	(0.110)	-0.005	(0.110)
Credit card reward	0.723***	(0.112)	0.585***	(0.112)
Debit card reward	-0.027	(0.109)	0.007	(0.109)
Credit card revolving	-0.290***	(0.099)	-0.336***	(0.097)
Overdraft	-0.678***	(0.111)	-0.635***	(0.111)
Lost Job	-0.348***	(0.131)		
Bankruptcy	-0.751	(0.508)		
Foreclosure	-1.740***	(0.630)		
Closure or freeze on credit card account	-0.887***	(0.161)		
Financial difficulties in the past 10 years			-1.276***	(0.139)
Log likelihood	-791.9		-775.3	

Notes: The number of observations is 581. Credit score is grouped as follows: 1 - Below 600; 2 - 600-649; 3 - 650-699; 4 - 700-749; 5 - 750-800; 6 - Above 800. Age and Income group are continuous, and the other variables are dummy. Default education level is College. Default race is White. Default marital status is Married. Definition of Income group: 1 - if household income is less than $25,000; 2 - $25,000-$49,999; 3 - $50,000-$74,999; 4 - $75,000-$99,999; 5 - $100,000-$124,999; 6 - greater than $125,000. ***,**,*, : Significant at the .01, .05, and .10 level, respectively.

Source: 2008 and 2009 Survey of Consumer Payment Choice

Table 7: Regression Results for Payment Instrument Adoption (Heckman 1st Stage)

		Credit Cards	Debit Cards
	FICO Score	0.38 ***	-0.08 **
Age	Under 25	-0.37	0.84
	25 to 34	-0.20	0.15
	45 to 54	0.19	-0.15
	55 to 64	0.08	-0.62 ***
	Over 65	0.73	-0.58 **
Education	Less then high school	-1.22 **	-0.32
	High school	-0.80 ***	-0.11
	Some college	-0.52 ***	0.16
	Graduate School	-0.01	-0.06
Marital Status	Separated	-0.27	0.22
	Widowed	-0.16	0.02
	Single	0.00	-0.25
	Household Size	-0.01	-0.01
	Latino	0.21	-0.63 **
Race	Black	-0.23	0.09
	Asian	-0.79	-0.16
	American Indian & Other Race	-0.37	0.46
	Male	-0.11	-0.14
Income	Less than $25,000	-0.33	-0.37 **
	$25,000 to $49,000	0.00	0.12
	$75000 to $99,000	0.13	0.09
	Greater than $100,000	0.21	0.25 *
	Not Highest Income in Household	-0.04	-0.05
Net Worth	Less than $50,000	0.05	0.25 *
	$50,000 to $100,000	-0.15	-0.06
	$250,000 to $500,000	0.12	-0.07
	Greater than $500,000	0.23	-0.13
	Missing Net Worth	-0.74	0.05
Employment Status	Retired	0.14	0.24
	Not employed	-0.44 **	0.19
	Born Abroad	0.35	0.02
	Number of Children	-0.10	-0.05
	Owns Home	0.02	0.31 **
	Defaulted	-1.56 ***	-0.08
Relative Payment Characteristics	Cost Relative to Credit/Debit	0.17	0.31 ***
	Cost Relative to Other Payments	-0.08	0.63 ***
	Security	-0.02	0.10
	Acceptance	0.66 **	0.19
	Convenience	0.49 *	0.79 ***
	Number of Observations	1,313	1,317
	McFadden Adjusted R-square	0.33	0.11

Source: 2009 Survey of Consumer Payment Choice

Table 8: Regression Results for Payment Instrument Use (Heckman 2nd Stage)

		Credit Cards	Debit Cards
	FICO Score	0.02 **	-0.02 **
Age	Under 25	-0.02	0.06
	25 to 34	0.01	0.04
	45 to 54	0.01	0.00
	55 to 64	0.02	0.04
	Over 65	0.06 *	0.03
Education	Less then high school	0.01	-0.05
	High school	-0.04 *	0.02
	Some college	-0.05 ***	0.02
	Graduate School	0.03 *	-0.02
Marital Status	Separated	-0.03	0.02
	Widowed	0.01	0.02
	Single	0.06 **	0.01
	Household Size	0.00	-0.01
	Latino	0.00	0.03
Race	Black	-0.07 ***	-0.01
	Asian	0.09 **	-0.04
	American Indian & Other Race	-0.05	0.02
	Male	0.02	-0.03 **
Income	Less than $25,000	-0.01	-0.04
	$25,000 to $49,000	-0.01	-0.03
	$75000 to $99,000	0.02	0.03
	Greater than $100,000	0.00	-0.02
	Not Highest Income in Household	0.01	0.01
Net Worth	Less than $50,000	-0.03 *	0.00
	$50,000 to $100,000	-0.03	0.06 **
	$250,000 to $500,000	0.03 *	-0.05 **
	Greater than $500,000	0.09 ***	-0.09 ***
	Missing Net Worth	-0.06	0.06
Employment Status	Retired	0.03	-0.06 *
	Not employed	0.00	-0.01
	Born Abroad	0.06 **	-0.04
	Has Rewards Credit Card	0.09 ***	-0.10 ***
	Used Money Order	-0.01	-0.01
Number of Other Payment Instruments Adopted	Two	0.25 **	-0.38 ***
	Three	0.01	0.03
	Five	-0.01	-0.02
	Six	-0.02	-0.03
	Seven	-0.02	-0.05 *
Relative Payment Characteristics	Cost Relative to Credit/Debit	0.10 ***	0.03 *
	Cost Relative to Other Payments	-0.01	-0.02
	Security	0.01	0.04 **
	Acceptance	0.01	0.04
	Convenience	0.20 ***	0.04
	Inverse Mills Ratio	0.13 ***	-0.22 **
	Number of Observations	1,176	1,060
	Adjusted R-square	0.30	0.30

Source: 2009 Survey of Consumer Payment Choice

Table 9: Panel Regression Results for Payment Instrument Adoption (Heckman 1st Stage)

		Credit Cards	Debit Cards
	FICO Score	0.44 ***	-0.13 ***
Age	Under 35 [a]	-0.16	-0.22
	45 to 54	0.04	-0.18
	Over 55	-0.63 **	-0.63 ***
Education	Less then high school	-1.28 **	-0.97 *
	High school	-0.41	-0.12
	Some college	-0.32	0.23
	Graduate School	0.62 *	-0.12
	Married	0.47 **	0.15
	Household Size	-0.08	-0.13 *
	Latino	0.52	-0.44
Race	Black	-0.13	-0.18
	American Indian & Other Race	-0.27	-0.16
	Male	-0.18	0.01
Income	Less than $25,000	-0.54 *	-0.71 ***
	$25,000 to $49,000	-0.23	-0.03
	$75000 to $99,000	-0.13	0.00
	Greater than $100,000	0.09	0.27
	Not Highest Income in Household	-0.32 *	0.02
Net Worth	Less than $50,000	-0.05	0.12
	$50,000 to $100,000	-0.28	-0.19
	$250,000 to $500,000	0.22	-0.13
	Greater than $500,000	0.59	-0.38 **
	Missing Net Worth	0.27	-0.30
Employment Status	Retired	0.89 **	0.26
	Not employed	-0.23	0.28
	Born Abroad	0.84 *	-0.18
	Number of Children	-0.14	0.24 **
	Owns Home	-0.29	0.20
	Defaulted	-0.39	0.48 *
	Year 2009 (=1)	-0.35 *	-0.24 **
Relative Payment Characteristics	Cost Relative to Credit/Debit	0.33	0.00
	Cost Relative to Other Payments	-0.26	0.62 ***
	Security	0.06	0.35 **
	Acceptance	-0.11	0.32
	Convenience	0.70 **	0.84 ***
	Number of Observations	1,060	1,061
	McFadden Adjusted R-square	0.35	0.14

Source: 2008 and 2009 Survey of Consumer Payment Choice (SCPC)

[a] The age categories "Under 25" and "25 to 34" have been compressed since "Under 25" perfectly predicts adoption.

Table 10: Panel Regression Results for Payment Instrument Use (Heckman 2nd Stage)

		Credit Cards	Debit Cards
	FICO Score	0.02 **	-0.01
Age	Under 25	-0.06	0.13 ***
	25 to 34	0.01	0.06 **
	45 to 54	0.00	0.00
	55 to 64	0.03	0.05 *
	Over 65	0.02	0.06
Education	Less then high school	-0.08	0.11
	High school	0.00	0.02
	Some college	-0.03 *	0.04 **
	Graduate School	0.06 ***	-0.05 ***
Marital Status	Separated	-0.04	0.05 **
	Widowed	0.05	-0.01
	Single	0.05 *	0.02
	Household Size	0.00	0.00
	Latino	0.03	-0.05
Race	Black	-0.08 **	0.01
	Asian	0.07 *	-0.11 **
	American Indian & Other Race	-0.03	0.06
	Male	0.02	-0.04 ***
Income	Less than $25,000	-0.02	-0.04
	$25,000 to $49,000	-0.02	-0.03
	$75000 to $99,000	-0.02	0.04 *
	Greater than $100,000	0.03 *	-0.02
	Not Highest Income in Household	-0.01	0.01
Net Worth	Less than $50,000	-0.02	0.01
	$50,000 to $100,000	-0.02	0.03
	$250,000 to $500,000	-0.02	-0.02
	Greater than $500,000	0.05 **	-0.08 ***
	Missing Net Worth	0.07	0.09
Employment Status	Retired	0.06 **	-0.09 ***
	Not employed	0.06 **	-0.01
	Born Abroad	0.02	0.03
	Has Rewards Credit Card	0.11 ***	-0.07 ***
	Used Money Order	-0.01	-0.02
	Year 2009 (=1)	-0.02	-0.03
Number of Other Payment Instruments Adopted	Two	-0.04	-0.40 *
	Three	-0.06 *	0.13 **
	Five	-0.01	-0.01
	Six	-0.03	0.01
Relative Payment Characteristics	Cost Relative to Credit/Debit	0.07 **	0.06 ***
	Cost Relative to Other Payments	0.01	0.04
	Security	0.00	0.05 ***
	Acceptance	0.02	0.04
	Convenience	0.15 ***	0.08 **
	Inverse Mills Ratio	0.01	-0.07
	Number of Observations	963	883
	Adjusted R-square	0.29	0.28

Source: 2008 and 2009 Survey of Consumer Payment Choice (SCPC)

Table 11: Relative Cost Rating of Credit Cards to Debit Cards

	Credit Card Rewards	No Credit Card Rewards	Total
Credit Card Revolver			
Revolver	-0.58	-0.68	-0.61
Non-revolver	-0.13	-0.57	-0.31
FICO Range			
Below 600	-0.81	-0.55	-0.61
600 to 649	-0.75	-0.78	-0.77
650 to 699	-0.64	-0.79	-0.70
700 to 749	-0.51	-0.64	-0.54
750 to 800	-0.32	-0.64	-0.39
Over 800	-0.14	-0.54	-0.21
Doesn't know	-0.35	-0.51	-0.45

Source: 2008 and 2009 Survey of Consumer Payment Choice

Note: Measured as the mean of the natural log the rating of the cost of credit cards to the rating of the cost of debit cards.

Table 12: Equifax Credit Score and Credit Card Correlations

	Credit Score 2009	Credit Score 2008
Number of Credit Cards	0.2064	0.206
Total Credit Limit	0.3605	0.3525
Average Credit Limit Per Card	0.4669	0.4373
% of Credit Limit Used	-0.6797	-0.6825
% of Credit Limit Past Due	-0.359	-0.3767

Source: Equifax Credit Bureau Data

Table 13: FICO Ranges and Credit Card Revolvers

FICO Ranges	Fraction Revolvers 2008	Fraction Revolvers 2009	Average Revolving Amount ($) [a] 2009
Below 600	0.77	0.31	8,195.84
600 to 649	0.70	0.70	7,381.61
650 to 699	0.86	0.64	9,323.19
700 to 749	0.71	0.65	9,853.29
750 to 800	0.54	0.44	6,011.16
Above 800	0.32	0.31	2,779.23
Doesn't know	0.50	0.25	7,272.30

Source: 2008 and 2009 Survey of Consumer Payment Choice

Notes: [a] Average revolving amount among respondents who carry a balance.

Table 14: Regression Results for Payment Use (Heckman 2nd Stage, Selected Coefficients)

	(1)		(2)		(3)	
	Credit	Debit	Credit	Debit	Credit	Debit
FICO	0.02 **	-0.02 **	0.01	-0.02 **	0.01	-0.01
Credit Card Revolver			-0.10 ***	0.04 ***	-0.10 ***	0.08 ***
Credit Card Adoption						-0.15 ***
Inverse Mills Ratio	0.13 ***	-0.22 **	0.09 *	-0.20 **	0.09 *	-0.19 *
Number of Observations	1176	1060	1176	1060	1176	1060
Adjusted R-squared	0.30	0.30	0.33	0.30	0.33	0.32

Source: 2009 Survey of Consumer Payment Choice

Note: Only selected coefficients are shown. The same controls as in Table 8 have been included.

Appendix

Components of FICO Score*
Account payment information
Presence of adverse public records
Severity of delinquency
Amount past due on delinquent accounts
Time since (recency of) past due items (delinquency)
Number of past due items on file
Number of accounts paid as agreed
Amount owing on accounts
Amount owing on specific types of accounts
Lack of a specific type of balance, in some cases
Number of accounts with balances
Proportion of credit lines used
Proportion of installment loan amounts still owing
Time since accounts opened
Time since accounts opened, by specific type of account
Time since account activity
Number of recently opened accounts, and proportion of accounts that are recently opened
Number of recent credit inquiries
Time since recent account opening(s)
Time since credit inquiry(s)
Re-establishment of positive credit history following past payment problems
Number of (presence, prevalence, and recent information on) various types of accounts

*Accessed from http://www.myfico.com/CreditEducation/WhatsInYourScore.aspx