

The decision between debit and credit: finance charges, float, and fear

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Abstract

We develop a simple model of a consumer's choice between using credit and debit and show that consumers are always better off using credit than debit when both types of cards are available for a purchase. This result is tested and the persistence of debit cards in the marketplace is examined using data from the 1998 Survey of Consumer Finances. Empirical evidence is presented suggesting that the persistence of debit cards in the marketplace is because of (1) the fact that even households that use credit cards without borrowing do not view credit as a substitute for debit and (2) consumers' fear of credit. © 2005 Academy of Financial Services. All rights reserved.

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1. Introduction

Between 1993 and 1997, the number of debit card transactions in the United States grew at an average annual rate of 53.3%. Also during this time period, the debit card's share of total non-cash transactions more than quadrupled (Weiner, 1999). From a social perspective this would appear to be good news. Humphrey, Pulley, and Vesala (2000) place the social cost of paper checks at \$181 billion per year. According to that study, the payee cost per \$100 of sales value for debit cards is only \$0.70, while it is \$1.07 for checks and \$2.41 for credit cards [based on data compiled by the Food Marketing Institute (1998) for U.S. supermarkets].

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Although the growth rate in the usage of debit cards reported above seems quite large, the United States lags behind other countries in the adoption of all forms of electronic payment. The question of why the U.S. lags behind other countries has thus received much attention in the literature. Recent studies have suggested that a lack of price incentives for consumers, along with supply side barriers, has led to the slow adoption of electronic payments in the United States [see, e.g., Humphrey, Pulley, & Vesala (2000); Caskey & Sellon (1994)]. Indeed, if society is to switch to the socially desirable debit card it must be consumers who decide to make the change. For this reason, we will take a different approach than the existing literature: given the availability of credit cards, why would a consumer ever choose to use a debit card?

We provide a contribution to the literature on methods of payment by addressing the reasons that consumers might choose the debit card over the credit card. In many respects the two options work in the same way. Many retail locations use the same hardware to process both types of transactions, yet the credit card seems to give the consumer many more perks than does the debit card. From the payee standpoint it is obvious why the debit card is preferred since transactions costs, which are borne almost entirely by the payee, are much lower (see Caskey & Sellon 1994). For consumers, however, it would seem that credit cards would be the preferred method of payment. Because credit cards are accepted almost everywhere that debit cards are accepted and the choice of which to use belongs to the consumer, the question is not why are consumers so slow in adopting debit but, rather, why are consumers adopting it at all?

A common answer to this question is that consumers avoid the “risk” of incurring high finance charges on a credit balance by using a debit card. There is, however, no exogenous risk involved in using a credit card; credit card usage involves only actions taken by rational economic agents and the certain consequences of those actions. It is possible that consumers fail to fully understand how credit cards work, and therefore, have a fear of falling into debt (or falling deeper into debt) simply by using credit. The perception of risk can then best be categorized as incomplete information regarding the consequences of credit card usage. We provide a simple model of a consumer’s choice between using credit and debit and test our predictions using data from the 1998 Survey of Consumer Finances.

In the next section, we review payment options available to consumers and the relevant literature. In Section 3, we argue that fully informed consumers should never use debit cards if they have the option of using credit cards. More specifically, we argue that only a consumer holding a strong belief that it is fundamentally wrong or dangerous to buy on credit should use debit cards. Section 4 examines various other explanations for the persistence of debit. We discuss the data and methodology and present empirical evidence in Section 5. Section 6 concludes.

2. Payment options and literature review

Consumers have many choices when it comes to payment methods, each with its own costs and benefits. The most common forms of payment are cash, paper checks, credit cards,

and debit cards. Less common payment methods include pre-authorized debit and stored value and smart cards.

Using cash is convenient because it is accepted almost everywhere (with the notable exception of online retailers), but carrying large amounts of cash entails both a substantial opportunity cost and a physical risk of being the target of crime. Paper checks are less risky for consumers than cash since (1) stolen checks are much more risky for thieves than stolen cash and (2) account holders have the option to stop payment on checks. Not only do paper checks eliminate the opportunity cost of holding cash *before* a transaction is made, but consumers also benefit from the float created when money stays in their accounts *after* a transaction takes place. Checks, however, are risky for those accepting them. There is always the possibility that the check will bounce and the payee will not be able to collect payment for goods and services already rendered. There is also the possibility that the check is stolen and payment will be stopped before collection takes place. Because of these risks, checks are not accepted at as many locations as cash. Other drawbacks for consumers are that checks are costly, bulky, often require identification, and are normally not accepted by online retailers.

Credit cards, while costly from the perspective of payees (as noted above), offer consumers many advantages. A substantial period of float, limited liability in the case of theft or loss, dispute resolution assistance, consolidation of bill payment, itemized bills, and the ability to borrow are just some of the standard features of most bank issued credit cards. The ease with which consumers can make purchases over the phone or on the Internet with a credit card is another important advantage that has received much attention lately. Some cards even offer additional services such as increased warranty periods on products bought using the card and insurance on rental cars when paid for with the card. These types of services can be obtained on a credit card with no annual fee. If consumers are willing to pay annual fees, they can take advantage of other popular options such as airline miles. As long as the monthly bill is paid in its entirety, all of these benefits can be enjoyed without periodic finance charges. Drawbacks to credit cards include limited acceptance (due mainly to payee cost) and high interest rates if one uses the card for borrowing. Credit cards may also be difficult to obtain if a consumer has a limited or unfavorable credit history.

The other major payment choice available to most consumers is the debit card. These cards are accepted at the same locations where credit cards are accepted. The major advantages of the debit card are that it normally doubles as an ATM card, thus allowing the consumer to carry one less card, and it also allows the user to receive cash back after purchases are made when used in combination with a personal identification number (PIN). Like credit cards, debit cards also offer consolidated billing/record keeping and ease of telephone and Internet based transactions. Drawbacks to the debit card include limited acceptance and the loss of all float in the case of online debits and most float in the case of offline debits.

One branch of research has focused on the demographics of consumers who choose to use electronic rather than more traditional methods of payment. Mantel (2000) finds that use of electronic payments in general is positively related to income, wealth, and age. Kennickell and Kwast (1997) show that those who use debit cards are younger, have higher levels of education (having a college degree seems to be particularly relevant), and have greater

amounts of financial assets than those who do not use debit cards. There are some key differences in the findings of Mantel (2000) and those of Kennickell and Kwast (1997). For example, Mantel's (2000) education result differs from that of Kennickell and Kwast (1997). Mantel (2000) argues that the education variable in his results was insignificant because of the inclusion of other demographic variables that are closely related to level of education. The differences in the studies' age results are more puzzling, although Mantel's (2000) results may be picking up households using ACH type electronic media which have been around much longer than debit cards since he looks at all types of electronic payment media. Older households may be more likely to use the ACH type media than are younger households because they are more likely to have long-term relationships with banks and therefore trust using such media. On the other hand, if one considers only debit cards, as in Kennickell and Kwast (1997), then it is reasonable to see more use among younger people since they tend to adopt newer technologies more quickly than older people.

Other research focuses on incentives for consumers to adopt debit cards. Caskey and Sellon (1994) examine why the debit card had not taken over as the major payment medium by 1993. After all, it seemed like the perfect medium for the cashless society that analysts had been predicting for decades. They conclude that consumers have no cost-based incentive to use debit cards because checks, debit cards, and credit cards all tend to face account-based fees rather than transaction-based fees. This would seem to suggest that consumers have no preference over which type of payment they use and thus very little enticement would be needed for them to switch to the socially efficient debit card. They find, however, that even though there is no difference in transaction-based fees (both are zero) consumers do not view debit cards as a substitute for credit cards. Humphrey, Pulley, and Vesala (2000) concluded that a lack of price incentives for consumers and the benefit of check float combined with supply-side barriers, has led to the slow adoption of electronic payments in the U.S. In contrast, Wells (1996) found that check float is not a deciding factor in the persistent use of paper checks when compared to ACH payments.

Caskey and Sellon (1994) find that consumers do see debit cards as substitutes for cash and checks, implying that small enticements could convince consumers to choose debit cards over paper checks. They argue that the 30% growth in debit card usage between 1990 and 1993 was most likely because of (1) the integration of the ATM networks that allow for the transfer of funds and (2) the introduction of the VISA and MasterCard debit programs. They predicted that, as the importance of network effects declined because of changes in technology and in the way the banking industry did business, debit card usage would increase. Indeed, between 1993 and 1997 debit card usage grew at an average annual rate of 53.3%. Credit card usage grew at an annual rate of only 7.8% during the same time period (Weiner, 1999). This rapid increase in debit card usage has been attributed to consumers substituting debit for cash and check purchases. It is clear why consumers might not see debit cards as a substitute for credit cards (borrowing capacity), but aren't credit cards a very close substitute for debit cards? If this were the case, consumers should have already switched from cash and checks to credit cards and we shouldn't see such rapid growth in the use of debit cards.

The existing literature leaves us with no clear answer to our question of why consumers have chosen to adopt debit cards. There is no monetary incentive for consumers to switch

from credit cards to debit cards and, since credit cards are pre-existing substitutes for cash and checks, there is no reason that debit cards should be adopted at all. The observed increase in debit must, therefore, have come as the result of substantial incentives based on something other than cost. A generally unfavorable view of credit could be just the incentive needed to convince consumers to use debit. Durkin (2000) examined consumer attitudes regarding the use of credit and found that, while credit card users are about evenly divided between believing that using credit is a good thing and a bad thing, those who borrow on credit cards tend to have a less favorable view. In the next section, we strengthen our argument that substantial non-price incentives are driving the migration to debit by formally modeling the choice between credit and debit.

3. The choice between credit and debit

In this section, we provide a simple model to examine a consumer's choice between making a purchase with a credit card and making a purchase with a debit card. In what follows, we make the following simplifying assumptions: (1) billing cycles are N days long, (2) the credit card bill is delivered on the last day of the billing cycle, and (3) payday is also the last day of the billing cycle. We further assume that, when using debit, consumers are able to leave their money in an interest bearing account earning a return of $b\%$ per day until the time of purchase without facing substantial transaction costs (i.e., "shoe-leather" cost). Although not entirely realistic, this assumption will cover even the most convenient of debit accounts and in any case will only bias the results towards the use of debit. Interest on the credit card accrues at the rate of $c\%$ per day, but (as with most credit cards) is waived in the event that the bill is paid in full. We assume that b is strictly less than c . Because interest on the credit card is waived if the bill is paid in full, it is useful to separate users based on whether or not they carry a balance on their credit card. Because the choice between credit and debit is irrelevant if the consumer does not currently have enough money to make the purchase, we only consider consumers who have enough cash on hand to make the purchase before the purchase is made.

When a consumer who carries no balance uses a credit card rather than a debit card to make a purchase, she receives a discount of sorts. By using the credit card rather than debit, the consumer is able to leave the cash in an interest bearing account earning float until the credit card bill becomes due. Since the consumer doesn't carry a balance to the next billing period, there is no charge for using the credit card. With earned float and no charge, this person will be better off using a credit card.

Even when a consumer does carry a balance, there exists an opportunity to make continued credit card usage work to their advantage. Consider an individual who sends money for anticipated purchases to the credit card company at the beginning of the month rather than leaving the cash in an interest bearing account to be used for the purchase later in the month. The individual pays credit card interest on a lower balance until the purchases are made. The balance returns to its previous level once the purchases are made, but the interest saved on the card before the purchase outweighs the interest that could have been earned had the money been left in the bank. It may seem that paying down a credit card

balance in anticipation of future purchases is too much to expect from the average consumer, but consumers could benefit by just sending in a small payment and then using the credit card to make purchases totaling the amount of the payment (i.e., a consumer could send a \$100 payment to the credit card company at the beginning of the month and then buy their first \$100 worth of groceries for that month using the credit card).

The above arguments are formalized in the following theorem:

Theorem 1: Under the assumptions made at the beginning of this section, a wealth-maximizing consumer always prefers using a credit card to using a debit card when both are accepted without fee.

Proof: Consider a one-dollar purchase for each of the two cases:

No balance Let n represent the number of days left in the billing cycle when the purchase is made. By using a credit card, this person is able to leave the dollar in the interest bearing account earning float at a rate of b per day for n days longer than they could have if they used a debit card. This dollar, at the end of n days, is worth $(1+b)^n$. Subtracting the original dollar leaves additional accrued interest of $(1+b)^n - 1$. Subtracting this from the original purchase price of \$1 gives a true cost of $2 - (1+b)^n < 1$. Because there is no balance, there are no finance charges on the credit card. Clearly, this person prefers making the purchase using the credit card.

Balance Consider a consumer who does carry a balance on his credit card. Recall that, since there is a revolving balance, finance charges accrue at a rate of c percentage per day on the balance. A dollar's worth of purchases on the credit card for this person then costs $(1+c)^n$, where n is the number of days left in the cycle when the purchase is made. Remember, however, that this consumer also earns float of $(1+b)^n - 1$. The net cost then is $(1+c)^n - (1+b)^n + 1$, which is greater than 1 as long as the rate on the card is greater than the rate on the interest bearing account. From this it appears that this consumer would prefer making the purchase with cash. When the purchase is anticipated, however, it is possible to save money by using the credit card.

Consider an individual who anticipates making a \$1 purchase with n days left in the cycle. If this individual sends \$1 to the credit card company on payday (at the beginning of the N day cycle), then he saves money by reducing the current month's finance charges. By reducing the balance by \$1 on the first day of the cycle (payday), the amount due on the credit card at the end of the cycle is lowered by $(1+c)^N$. The purchase is then made on the credit card with n days left in the cycle, leading to an increase in the credit card bill of $(1+c)^n$. The credit card bill is thus lowered by the amount

$$(1+c)^N - (1+c)^n, \quad (1)$$

which is non-negative and strictly positive as long as $N > n$.

Because the purchase was made not at the beginning of the month but rather with n days remaining, if the dollar had been left in the interest bearing account until purchase via a debit card, it would have generated interest of

$$(1 + b)^N - (1 + b)^n. \quad (2)$$

Here the first term is the future value of the dollar if left in the interest bearing account for the entire period and the second term is the loss (the dollar plus interest) that results when the purchase is made with n days remaining in the cycle. The consumer's net gain at the end of the month is then given by the difference between Eqs. (1) and (2):

$$(1 + c)^N - (1 + c)^n - (1 + b)^N + (1 + b)^n. \quad (3)$$

Again, as long as the rate on the card is greater than that on the interest bearing account, this will be a net gain and the consumer will prefer using the credit card. QED

In the next section, we examine the validity of different explanations for the persistence of debit.

4. Possible explanations for the persistence of debit

One possible explanation for the rapid growth in the use of debit cards relative to credit cards is that debit cards are currently in the new product adoption phase while credit cards are reaching saturation. Recall, however, that while debit cards are not a substitute for credit cards, credit cards are a substitute for debit cards. The very households that are *able* to use debit cards for purchases are the same ones that *could* be moving their income from low yield checking accounts (typically the accounts that are linked to debit cards) to higher yield accounts, enjoying the float, and paying off the credit card bill at the end of the month. Duca and Whitesell (1995) and, more recently King (2004), find that many households do in fact use their credit cards in this way.

A weaker argument is that the cost of writing a check at the end of the month for the credit card bill outweighs the benefit of the additional float created by use of the credit card. This is highly unlikely given that there is in general little or no monetary cost to writing one additional check.

Risk aversion on the part of consumers offers another possible explanation for the persistence of debit cards. It is difficult to imagine modeling such risk aversion given that there really isn't any exogenous risk involved in using a credit card. The Truth in Lending Act (Title I of the 1968 Consumer Credit Protection Act) requires disclosure of the annual percentage rate before a contract is signed. Interest rates are disclosed not only when the card is applied for, but every month on the account statement. When consumers are informed, the only possible source of risk is in "accidental borrowing," which occurs if consumers borrow even though they make a decision not to (implying irrational consumers). If we were to allow

consumers to borrow unintentionally, perhaps because of poor bookkeeping, we would also have to allow them to accidentally incur overdraft charges on bank accounts (possible when using debit cards offline). The penalty of paying finance charges when a consumer charges more than they are capable of paying back at the end of the month is in general much less than the penalty for overdraft on a conventional checking account. To be sure, debit card holders may avoid overdraft penalties through overdraft protection plans, but these plans involve rates that rival the highest credit card rates.

We stop short of arguing that debit cards should or will disappear if consumers are not offered incentives to choose them over credit cards. There are instances when debit cards are superior to credit cards. For example, some firms (e.g., some movie theaters) accept debit but not credit cards. Debit cards also serve an important role in allowing those who are unable to qualify for unsecured credit to participate in virtual markets. Online debits also have the advantage of offering the user the opportunity to receive cash back after a purchase when an ATM is not available. We will, however, contend that debit cards will become less popular in the absence of price incentives as the novelty of the “new” product wears off.

It is still, however, unlikely that the base of debit card users will dwindle to only include those who fail to qualify for credit and those who are making purchases where debit is accepted and credit is not. We believe that the main reason that debit cards have become (and will remain) so popular is that consumers fear that credit card usage will lead to debt. More specifically, consumers that have a fundamental belief that it is bad or dangerous to buy on credit will choose debit even though it entails a cost. This fear could be the result of bad past experiences with credit [see Durkin (2000)] or it could be a result of negative publicity in the popular press. In the next section, we offer empirical evidence in support of our claim that debit usage is driven primarily by fear of credit.

5. Empirical evidence

5.1. Data

We use the 1998 Survey of Consumer Finances (SCF) to test whether or not consumers’ beliefs about credit play a key role in their decision to use a debit card. The Board of Governors of the Federal Reserve System collects the SCF every three years. The rich are over-sampled in the survey as a way of making sure that all types of financial assets households can hold are accounted for. There were 4305 interviews completed for the 1998 public use dataset. Of these, 1496 were of households from a list sample to ensure over-sampling of the rich. Population weights are unnecessary to correct for this over-sampling because both income and assets are controlled for in our model.

Descriptive statistics found using the public use data set are less accurate than those found using the entire data set since, to protect confidentiality, some observations are missing and the exact weighting procedure cannot be revealed. Using the entire 1998 SCF, Kennickell, Starr-McCluer, and Surette (2000) report that mean household income is \$53,000 and median income is \$33,400. These figures are inflation adjusted 1998 dollars and represent pre-tax income for 1997. There were 66.2% of households that owned their primary residence. The

Table 1
Population-weighted descriptive statistics

	Corrected mean	Corrected SD
Uses debit card	0.34	0.47
Buying on credit is bad	0.34	0.47
Uses credit card	0.59	0.49
Credit card ownership	0.72	0.45
Revolving balance	1721.15	4772.49
Own home	0.58	0.49
Asset	330,699.00	1,872,846.32
Income	52,295.69	239,061.34
Bad credit history	0.16	0.37
No credit history	0.03	0.18
No high school	0.03	0.16
High school diploma	0.29	0.45
Some college	0.18	0.38
College degree	0.22	0.42
Graduate degree	0.12	0.32
Age 24	0.05	0.22
Age 25–34	0.18	0.39
Age 35–44	0.23	0.42
Age 45–54	0.19	0.39
Age 55–64	0.13	0.33
Age 65 and over	0.21	0.41
Race	0.22	0.42
Gender	0.72	0.45
Average risk taker	0.38	0.49
Above average risk taker	0.18	0.38
Risk loving	0.05	0.22
Risk averse	0.39	0.49
Neast	0.19	0.39
Ncentral	0.24	0.43
South	0.36	0.48
West	0.21	0.41

median value of assets (in 1998 dollars) was \$123,500. Of the households surveyed, 44.1% had credit card debt, with a median debt of \$1,700 (including debt on gas cards that are not included in our credit card variable). The number of households carrying a credit card balance fell a bit from the 1995 survey, indicating an increase in convenience usage over the three year period (Kennickell, Starr-McCluer, & Surette, 2000).

Of households in the public use version of the 1998 SCF, 34% used debit cards and about 72% had credit cards. There were 72% of the household heads in the survey that were male. Three percent of household heads had no high school education, 29% had only a high school diploma, 18% completed some college but had no degree, 22% had a college degree, and 12% had a graduate degree. Thirty-nine percent of the household heads reported being risk-averse, 34% of household heads reported that they believed that buying on credit is bad, and 16% reported having a bad credit history. Descriptive statistics for all variables have been weighted following the technique suggested by Montalto and Sung (1996) and are reported in Table 1.

Beginning with the 1989 SCF, a technique known as multiple imputation is used to

estimate missing data. Multiple imputation is superior to other methods of estimating missing observations (such as hotdecking) because it allows for the estimation of the distribution of the missing data. This leads to more reliable variance estimates (Kennickell, 1991). The 1998 dataset is therefore comprised of five smaller datasets (known as replicates) that are intended for use together. If a household responded to a survey question then the answer in each of the five datasets is identical. If the answer is missing, the response is estimated five different times, and these five responses are entered for the household.

The use of multiple imputation changes the technique used for finding coefficients and standard errors slightly. We estimated our model using each of the five replicates separately. We then took the average of the coefficients for each explanatory variable to get the coefficient corrected for multiple imputation. The variance between replicates and the variance within each replicate were computed and used to produce an estimate for the overall standard error. For an in depth explanation of this procedure, see Montalto and Sung (1996).

5.2. Model and results

We estimated a probit model to examine the effects of key variables on the probability that a household uses a debit card. We postulate that the two major reasons consumers choose to use debit cards are (1) because they fear falling into debt on a credit card or (2) because they are unable to obtain a credit card because of poor credit status. Thus we include variables for believing that buying on credit is bad (**buying on credit is bad**) and having a bad credit history (**bad credit history**) in our empirical model. Since we argue that households with the opportunity to use a credit card or a debit card should choose to use the credit card, it is important to test to see if households really do see credit cards as substitutes for debit cards. We thus include a variable for whether or not the household owns at least one credit card (**credit card ownership**). The dollar value of the revolving balance/credit card debt (**revolving balance**) is included to capture a pre-disposition of a household to use debit [recall that Durkin (2000) finds that those who have credit card debt tend to have less favorable views of credit]. This variable will also control for households who are unable to (or choose not to) use their credit cards because of very small or no available credit limits. To test our belief that risk aversion should not contribute to the use of debit, we have included a set of variables reflecting whether a household reports that they are risk averse (**risk averse**), average risk takers (**average risk taker**), above average risk takers (**above average risk taker**), or risk loving (omitted for comparison). Demographic variables found to be important in the decision to use electronic methods of payment in previous studies (e.g., Kennickell & Kwast, 1997; Duca & Whitesell, 1995; King, 2004) have also been included in our model. Table 2 gives a brief description of the demographic variables.

Table 3 presents the results for our model, which was estimated using the following equation:

$$\text{Debit} = \beta_0 + \beta_2(\text{buying on credit is bad}) + \beta_3(\text{uses credit card}) + \beta_4(\text{credit card ownership}) + \beta_5(\text{revolving balance}) + \beta_6(\text{own home}) + \beta_7(\text{asset}) + \beta_8(\text{income}) + \beta_9(\text{bad credit history}) + \beta_{10}(\text{no credit history}) + \beta_{11}(\text{did not complete high school}) + \beta_{12}(\text{some college}) + \beta_{13}(\text{college degree}) + \beta_{14}(\text{graduate degree}) + \beta_{15}(\text{age 24 or less})$$

Table 2
Demographic variable descriptions

Variable name	Variable description
Did not complete high school	A dummy variable equal to one if the head of household completes grade 11 or less.
High school education	A dummy variable equal to one if the head of household completes high school only.
Some college	A dummy variable equal to one if the head of household attended some college but did not finish.
College degree	A dummy variable equal to one if the head of household completed a college education (16 years of education).
Graduate degree	A dummy variable equal to one if the head of household attended graduate school.
Age 24 or less	A dummy variable equal to one if the household head is 24 years old or less.
Age 25–34	A dummy variable equal to one if the household head is 25–34 years old.
Age 35–44	A dummy variable equal to one if the household head is 35–44 years old.
Age 45–54	A dummy variable equal to one if the household head is 35–44 years old.
Age 55–64	A dummy variable equal to one if the household head is 35–44 years old.
Race	A dummy variable equal to one if the household head is non-white.
Gender	A dummy variable equal to one if household head is male.
Neast	A dummy variable equal to one if the household is located in CT, ME, MA, NH, RI, VT, NY, NJ, or PA.
Ncentral	A dummy variable equal to one if the household is located in IL, IN, MI, OH, WI, IA, KS, MN, MO, NE, ND, or SD.
South	A dummy variable equal to one if the household is located in DE, DC, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, or TX.
West	A dummy variable equal to one if the household is located in AZ, CO, ID, MT, NV, UT, WY, NM, AK, CA, HI, OR, or WA.

$$+ \beta_{16}(\text{age } 25\text{--}34) + \beta_{17}(\text{age } 35\text{--}44) + \beta_{18}(\text{age } 45\text{--}54) + \beta_{19}(\text{age } 55\text{--}64) + \beta_{20}(\text{race}) + \beta_{21}(\text{gender}) + \beta_{22}(\text{average risk taker}) + \beta_{23}(\text{above average risk taker}) + \beta_{24}(\text{risk averse}) + \beta_{25}(\text{Neast}) + \beta_{26}(\text{Ncentral}) + \beta_{27}(\text{South})$$

The results presented in Table 3 have been corrected for multiple imputation and also for heteroskedasticity using the Huber/White/sandwich estimation of robust variances. The Wald statistic indicates that our model is significantly different from a constant only probit. We have also included the marginal effects of each variable in Table 3 to simplify inter-

Table 3
Probit results for debit card usage

	Corrected Coefficient	t-value	Corrected marginal effects	t-value
Buying on credit is bad	.12	2.71***	.04	2.69***
Use credit card	-.10	-1.37	-0.03	-1.37
Credit card ownership	.49	5.68***	.16	6.19***
Revolving balance	9.79E-06	2.64***	3.43E-06	2.64***
Own home	.06	1.17	.02	1.17
Asset	-2.80E-09	-1.99**	-9.82E-10	-1.99**
Income	1.38E-09	.21	4.82E-10	.21
Bad credit history	.18	2.87***	.07	2.80***
No credit history	.25	1.95*	.09	1.88*
No high school	-.29	-3.59***	-.09	-3.84***
Some college	.15	2.36***	.05	2.33**
College degree	.09	1.35	.03	1.34
Graduate degree	.11	1.54*	.04	1.52
Age 24	.91	8.08***	.35	8.32***
Age 25–34	.94	11.88***	.36	12.05***
Age 35–44	.68	9.72***	.25	9.55***
Age 45–54	.48	6.91***	.18	6.70***
Age 55–64	.21	2.65***	.07	2.58***
Race	-.17	-2.82***	-.06	-2.91***
Gender	-.02	-.44	-.01	-.44
Average risk taker	-.05	-.59	-.02	-.59
Above average risk taker	-.05	-.57	-.02	-.58
Risk averse	-.14	-1.47	-.05	-1.49
Neast	-.19	-2.96***	-.06	-3.06***
Ncentral	-.26	-4.05***	-.09	-4.25***
South	-.14	-2.37**	-.05	-2.41***
Constant	-1.19	-8.81***		
Wald statistic	1448.35			

***Significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

pretation. These marginal effects have been estimated at the population-weighted means (reported in Table 1) to correct for the over-sampling in the data.

First, consider the variables that relate to our “fear of credit” hypothesis for the use of debit. Consistent with the implications of Theorem 1, households who believe that buying on credit is bad are significantly more likely to use a debit card than households that do not hold this belief. The size of the revolving balance that a household is carrying on its credit card is also positively and significantly related with the use of debit cards, as is the presence of a bad credit history. Because, according to Durkin (2000), those with debt and negative experiences with credit tend to have less favorable views of credit, these results are also consistent with Theorem 1 and the discussion in Section 4. Also consistent with the discussion in Section 4, having no credit history increases the likelihood that a household uses debit. As predicted, the level of risk aversion in a household has no impact on the probability that a household uses a debit card (see coefficients on **average risk taker**, **above average risk taker**, and **risk averse**).

Somewhat surprisingly given their interchangeable nature, we found that a household is more likely to use a debit card if it owns a credit card. This means only that the household

has in its possession a credit card (i.e., it does not necessarily imply that the household *uses* the credit card). This positive relationship seems to run counter to our finding above that households with access to credit cards should *not* want to use debit cards. Our interpretation of this result is that households which own credit cards are more comfortable making electronic purchases in general but do not see credit cards as substitutes for debit cards. We included a variable on actual credit card use to look at people who not only own credit cards but also are willing to use them. While the **uses credit card** variable does not have a significant impact on the probability that a household uses its debit card, the negative sign on the coefficient is what our theory would suggest. The lack of a significant relationship here is troubling because it implies that even the many households which Duca and Whitesell (1995) and King (2004) show to use their credit cards without borrowing do not see credit cards as substitutes for debit cards.

Previous research on debit card adoption and ACH usage has found positive relationships between wealth and the use of electronic payment methods. Thus, it is somewhat surprising that **asset**, the dollar value of a household's financial and non-financial assets, is inversely related to the probability of using debit. This result does, however, lend support to our theory. Households with greater wealth have higher levels of spending and therefore, more incentive to take advantage of the float creation made possible by using credit cards [see Duca & Whitesell (1995); King (2004)]. Income and homeownership may be insignificant because their impact is being picked up in the education or asset variables, because education, income, and wealth tend to be correlated.

Our education variables produced interesting results. Households with heads who did not complete high school are less likely to use debit cards than are those with heads having a high school education (the benchmark group). Households with heads having completed some college are more likely to use debit cards than those whose heads have only a high school education. If the household head has a college degree, the household is no more likely to use debit cards than if the household head has only a high school education. This looks somewhat like a "learning curve." One possible explanation is that with education comes some level of financial sophistication, so the no high school and high school level households do not use as many "sophisticated" banking products (and indeed may not even have a bank account) leading to a lower probability of having a debit card. With some amount of college, households are more likely to use newer technologies such as debit cards. Those with college and/or graduate degrees, however, are no more likely than those with a high school education to use debit cards. These are not households that would typically be considered "unbanked" but they are households that should have a higher level of financial sophistication and therefore understand the advantages of using credit.

As noted in Section 2, previous research on the effect of age on the adoption of electronic payments has produced mixed results (see Kennickell & Kwast (1997) and Mantel (2000)). Our results show that households with heads in the youngest age brackets (**age 24 or less** and **age 25–34**) are most likely to use debit cards, while those over 64 are least likely. The dummy variable indicating households with heads of retirement age (65 or older) is left out for comparison. Overall, the age results are consistent with the idea that younger individuals are quicker to adopt new technologies and are similar to the findings of Kennickell and Kwast (1997). The region of the country in which the household is located also has a

significant effect on the probability that a household uses debit, with households in the West being most likely to use debit cards. By 1994, California had the most advanced debit programs of any state (Caskey & Sellon 1994). It, therefore, makes sense that households in the western United States are most likely to use debit cards.

From the marginal effects, we can see that a household head's age is the largest determining factor in whether or not members of the household use debit cards. This is followed by whether or not any member of the household owns a credit card and the credit worthiness, level of education, and race of the household head. After these variables that we interpret as determining whether a household is willing and able to use debit, the largest impact comes from a household's beliefs about credit. As we predicted above, beliefs about credit are important in determining whether or not a household will choose debit over credit.

6. Conclusions and implications

Theorem 1 states that, as long as both are payment options, debit cards should never be preferred to credit cards. Yet debit cards persist in the marketplace. We postulated that this was due primarily to consumers' fear of credit. We have presented empirical evidence in support of the idea that households choose to use a debit card because they believe that "using credit is bad" (i.e., they are afraid they will fall into debt). In fact, after factors that determine a household's willingness to use electronic payments and ability to obtain credit, holding this belief is the largest factor in determining whether or not a household will use debit. The age variable actually has the largest marginal effect on the decision to use debit, although this probably only reflects younger households' willingness to adopt new technologies. According to Theorem 1, we should find an inverse relationship between credit card usage and debit card usage because those who use credit cards must see them as a legitimate payment option. We do find an inverse relationship, but the result is not significant. Simply *owning* a credit card increases a household's likelihood of using a debit card and has a rather large marginal impact. We believe that the insignificance of credit card usage and the positive effect of credit card ownership on debit card usage both reflect the fact that some households do not see credit cards as substitutes for debit cards (even though with minimal financial management skills they are excellent substitutes). We find some evidence to support previous research on the demographic characteristics of those who use debit cards, although some of our results are mixed when compared to previous literature.

There are a couple of important implications from our findings. First of all, consumers need to become more educated about the benefits of using credit cards as a medium of exchange (but NOT as a method of borrowing). Although believing that it is bad to buy on credit doesn't have the largest marginal effect on the decision to use debit, it is one that could be influenced through education. It can be argued that the benefits of using a credit card in place of a debit card are small, but there is essentially no cost involved in gaining these benefits. As consumers come to understand the benefits of using credit, they should begin to see credit as a substitute for debit cards and the volume of debit transactions should decline. Of course, Elmerick, Montalto, and Fox (2002) report that, while over 20% of households from the 1998 SCF sought advice from a financial planner, less than 3% sought specialized

advice on credit and debt. Even if this number were higher, it is doubtful that many financial planners would sing the praises of using credit wisely as a method of lowering debt.

We also expect debit to persist for the reasons noted in Section 4. These include debit's availability to those with no or bad credit histories, some retailers' preference for debit, the ability to use the debit card as an ATM card, and the option of receiving cash back with online debits.

Another possibility and a direction for future research is that consumers have hyperbolic discount functions [for an in-depth look at the characteristics of hyperbolic discount functions, see Harris & Laibson (2001)]. With hyperbolic discounting, the discount rate is higher in the short-run than in the long run. This implies that a consumer may set a spending limit in the present and then choose to ignore or revise that limit in the future. If the current self anticipates that the future self will borrow on credit to increase consumption, then it may be rational (from the perspective of the current self) to pre-commit to using only debit. Of course, this would only partially explain debit use since true pre-commitment would mean not owning a credit card. If a credit card were available, the future self would still overspend. Indeed, Harris and Laibson (2001) find that simulations using hyperbolic discounters predict levels of credit card borrowing that are consistent with data from the 1995 SCF while simulations using exponential discounters underestimate levels of credit card borrowing.

Of course, with much lower payee costs for debit transactions, a decline in debit transactions is socially undesirable. If debit cards are to become the preferred method of payment, consumers will eventually need to be given some of the gains from switching. Without any rewards for switching to debit there is no incentive for informed consumers to use debit when credit is an option. In any case, debit will likely remain a major payment option in the years ahead.

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