Why Are (Some) Consumers (Finally) Writing Fewer Checks? The Role of Payment Characteristics

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PRELIMINARY AND INCOMPLETE – COMMENTS WELCOME

Abstract: The number of paper checks written in the United States has declined significantly during past decade and electronic payment methods are now the most common form of noncash payment. Although a shift from checks to electronic payments had been expected, the actual timing and magnitude have been surprising. Very little data or previous research can explain *why* people choose checks versus other payment methods. Thus, the stubborn persistence of check-writing in the presence of cheaper and more convenient electronic alternatives remains a puzzle. This paper provides evidence that the fundamental characteristics of payment methods – cost, convenience, security, and the like – are much more important determinants of payment choice than traditional demographic and other observable variables. Using data from a new survey on consumer payment behavior by Federal Reserve employees, we demonstrate that payment characteristics increase the cross-section explanatory power of payment adoption and use regressions from less than 10 percent to more than 30 percent.

Since the mid- to late-1990s, the number of paper checks written in the United States finally has begun to decline significantly. Figure 1 shows that total U.S. check volume dropped 26 percent from 1995 to 2003 (Gerdes and Walton 2002), although a paucity of data leave the exact timing of the trend unclear. The core volume of checks processed by the Federal Reserve, which accounts for less than half of total U.S. check volume, continued to increase through the early 2000s but is declining now as well. The demise of checks has been predicted for a long time. For example, the Federal Reserve Bank of Atlanta (1983, p. 5) declared, "Between 1989 and 1994, personal check volume should decline sharply…" Instead, check writing appears to have continued to increase through the mid-1990s.

Checks remain the single most common form of non-cash retail payment, but a long-awaited shift to electronic payment methods is under way and electronic payments together now account for most non-cash payments. According to Federal Reserve System (2004), the share of checks dropped from 60 percent of all non-cash retail payment transactions in 2000 to 45 percent in 2003; thus, for the first time, the number of electronic retail payments exceeded the number of paper checks. In place of checks, consumers are adopting alternative electronic payment methods, such as debit cards, bank account deductions via the Automatic Clearing House (ACH) network, and online bill payment, as shown in Figure 2. The payments industry is scrambling to provide the most appealing electronic alternative to consumers.

The actual timing and magnitude of the decline in paper checks has been a surprise, and it is difficult to predict which electronic payment methods consumers will switch to most. More generally, while not much is known about *how* consumers pay (lack of data), even less is understood about *why* they choose their payments instruments (lack of theory). The literature on consumer payment choice is very thin – fewer than 5 percent of entries in the Federal Reserve Bank of Philadephia's "Consumer Payment Bibliography" (2006) actually offers data or theories about consumer payment choice. And not much data on consumer payment behavior is readily available either (see Carten, Littman, Schuh, and Stavins 2007).

Analyses such as Garcia Swartz, Hahn and Layne-Farrar (2004) suggest that the marginal cost to the consumer is highest for cash and check, while marginal benefits are similar across payment methods. Social marginal costs of checks and cash have also been estimated to exceed those of credit or debit cards. So, why do checks continue to dominate among payments?

To answer this question, we estimate reduced-form models of payment choice using a unique new data source from a consumer payment survey conducted with a convenience sample of about 5,000 Federal Reserve employees in 2004. As described in Benton, Blair, Crowe, and Schuh (2007), the survey's main contribution is to ask respondents why they did or did not adopt and use the main U.S. payment methods (cash, check, credit and debit cards, ACH payments, and online bill payments). In particular, the Fed survey asked consumers (respondents) to assess the fundamental characteristics of the payment methods – cost, convenience (ease), safety, privacy, errors, timing, and recordkeeping. We assume these characteristics yield utility to consumers and thus form an important part of the demand for payment methods.

To quantify this idea, we follow the empirical literature on the demand for payment methods and estimate reduced-form models of payment choice.[1] Our econometric models partition the payment choice into an adoption decision (extensive margin) and a use decision (intensive margin, conditional on adoption), relying on limited dependent variables techniques, as is common in the literature.[2] We include standard explanatory variables found in the literature to be important: demographics and other observable consumer traits, plus financial (income and wealth) data. Then we supplement the models with payment characteristics as reported by the consumers. Although including payment method characteristics in payment choice behavior has been done in the literature (see the literature review section below), previous studies limited their sample to cardholders only (Carow and Staten 1999), lacked individual consumer demographic data (Klee 2006b), included a very limited set of payment characteristics, or modeled consumer payment choice using consumer attitudes and perceptions about payments rather than fundamental payment characteristics (Jonker 2005).

Our central finding overall is that fundamental payment characteristics are much more important for explaining the cross-section pattern of consumer payment demand than are the standard demographic and financial variables. Payment choice regressions (adoption or use) with only demographic and financial variables explain less 10 percent of the cross-section variation in consumer payment demand, whereas payment choice regressions with only payment

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[1] For examples of econometric models of consumer payment choice, see Stavins (2001), Mester (2003), Hayashi and Klee (2003), and Zinman (2004).
[2] In previous versions of this paper, we explored models of the change in payment use (more, same, or less) and the substitution of payment methods for checks, but the econometric results for these models thus far have not been as successful or reliable.

characteristics variables can explain 30 percent or more. Moreover, once payment characteristics are included, the standard demographic and financial variables become statistically insignificant or economically unimportant. For example, age effects that are readily apparent in the data, such as a decline in the adoption rates of online bill payment with an increase in age, diminish markedly after controlling for consumers' assessments of payment characteristics.

Our econometric results motivate further investigation into a deeper understanding of the meaning and role of payment characteristics in consumer payment choice. Although consumers' (respondents') reported characteristics are assumed to be valid summary statistics of the true characteristics embedded in the payment methods, potential errors in variables may arise. Reported characteristics may reflect errors associated with limited information, measurement, and subjective perceptions; we explore instrumental variables techniques to try to correct for these problems. Regardless, variation in payment demand across consumers but *within* demographic groups appears to be driven largely by heterogeneity in payment characteristics across consumers, and this heterogeneity is reasonably well captured by the signal in consumers' assessment of characteristics.

The econometric success of the payment characteristics data in explaining cross-section variation in consumer payment choice is striking. Consumers' payment choices are generally consistent with their assessments of the characteristics: for example, consumers who still write relatively many checks appear to do so because they rate the characteristics of checks better, relatively speaking, than do consumers who rate the characteristics of electronic payment methods better. However, much more research, and more and better data, are needed to better identify and explain why consumers' reported payment characteristics are so informative.

[ADD – discussion of other specific results pertaining to checks?]

[TO BE REVISED] The rest of the paper is as follows. Section I summarizes the literature on consumer payment behavior. ….

I   Literature review

Demographics and Other Consumer Attributes

Although the literature on the supply side of payments is fairly extensive, little research has been done on the demand side for payment methods. Data on individual consumer payment

behavior are especially difficult to get. Some researchers estimate payment method use or adoption using *country*-level data. They include Amromin and Chakravorti (2007), Humphrey, Kim and Vale (2001), and Humphrey, Pulley and Vesala (1996). However, heterogeneity within each country can be substantial and one cannot infer what payment or consumer characteristics induce specific payment behavior based on aggregate international comparisons.

Another set of papers analyzed the effects of individual consumers' socio-demographic characteristics on the choice of payment instruments. Stavins (2001), Mester (2003), and Klee (2006a) found strong effects of demographic characteristics on the use of electronic payments, based on data from the Survey of Consumer Finances data. Also using the Survey of Consumer Finances data, Zinman (2007) estimates the effect of consumer characteristics on the use of debit and credit cards.

Anguelov, et al. (2004) showed demographic characteristics of users and non-users of selected electronic payment methods, based on the Survey of Consumer Finances. Based on the data from the Michigan Surveys of Consumers, the authors showed consumers' perception of electronic banking, and the use of electronic banking technologies by households with various types of perception.

Using data from several waves of the Survey of Consumer Finances, Bertaut and Haliassos (2005) estimate the effect of socio-demographic variables on the adoption of credit and debit cards. In addition to demographic characteristics, they include a few other SCF variables describing consumers' financial attributes: whether a person is a saver, whether s/he is liquidity constrained, and whether s/he believes that buying on credit is usually a bad idea.

Kim, Widdows and Yilmazer (2005) used the 2001 Survey of Consumer Finances to show that Internet banking adoption is more likely among consumers who are younger, affluent, and well-educated; have good computer skills; are experienced with other banking technologies, such ATMs and direct payment; work in occupations related to the computer or Internet; and have a longer time horizon for saving and spending.

Amromin, Jankowski and Porter (2007) used zip code-level data to estimate the effect of demographic characteristics on the adoption of I-PASS, the Illinois Tollway's electronic toll collection system. They found that both income and education were highly correlated with the adoption of the electronic tollway payment device. In a rare natural experiment, they were able to observe the effect of price change on the adoption of I-PASS. They could therefore isolate the

effect of the price change from the effect of socio-demographic characteristics. While income was an important determinant of I-PASS ownership, a change in cost affected adoption among residents of low-income zip codes, but not among the more affluent neighborhoods.

Most of the literature described above used data from the Federal Reserve's Survey of Consumer Finances (SCF), "a triennial survey of the balance sheet, pension, income, and other demographic characteristics of [4,500] U.S. families."[3] The SCF is the most comprehensive survey on U.S. consumers' assets, income and debt, and is certainly more representative than the Boston Fed survey. Although the SCF contains a set of questions on consumers' *adoption* of payment methods, it has very limited information on the *use* of payments and on what affects consumers' payment behavior. A number of private consulting firms have sponsored their own consumer payment surveys, but information to assess their methodology and results is costly and limited.[4]

A few researchers used proprietary data to explore consumer payment behavior. Rysman (2007) used consumer transaction data from Visa's Payment Systems Panel Study to explore the effect of demographic attributes on consumers' use of credit cards for the major credit card networks. He found that most consumers used cards from a single network, and that there was a positive correlation between merchant acceptance and consumer usage of payment cards. Fusaro (2006) estimated debit card use as a function of demographic variables and credit card use, based on proprietary data on consumers' accounts held at a single small depository institution.

Beyond Demographics

The papers mentioned above show that demographic attributes tend to affect consumer payment behavior. However, heterogeneity within demographic groups can be large (see Benton, Blair, Crowe and Schuh 2007) and substantial part of the variation in consumer payment use remains unexplained. Therefore including the characteristics of the payment methods and consumer perception of those methods could supplement or even replace the effect of

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[3] For more details about the SCF, see http://www.federalreserve.gov/pubs/oss/oss2/scfindex.html.

[4] For example, Dove Consulting conducts a semiannual survey of approximately 2,000 respondents on consumer payment preferences.

demographics. A number of researchers used other sources of data to examine the effect of payment characteristics and consumer perceptions on payment behavior.

Carow and Staten (1999) analyzed consumers' choice of payment method at gasoline stations and found that consumers were more likely to use cash when they had less education, lower income, were middle-aged, and owned fewer credit cards. In contrast, debit and credit card users were younger, more educated, and held more credit cards. In addition to demographic characteristics, the authors included some attributes of payment methods, such as convenience, record keeping and acceptance. However, their sample included cardholders only, and the questions were limited to cash, credit and debit use at gasoline stations.

Besides the literature using U.S. survey data, some researchers use surveys of European consumers that provide more extensive information on consumer payment behavior. Jonker (2005) used a survey of Dutch consumers and found the characteristics of payment methods as perceived by the respondents to be important in payment use. Differences in those perceptions of payment methods were more important than payment location in explaining differences among the Dutch consumers. Jonker regressed consumers' perceptions of payment methods, such as speed, cost and safety, on a set of socio-demographic variables. In most of the regressions, the estimated R^2 was below 0.01, indicating that demographic characteristics do not explain differences in consumers' perception of payments.

Klee (2006b) examined what affected consumers' choice between checks and debit cards at grocery stores. Speed and cost of transaction, record keeping, value and type of purchase were found to be significant. Although both transaction and payment method characteristics turned out to be significant in payment choice, the data had no demographic information on individual consumers, and therefore it is impossible to predict whether payment characteristics would remain significant when individual consumer demographic data were included in the estimation.

Mantel (2000) explored the effect of consumer preferences on the use of electronic bill payment, using the results of a national survey. He found that personal preferences for control, record keeping, and convenience, as well as transaction-specific factors affected consumers' decision whether or not to use electronic bill payment.

In one of very few papers that address the question *why* consumers use or do not use certain payment methods, Borzekowski and Kiser (2006) and Borzekowski, Kiser and Ahmed (2007) use a survey conducted as a special unit of the Michigan Survey of Consumers in 2004.

They estimate debit card adoption and use as a function of socio-demographic characteristics of consumers, but also use open-ended responses to analyze the reasons why consumers choose to use or not to use debit cards. In their survey, convenience was cited as a main reason for using debit cards, while fewer respondents mentioned cost, speed and restraint from spending as reasons for using debit. Although they estimate consumers' preferences with respect to a few features of payment methods—speed; electronic versus paper; and liquidity versus debt—the survey did not fully explore the attributes of various payment methods and thus did not allow for a complete analysis of consumer payment behavior.

Using data from one of the surveys conducted by private consulting or market research firms—a biannual survey of consumer payment preferences conducted by Dove Consulting and the American Bankers' Association, Hayashi and Klee (2003) showed that the choice of payment instruments depends on consumers' propensity to adopt new technologies and on the nature of the transaction, such as the value of the transaction, the physical characteristics of the point of sale, and a bill's frequency and value variability. Consumers who used computers were found to be more likely to use electronic forms of payment, such as debit cards and electronic bill payments. Ching and Hayashi (2006) used the 2005 Dove survey data to estimate the effect of demographic attributes and consumers' perceptions of payment methods on payment use. Although their data contain extensive information on consumers' perceptions of payment methods, the sample is not nationally representative compared to the SCF or the Michigan Survey of Consumers.

The empirical results in the literature show that both socio-demographic attributes and payment method characteristics affect consumer payment behavior. The contribution of our paper is to include a wide range of payment characteristics to empirical estimation of payment method adoption and use.

II   Econometric Models

1.   Adoption of payment instruments

Our first model of payment behavior attempts to identify the determinants of a consumer's decision to adopt a particular payment instrument. We define the discrete adoption dummy variable as

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

where subscript i indexes individual consumers and subscript j indexes payment instruments. A consumer is assumed to have adopted the payment instrument if they checked "Yes" to the question "Do you use it?" or entered a positive number for the question about the "Number of payments." Because virtually everyone in the sample used checks, we did not estimate an adoption regression for checks.[5]

To estimate the effects of demographic attributes and payment method characteristics on the adoption of each payment instrument, we estimated the following logit regression models:

$$A_{ij} = f(DEMOG_i, \ CHARACTERISTICS_i) \ .$$

Subscript i denotes consumer, while subscript j denotes payment method. The payment methods are: paper checks (CK); credit cards (CC); debit cards (DC); automated clearing house payments (ACH); on-line banking (OB); and stored value cards (SVC).

$DEMOG$ is a vector of demographic characteristics, including age, education, homeownership, and income. The data sample is divided into subgroups by those four demographic characteristics. The six age variable categories are

$$AGE = \{ <25 \quad 25-34 \quad 35-44 \quad 45-54 \quad 55-64 \quad \geq 65 \} \ ;$$

the four education variable categories are

$$EDUCATION = \{ \text{High school or less} \quad \text{Some college} \quad \text{College} \quad \text{Post-graduate} \} \ ;$$

the two homeownership variable categories, which are a crude measure of wealth, are

$$HOME = \{ \text{Rent} \quad \text{Own} \} \ ;$$

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[5] Because the survey was "check-centric" the only meaningful responses to most of the questions were from respondents who had a checking account.

and the four annual household income variable categories are:

$$INCOME = \{<\$50,000 \quad \$50,000\text{-}74,999 \quad \$75,000\text{-}99,999 \quad \geq \$100,000\} \; .$$

In the regression models below, the demographic variables are defined as discrete dummy variables.

$CHARACTERISTICS_i$ include characteristics of payment method j as well as of the other payment methods for consumer i. These variables are constructed based on a set of questions that asked the respondent to compare and contrast each of the non-cash, non-check payment instruments with checks, one instrument at a time, along seven payment characteristics: cost (out-of-pocket only), convenience, safety, privacy, errors, timing/control, and record keeping. For each dimension, respondents rated each payment instrument, $j = \{CC, DC, ACH, OB, SVC\}$, as better than, same as, or worse than checks (CK). This response suggests dummy variables for characteristics defined as

$$P_{k,j\_CK} = \begin{cases} 1 & \text{if } j \text{ is better} \\ 0 & \text{if } j \text{ is the same} \\ -1 & \text{if } j \text{ is worse} \end{cases}$$

where subscript k indexes the seven payment instrument characteristics.

Consumer i decides whether to use payment j or $j\,'$. He uses j if $u_{ij} - u_{ij'} > 0$, where $u_{ij} - u_{ij'} = \sum_k \omega_{kj} P_{k,ij\_j'}$ and $P_{k,ij\_j'}$ are customer i's characteristics of payment j relative to payment j' for each characteristic k and ω_{kj} are utility weights for each characteristic k and payment j. Consumer i evaluates his choices of payment methods and selects the one with the highest value of $\sum_k P_{k,ij\_j'}$. Therefore the higher the value of characteristics for payment j, the higher is the share of all of i's payments made using j and the more likely was i to have switched from checks to payment j.

Although the survey directly asks only for pair-wise comparisons of payment instruments with checks, the complete set of characteristic questions implicitly defines pair-wise (relative) characteristics for all payment instrument pairs (except cash, which was excluded). Assuming

strict transitivity of characteristics, we can define the relative characteristic of two instruments j and j' as the difference in each of their characteristics relative to checks:

$$P_{k,j\_j'} = P_{k,j\_CK} - P_{k,j'\_CK} \ .$$

Obviously, however, there is not strict transitivity here. For example, if credit cards are considered more convenient (characteristic 2) than checks and ACH is considered more convenient than checks, $P_{2,CC\_ACH} = 0$ by definition and the characteristic variable would rank credit cards and ACH equally convenient, which clearly may not necessarily be true for the consumer. However, the relative characteristic variable definition at least does not allow for false preference reversals. Nevertheless, the other relative characteristic variables should not be expected to yield as clear inference as the characteristic variables comparing payment instruments to checks directly. Of course we expect $CHARACTERISTICS_{ij}$ to be much more important in explaining the adoption of j than characteristics of the other instruments, $CHARACTERISTICS_{i,-j}$.

2. Payment Use

Whether or not consumers adopt a given payment method does not give us any information about the *intensity* of their use. For example, a person may use his or her credit card for an occasional big-ticket purchase, but pay with cash or check the rest of the time. The survey asked respondents how many payments they made using each non-cash payment type "in a typical month." Based on those responses, for each respondent i we computed the share of each payment method j as

$$s_{ij} = \frac{n_{ij}}{N_i}$$

where n_{ij} is the number of payments made in a month and $N_i = \sum_j n_{ij}$ is the total number of all non-cash payments made by the respondent in a month.

To assess the determinants of the intensity of use, we estimated the following regression model of monthly payment shares for each payment instrument

$$s_{ij} = f(DEMOG_i, \ CHARACTERISTICS_i) .$$

III   New Consumer Payment Survey Data

[ADD BRIEF DISCUSSION OF AARP DATA, WHICH WE WILL USE FOR THE REVISED "SUMMARY STATISTICS" SECTION.]

Our data come from a survey of consumer payment behavior conducted by the Federal Reserve Bank of Boston (Boston Fed) in 2004 with employees of the Federal Reserve System.[6] More than 5,300 employee-consumers responded to the voluntary, 55-question survey (response rate of 24 percent), but only 4,631 of the observations are usable because of technical difficulties during one week of the survey. All employees from each of the twelve Federal Reserve Districts, plus the Board of Governors, were eligible to participate in the survey and did. The response rate across Districts varied from 51 percent in Minneapolis to 12 percent at the Board of Governors.

Because of the Federal Reserve's keen interest in paper check writing trends, the survey was designed to be "check-centric" – that is, to focus on the paper check decision vis-à-vis other payment methods. The survey questions can be grouped in the following categories:

- Paper **checking behavior and attitudes** in general and reasons for not having a checking account.
- The **adoption** and **use intensity** of six non-cash payment methods: paper checks, credit cards, debit cards, ACH payments, online banking, and stored value cards (SVC).[7]
- Three-year retrospective **changes** in payment method usage.
- Reasons for **substitution** of other payment methods for paper checks.
- Types of payments made using debit, ACH, and SVC.
- Pair-wise comparisons, or **characteristics**, of checks versus other payment methods along seven payment characteristics.
- Experience with **check truncation** in retail stores, also known as point of sale (POS), and by mail, also known as the lockbox.
- Miscellaneous payment experiences.
- **Demographic** questions.

The bold-faced text identifies categories of variables used in our analysis.

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[6] For details on the survey see Benton, Blair, Crowe, and Schuh (2007).
[7] The omission of cash from this group was an unintentional error in the survey design.

An obvious shortcoming of the Boston Fed survey is that it is not representative of the U.S. consumer population, in at least three respects. First, Federal Reserve employees are not representative of the basic demographic characteristics of the U.S. population. Fed employees are much older, richer, and more educated than the general U.S. public.[8] A second bias likely exists because Fed employees are much more highly educated about payments issues than is the general U.S. public simply because they work in a financial institution that is heavily involved in payments issues. A third, related bias may exist if Fed employees had difficulty answering questions purely as consumers. Respondents may have consciously or subconsciously answered questions from the perspective of a Fed employee; thus, the perspectives and preferences of the Fed – a payments supplier – may have crowded out the perspectives and preferences of the consumer – a payments demander. It is difficult to identify this potential bias for certain, but some comments in the essay portions of the survey reflect the job security concerns of check-processing employees.

Although the alternative sources of data on consumer payment behavior discussed below probably are more representative and less biased, the Boston Fed survey has some broader and deeper innovative data about *why* consumers are making their payment choices. The alternative data sources can provide more accurate information about *what* U.S. consumers are doing in terms of choosing payment methods. However, the Boston Fed survey directly asks consumers two additional types of questions: 1) why they make their payment choices; and 2) whether their choices have changed, and why. This second type of question provides some individual-specific longitudinal information that is lacking from all other studies at this time.[9] Thus, despite its flaws, the Boston Fed survey provides intriguing motivation for developing future data sources that incorporated this kind of information to help improve our understanding of consumer payment choice.

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[8] However, the sample of survey respondents is approximately representative of the population of Fed employees, at least in terms of age.

[9] We are aware that many private companies in the payments industry have collected a great deal of data on consumer payments behavior, but these data are proprietary.

1.   Payment Adoption

While the adoption of payments varied across the different methods, there was less variation across the demographic groups. Table 1 shows the percentage of respondents in each demographic subgroup who had adopted each payment method. The first column of Table 1 shows the number of respondents in each subgroup. Checks were used almost universally, with at least 97 percent of respondents in each subgroup using checks. Credit cards were the second most commonly used payment instrument, and at least 73 percent of respondents in each subgroup used credit cards. Use of credit cards increased with age, education, and income. The opposite was found in the case of debit cards—the fraction of respondents using debit cards decreased with income, with age—with 83 percent of the youngest and 53 percent of the oldest respondents using debit cards—and was lower for those with a college or graduate degree than for those without a college degree. Homeowners were more likely than renters to use credit cards, but less likely to use debit cards.

ACH payments were most commonly used by respondents between 25 and 34 years old, and the least by those under 25, probably because the latter have the fewest bills to pay. Homeowners, those with a college or graduate degree, and wealthier respondents were also more likely to use ACH. Online banking and stored value cards were less frequently used than the other payment types. Online banking was much more common among younger respondents. While 66 percent of respondents in the 25-34 age group used online banking, only 29 percent of those over 65 did so. Those with a college or graduate degree and those with higher annual income were somewhat more likely to use online banking. The use of stored value cards also increased with education and income, although less than half of respondents in any subgroup reported using them, and only 35 percent of the total sample used stored value cards.

The adoption of payment methods is comparable to other surveys (see Table 2). In the Federal Reserve's 2004 Survey of Consumer Finances (SCF), the rate of adoption was 75 percent for credit cards (compared to 86 percent in the Federal Reserve survey), 59 percent for

debit cards (compared to 67 percent), 47 percent for ACH (compared to 71 percent),[10] and 40 percent for online bill payments (compared to 49 percent).

2. Payment Use

Table 3 shows the average shares of monthly payments that are paid with each payment type for each subgroup. Checks were used the most: an average respondent paid 35 percent of all monthly payments with checks. Debit and credit cards followed, with 24 percent and 21 percent of all monthly payments, respectively. There was substantial variation across age groups. While those under 25 paid only 17 percent of all their payments with checks and 35 percent with debit cards, respondents over 65 made 43 percent of their payments with checks and 13 percent with debit cards. While high school graduates made almost half of their payments with checks and 11 percent with credit cards, those with graduate degrees used checks for 29 percent and credit cards for 30 percent of their payments. Wealthier respondents made relatively more payments with credit cards, but fewer with checks or debit cards than respondents in lower income subgroups. There was less variation among the subgroups in their shares of online banking and stored value card use.

3. Payment Characteristics

Due to a flaw in the survey design, the characteristic questions were supposed to be only answered by users of a given payment method (e.g., only ACH users were supposed to evaluate ACH). However, because a substantial number of nonusers answered those questions anyway[11] (essentially ignoring the survey instructions), we were able to collect information about the characteristics from users as well as from the nonusers, therefore enabling us to estimate the payment adoption regressions. However, because we could only include the observations for

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[10] ACH can be used for automatic bill payments (also called ACH debits) or for automatic pay deposits (ACH credits). ACH credits have been much more commonly used, and the distinction might have caused the discrepancy between the surveys.

[11] In the case of credit cards, over 40 percent of nonusers answered the characteristics questions. The percentage was smaller for the other methods.

respondents who filled out the characteristics questions, we were left with less than 1,200 observations out of the original sample of almost 5,000 respondents.

[ADD MORE DETAILS ON SAMPLE CONSTRUCTION]

Table 4 summarizes *CHARACTERISTICS* by showing the percentage of users of each payment method who consider that method to be worse, same, or better than check along each of the seven characteristics. The responses vary substantially across the seven characteristics. For example, 85 percent of respondents consider credit cards to be easier to use than checks, but only 23 percent think that credit cards are better than checks for "privacy of personal identity." This result illustrates the divergence between consumers' perceptions of payments and reality—even though checks are more vulnerable than credit cards, consumers tend to trust checks much more.

No payment method dominates checks—there is no method which the majority of respondents perceive as better than checks along all the characteristics. Ease of use, cost, and timing are the three characteristics selected by most as advantages of electronic payments over checks. In regressions below, we test whether those characteristics help predict the use of various payment methods when controlling for other consumer attributes.

4.   Barriers to Adoption of Instruments

One group of variables provides information about barriers to consumers' adoption of payment instruments based on questions that ask the consumers who do <u>not</u> use each payment instrument to identify the factors that inhibited their adoption of each instrument. Because only non-users of each instrument were asked to answer these questions, the barriers indicate consumers' negative attitudes toward each payment instrument. We constructed dummy variables that incorporated each consumer's assessment of barriers for each payment instrument. Most of the barriers are common, or very similar, across instruments.

For each payment method, Table 5 shows the fractions of non-users citing each barrier as a reason for not using that method. The first column shows the fraction of non-users who reduced their check use during the previous three years, while the last column shows the fraction of non-users who either increased their check use or reported no change. The responses vary

across the barriers. For example, respondents who did not use credit cards cited fees and debt as main barriers preventing them from using credit cards, while those who did not use online banking cited privacy and theft as main reasons why they did not use that method. However, for most barriers listed in the survey, fewer than half of the non-users consider it a reason why they did not use the various payment instruments. The results confirm that consumers' tastes are heterogeneous and no single characteristic appeals or matters to most consumers. For several of the barriers, non-users who cited that barrier were less likely to have reduced their use of checks. That result is not surprising—a person who does not use ACH because of his concern about loss of privacy is much less likely to switch from checks to ACH or other electronic payment methods.

5. Check Conversion

Another group of variables provides information on consumer attitudes toward paper checks and changes in the paper checking environment. These variables fall into two broad categories: image and conversion. In general, the variables reflect consumers' views about different aspects of the move to electronic check processing, which the recent Check 21 legislation facilitated.

One implication of this movement to electronic check processing is that banks are asking paper check writers to accept electronic images of cancelled checks instead of the cancelled paper checks. The cancelled check and image variables help identify which consumers are resistant to changes in the paper check cancellation practices.

Another implication of the electronic check processing movement is that checks are being converted (or truncated) to electronic transactions at the point of sale (POS), such as the checkout counter of retail establishments, or at the "lockbox," where bills are mailed to Post Office boxes. The electronic conversion is to ACH for POS conversions and to an accounts receivable check (ARC) for lockbox conversions. The conversion (truncation) variables help identify which consumers are resistant to changes in electronic check truncation.

Finally, the issue of float is potentially important because electronic check processing generally speeds up the clearing process and reduces check float to some extent. Users that care

about float should move away from checks when float declines. Float-related variables indicate whether consumers would reduce their paper check writing if they lost their float.

Table 6 shows the fraction of users indicating their preferences related to each check conversion variable, by change in check use. The majority of users indicated that they did not care about check conversion. As was the case with the *BARRIERS* shown in Table 5, respondents who disliked check conversion were less likely to have reduced their use of checks. When the check conversion variables were included in the regressions, the coefficients were not statistically significant.

IV   Regression Results

1.   Payment Adoption

The results of the adoption regressions are in Table 7. The control (omitted) group in each regression was: respondents between 45 and 54 years old, those with a college degree, renters, and those with a household income over $100,000. The results reported in Table 7 are the odds ratios, rather than the estimated coefficients from the logit regressions. A value of 1 indicates that the independent variable neither increased nor decreased the probability of adoption of a given payment method. A value less than 1 indicates that a higher value of the independent variable is associated with a *lower* probability of adoption, and vice versa for values greater than 1. Stars next to the odds ratios indicate statistical significance of the estimated coefficients (three indicate the 1 percent level, two indicate the 5 percent level, and one indicates the 10 percent level).

Overall, very few demographic variables were significant in the adoption regressions when $CHARACTERISTICS_i$ were included. When $CHARACTERISTICS_i$ were not included in the regressions, most of the demographic variables became statistically significant but the fit was significantly worse (see Table 8). Excluding the original $CHARACTERISTICS_i$ (comparing all

payments to checks) was strongly rejected, and excluding the derived $CHARACTERISTICS_i$ (comparing non-check payments to each other) was rejected in one regression. That demonstrates the importance of accurately recording and including payment characteristics in the estimation. While characteristics are likely to be correlated with some socio-demographic attributes, they can only approximate what consumers really care about. Unfortunately, they are rarely available.

While demographic variables were only weakly important in explaining adoption of payments, the characteristics of payment instruments were more important. In estimating the probability of adoption of payment j, some characteristics of j were statistically significant. Ease of use and timing seem to be the most important factors in consumers' decision whether or not to adopt a payment method, with cost and safety also statistically significant in some regressions.

2.   Payment Use

The dependent variable s_{ij} is a fraction between 0 and 1. We estimate the share equations using OLS. The results are in Table 9. As in the adoption regressions above, we include both users and nonusers of each payment method who responded to the $CHARACTERISTICS_i$ questions.

The control group is the same as in the adoption regressions. In contrast to the adoption regressions, demographic variables were more significant in explaining the intensity of use of the various payment methods. Compared to the control group (those aged 45 to 54), younger consumers made a lower share of their payments with checks, ACH, or online banking, but a higher share with credit and debit cards. Respondents with graduate school degrees made more payments with credit cards and fewer with checks. Income and homeownership were not significant.

Several characteristics had a significant effect on the share of payments. Ease of use, cost, and record keeping were the most important characteristics affecting the share of each payment method, with safety significant in the case on online bill payments. Clearly, supply factors, such as where each payment method is accepted and practical, are important in determining the use of instruments. Nevertheless, we can explain a substantial portion of the intensity of use with the demand factors alone.

V   Use versus perception

Although previous surveys have linked the use of various payment instruments to socio-economic or demographic variables, this survey is almost unique in its richness of information about consumers' attitudes, preferences and concerns. In the sections above we showed how some of those perceptions affect the use or intensity of use of payment methods. In this section, we explore the consistency between payment use and perception.

We tested whether the barriers expressed by the respondents in questions 10-16 were consistent with their use of payments instruments. To generalize the usefulness of this information, we constructed dummy variables that incorporated each consumer's assessment of barriers for all payment instruments. An aggregate barrier variable equals 1 if the consumer checked the barrier as a reason for not adopting *any* of the payment instruments. Most of the barriers are common, or very similar, across instruments.

Those concerned about privacy or theft were significantly less likely to use debit cards, ACH, or stored-value cards, and especially less likely to use online banking. Not surprisingly, those concerned about ease of tracking payments were much less likely to use debit cards. Concern about payment fees had a strong negative effect on the use of credit cards, arguably the most expensive payment instrument. A concern about credit card debt had a negative effect on the use of credit cards, while those concerned about convenience or credit card incentives were more likely to use credit cards.

Even though empirical evidence on the issues of privacy and security of payments instruments is scarce, we can compare our survey results to some related surveys. In a 2003 survey of 4,057 US adults on the topic of Identity Theft sponsored by the Federal Trade Commission, 2.4 percent of respondents "reported misuse of their information in the last year that was limited to the misuse of one or more of their existing credit cards or credit card account numbers," while 0.7 percent of respondents reported misuse of one or more of their existing accounts other than credit cards – for example checking or savings accounts or telephone accounts (http://www.ftc.gov/os/2003/09/synovatereport.pdf).

CHUBB insurance company financed an identity fraud survey in July 2005 (see www.chubb.com). In a survey of 1,850 Americans, they found that 20% of respondents had been victims of identity fraud or theft. By comparison, in a December 2002 survey by STAR Systems (Star Systems, www.star-systems.com, "Identity Theft," December 2002), 5.5% of

respondents had been victims of identity theft. In the CHUBB survey, 95% of respondents were "concerned" about identity fraud, 27% of respondents reported that they or a family member had experienced credit card fraud, while 8% experienced check fraud. In contrast, around 80% of respondents in our sample believe that credit cards are as safe/private or more safe/private than checks.

VI   Demographics vs. characteristics

In the regressions above, we showed that characteristics play a very important role in explaining consumer payment behavior. Although socio-demographic variables remained significant in some cases, it is clear that we cannot fully explain differences in how consumers choose their payment methods by assigning them to socio-demographic groups.

A question still remains: To what extent are consumers within a socio-demographic group heterogeneous in their characteristics? When grouped by age, education and income, are their tastes and preferences are really quite similar? In this section, we analyze the heterogeneity of characteristics within and across demographic cohorts more closely.

It turns out that while some of the heterogeneity is eliminated by grouping the respondents, a substantial amount remains. We divided all the respondents into age, education, and income cohorts. For each cohort, we looked at the dispersion of characteristics on cost and ease of use of all payments, two of the most important factors. Out of 360 demographic/characteristic combinations,[12] 39 percent [CHECK] showed heterogeneous characteristics.[13] The majority of those combinations were related to the cost of payment instruments, but there was no demographic attribute that defined where characteristics were more heterogeneous (e.g., younger respondents did not have more heterogeneous characteristics than did older ones).

Clearly, characteristics of payments as viewed by consumers are important. Even with detailed information on their socio-demographic attributes, consumer preferences cannot be

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[12] There are 45 demographic combinations (5 age × 3 education × 3 income), 4 payment types (credit, debit, ACH, and online banking) and 2 characteristics (cost and ease of use).

[13] We defined a cohort as heterogeneous if all three possible responses—better than, same, worse than—were in the two-standard deviation confidence interval around a characteristic mean.

adequately accounted for, as demonstrated by the wide dispersion of characteristics in our sample among consumers with otherwise similar observable traits.

VII   Conclusions

Although we now know that the number of paper checks written in the United States is falling, there still exists very little understanding of exactly *why* check volume is declining. Moreover, many consumers have not reduced their check writing much at all, which is puzzling given the cost and convenience advantages of alternative payment methods.

This paper reports the estimates of econometric models of consumer payment choice using data from a survey of Federal Reserve System employees conducted in June 2004 and specially designed to learn why consumers choose checks versus other payment methods and why they change their payment behavior. In the survey, respondents were asked to evaluate each electronic payment method along several attributes, relative to paper checks. We provide evidence that the fundamental characteristics of payment methods – cost, convenience, security, and the like – are much more important determinants of payment choice than traditional demographic and other observable variables. Payment characteristics increase the cross-section explanatory power of payment adoption and use regressions from less than 10 percent to more than 30 percent.

[REFERENCES, TABLES & FIGURES IN SEPARATE FILES]

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Table 1: Adopters of Each Payment Instrument by Demographic Category								
			Percentage of Total Number in Each Demographic Category					
		Total Number	Checks	Credit Cards	Debit Cards	ACH	Online Banking	SVC
Age								
	Under 25	165	98	87	83	64	63	41
	25-34	796	97	85	79	75	66	38
	35-44	1356	99	85	70	72	51	33
	45-54	1539	99	87	62	69	44	36
	55-64	621	99	89	53	68	32	32
	65 or Over	17	100	100	53	70	29	41
Education								
	HS or Less	375	100	73	70	57	34	26
	Some College	1212	98	76	71	64	45	32
	College Degree	1677	99	90	68	75	52	37
	Post-Graduate School	1213	98	96	59	77	53	40
Homeownership								
	Rent	804	98	77	78	63	54	32
	Own	3673	99	88	64	72	48	36
Income								
	<50,000	749	98	73	73	61	44	31
	$50,000 - $74,999	1035	99	83	71	69	47	34
	75,000-100,000	1068	99	87	69	72	50	34
	>100,000	1511	99	95	60	76	53	39
Total		4564	99	86	67	71	49	35

Source: 2004 Boston Fed Consumer Payment Survey

Notes: An adopter is defined as one who gives a positive response on survey Question 9 for a specific payment instrument. Where no postive response was given but a number of monthly payments was indicated, the respondent was classified as an adopter.

Table 2

Comparison of Payment Method Adoption Rates

(Percent of respondents)

	2001 Survey of Consumer Finances	2003 Michigan Survey of Consumers	2004 Survey of Consumer Finances	2004 Boston Fed Survey				
				Unweighted	Education-Weighted	Income-Weighted	Age-Weighted	Own/Rent-Weighted
Check	87	---	89	99	99	98	99	99
Debit Card	50	54	59	67	69	70	69	68
Credit Card	80	---	75	86	79	80	86	85
ACH – All	44	46	47	71	64	66	70	70
Utility	13	---	18	28	22	25	27	27
Mortgage/Rent	14	---	16	30	25	23	28	26
Online Bill Payment	21	32	40	49	42	47	51	50
Stored-Value Card	---	73	---	35	31	33	36	35

Sources: Anguelov et al. (2004). 2004 Boston Fed Consumer Payment Survey.

Notes: The sample for both surveys includes only those households with a bank, thrift, or credit union account. The sample for the Fed Survey includes all respondents for check adoption, and only individuals with checking accounts for all other adoptions. Demographic weights are derived from the 2003 American Community Survey.

The reported results from the Fed Survey are tabulated from a subsample consisting solely of check users. Blank responses are considered to indicate that the respondent does not use the payment type.

Table 3: Share of Payment Instrument by Demographic Category*							
		Percentage of Total Payments in Demographic Category					
		Checks	Credit Cards	Debit Cards	ACH	Online Banking	SVC
Age							
	Under 25	17	28	34	7	8	5
	25-34	24	24	30	8	12	3
	35-44	33	21	25	9	9	3
	45-54	40	20	21	9	8	3
	55-64	45	21	16	9	7	3
	65 or Over	43	26	13	8	5	5
Education							
	HS or Less	49	11	24	7	6	2
	Some College	40	13	28	8	8	3
	College Degree	33	23	24	9	9	3
	Post-Graduate School	29	30	18	10	10	4
Homeownership							
	Rent	29	20	30	8	10	3
	Own	36	21	22	9	8	3
Income							
	<50,000	38	15	28	8	8	3
	$50,000 - $74,999	37	17	26	8	8	3
	75,000-100,000	36	19	25	8	9	3
	>100,000	31	28	19	9	9	3
Total		35	21	24	9	9	3

* Share is calculated as the number of monthly payments reported for each instrument divided by the total number of monthly payments over all instruments reported in survey Question 9. Each row should sum to 100 percent.

Table 4: Characteristics				
		Percentage of Respondents Citing Advantages/Disadvantages to Checks		
Payment Type	**Characteristics**	**Worse Than Check**	**Equal To Check**	**Better Than Check**
Credit Card	**Cost**	28	30	41
	Ease	2	14	85
	Safety	25	43	31
	Privacy	26	51	23
	Errors	11	59	30
	Timing	7	27	66
	Record	10	45	45
Debit Card	**Cost**	7	33	59
	Ease	2	9	89
	Safety	24	47	30
	Privacy	19	48	33
	Errors	9	58	34
	Timing	13	33	54
	Record	19	43	37
ACH	**Cost**	5	28	68
	Ease	3	10	86
	Safety	6	29	66
	Privacy	9	40	51
	Errors	8	46	46
	Timing	13	18	70
	Record	13	40	47
OB	**Cost**	9	20	70
	Ease	6	10	85
	Safety	24	36	40
	Privacy	28	39	33
	Errors	8	50	42
	Timing	5	16	80
	Record	8	33	59

Source: 2004 Boston Fed Consumer Payments Survey

Notes: Characteristics are constructed from survey Questions 27-31.

Table 5: Barriers				
			Percentage of Non-adopters Citing Barrier by Check Use	
			Reduced Check Use	**Same or Increased Check Use**
Payment Type	**Barriers**			
Credit Card	**Privacy**		12	23
	Theft		14	24
	Tracking		9	12
	Fees		62	61
	Debt		73	73
Debit Card	**Privacy**		20	37
	Theft		32	43
	Tracking		35	48
	Benefit		65	42
	Debit		33	32
	Debit Fees		32	43
	Overdraw		21	28
	Use		17	17
	Offer		2	3
ACH	**Privacy**		15	29
	Theft		14	27
	Tracking		15	25
	Use		9	15
	Control		37	40
	Overdraw		31	31
	Difficult		24	25
OB	**Privacy**		51	64
	Theft		42	54
	Tracking		10	19
	Expensive		23	20
	Control		18	25
	Overdraw		15	24
	Access		17	26
	Use		25	24

Source: 2004 Boston Fed Consumer Payment Survey

Notes: Barriers are constructed from Questions 10, 12, 14, and 16 asking respondents that don't use a specific payment instrument why they are non-users. Any indicated reason is coded as a barrier response. The number of respondents for the "reduced check use" category is as follows: 341 for credit card, 744 for debit card, 612 for ACH, and 1109 for OB. The number of observations for the "same or increased check use" category is as follows: 273 for credit card, 738 for debit card, 685 for ACH, and 1189 for OB.

Table 6: Check Related Preferences		
Fraction of Users Citing Preference by Check Use Change		
	Reduced Check Use	**Same or Increased Check Use**
FLOAT	32	27
RCC	23	29
LCC	26	44
DCC	11	20
NOIMAGE	8	11
ACH_PAY	14	13
ACH_STORE	3	9
ARC_PAY	2	2
ARC_CO	1	2
ARC_STOP	8	19

Source: 2004 Boston Fed Consumer Payment Survey

Notes: Number of Observations for "Reduced Check Use" category range from 2712 to 2840.
Number of Observations for "Same or Increased Check Use" category range from 1522 to 1586

Variable	**Definition**
FLOAT	Dummy variable indicating whether the consumer would write fewer checks if they lost their float.
RCC	Dummy variable indicating whether the consumer receives cancelled checks back.
LCC	Dummy variable indicating whether the consumer likes cancelled checks back.
DCC	Dummy variable indicating whether the consumer demands cancelled checks back.
NOIMAGE	Dummy variable indicating whether the consumer refuses to receive check images rather than cancelled paper checks.
ACH _ PAY	Dummy variable indicating whether consumer changed payment type when confronted with a point-of-sale ACH check conversion.
ACH _ STORE	Dummy variable indicating whether consumer changed stores when confronted with a point-of-sale ACH check conversion.
ARC _ PAY	Dummy variable indicating whether consumer changed payment type when confronted with a lockbox ARC check conversion.
ARC _ CO	Dummy variable indicating whether consumer changed company when confronted with a lockbox ARC check conversion.
ARC _ STOP	Dummy variable indicating whether consumer will choose the legal option/right to stop lockbox ARC check conversions.

Table 7: Adoption of Payment Instruments: Logit Regression					
		Odds Ratios			
Age		Credit Cards	Debit Cards	ACH	Online Banking
	Under 25	2.69	.98	1.08	2.34
	25-34	.41***	.71	1.19	.97
	35-44	.66	.97	1.13	.89
	45-54				
	55-64	2.6	.82	.54	.53*
	65 or Over	dropped	dropped	.04***	.18
Education					
	HS or Less	.84	1.83	.46	.67
	Some College	.81	.92	1.02	.87
	College Degree				
	Post-Graduate	2.57**	1.21	.96	.96
Homeownership					
	Own	1.62	1.15	1.48	1.4
	Rent				
Income					
	<50,000	0.51	.65	.39**	.46**
	50,000-74,999	1.00	1.18	.56	1.07
	75,000-100,000	1.02	1.11	.73	.79
	Over 100,000				
Characteristics					
Relative to Check	Cost	2.02*	1.04	1.09	1.88**
	Ease	1.24	2.45**	11.76***	4.97***
	Safety	0.93	2.66**	1.95	1.47
	Privacy	1.43	.69	.56	1.18
	Errors	1.12	1.45	1.23	.61*
	Timing	1.86*	4.22***	2.83***	4.10***
	Record	1.10	.65	.63	.98
Relative to Credit Cards	Cost		1.57***	1.1	1.02
	Ease		.81	.65	.71
	Safety		1.06	1.01	.92
	Privacy		1.44	1.1	.95
	Errors		1.22	1.12	1.20
	Timing		.85	.53***	.66**
	Record		1.97***	2.47***	.97
Relative to Debit Cards	Cost	1.27		1.3	.94
	Ease	1.94*		.79	.66*
	Safety	1.15		.88	1.29
	Privacy	.75		1.01	1.
	Errors	1.1		.91	.82
	Timing	2.04***		1.29	.87
	Record	0.69		.88	1.19
Relative to ACH	Cost	.72	1.08		1.12
	Ease	.96	1.89**		1.33
	Safety	1.33	.65		.98
	Privacy	.75	1.33		1.14
	Errors	1.11	1.04		1.26
	Timing	.82	.84		.78
	Record	1.03	1.41		.85
Relative to Online Banking	Cost	1.3	1.41	1.15	
	Ease	.82	.70*	.73	
	Safety	1.15	.65	.86	
	Privacy	.90	1.38	1.35	
	Errors	.96	1.04	.82	
	Timing	.70	.59**	1.07	
	Record	1.38	.91	1.18	
	Observations	1159	1159	1162	1162

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Adoption Model Evaluation: Model Fit

		Adoption of Payment Methods (Pseudo R^2)			
Payment Type	Observations	Full Model	Original CHAR Only	Derived CHAR Only	DEMOG Only
Credit Card	1159	.31	.17	.17	.14
Debit Card	1159	.37	.29	.24	.03
ACH	1162	.43	.34	.22	.08
Internet Banking	1162	.37	.31	.17	.06

Adoption Model Evaluation: Restriction Tests

		Adoption of Payment Methods (P values)			
Payment Type	Observations	Exclude DEMOG	Exclude Derived CHAR	Exclude Derived and Original CHAR	Exclude Original CHAR from model of DEMOG and Original CHAR
Credit Card	1159	.00	.12	.00	.00
Debit Card	1159	.72	.00	.00	.00
ACH	1162	.03	.23	.00	.00
Internet Banking	1162	.19	.24	.00	.00

Source: 2004 Boston Fed Consumer Payment Survey

| Table 9: Share of Payments: OLS Regression					
		Checks	Credit Cards	Debit Cards	ACH	Online Banking
Age						
	Under 25	-.07***	.08***	.05	-.02	-.05**
	25-34	-.04***	.045**	.06**	-.02***	.00
	35-44	-.01	.00	.03**	-.01	.00
	45-54					
	55-64	-.01	.02	-.03	.00	.02
	65 or Over	.06	-.03	-.05	-.05	.14
Education						
	HS or Less	.00	.00	.01	.00	.02
	Some College	.00	-.02	.02	-.01*	0.02**
	College Degree					
	Post-Graduate	-.04***	.04***	-.02	.00	.01
Homeownership						
	Own	.01	-.01	-.02	.01	.01
	Rent					
Income						
	<50,000	.01	.00	-.02	.01	.02
	50,000-74,999	.00	.00	-.01	.00	.00
	75,000-100,000	.02*	-.01	-.01	.00	-.01
	Over 100,000					
Characteristics						
Relative to Check	Cost		.02	.03*	.00	-.01
	Ease		.02	.08***	-.02*	0.02
	Safety		0.03	-.02	.01	.00
	Privacy		-.01	-.01	.00	.02
	Errors		-.03**	.01	.01	.01
	Timing		-.02	-.03*	0.01	0.01
	Record		.03***	.01	.01**	.03***
Relative to Credit Cards	Cost	.01		.05***	.00	.00
	Ease	.05***		-.01	.02***	-.01
	Safety	.01		.00	.00	.00
	Privacy	.01		-.01	0.01	.00
	Errors	.00		-.01	.00	.01
	Timing	.01		.03**	.00	-.01
	Record	.00		.03***	.00	.00
Relative to Debit Cards	Cost	.03***	.04***		.02***	.00
	Ease	.03**	.01		.01	0.02*
	Safety	.00	.00		.00	.00
	Privacy	-.01	.01		-.01	.01
	Errors	.01	.01		.00	-.01
	Timing	.00	.02**		-.01*	-.01
	Record	.02***	.03***		.01*	.00
Relative to ACH	Cost	.01	.01	-.01		.02*
	Ease	.04***	-.02	-.01		.00
	Safety	.01	.00	.00		.01
	Privacy	-.01	-.01	.02		-.01
	Errors	-.01	.00	.01		.00
	Timing	.01	.00	.00		.01
	Record	.01	.00	.01		-.01
Relative to Online Banking	Cost	.02*	-.01	.01	.00	
	Ease	.04***	.01	-.01	.00	
	Safety	.03***	-.02**	.02	.00	
	Privacy	-.01	.03**	-.01	.00	
	Errors	-.01	.02	.00	.00	
	Timing	.00	.01	.01	.01	
	Record	.04***	-.01	.00	-.01	
	Observations	1131	1057	1019	1038	951

* significant at 10%; ** significant at 5%; *** significant at 1%

Source: 2004 Boston Fed Consumer Payment Survey

Table 10: Share Model Evaluation: Model Fit

Share of Payment Methods (R^2)

Payment Type	Observations	Full Model	Original CHAR Only	Derived CHAR Only	DEMOG Only
Check	1131	.37	--	.33	.09
Credit Card	1057	.25	.12	.18	.08
Debit Card	1019	.2	.07	.14	.07
ACH	1038	.12	.04	.07	.03
Internet Banking	951	.11	.06	.06	.03

Share Model Evaluation: Restriction Tests

Share of Payment Methods (P values)

| Payment Type	Observations	Exclude DEMOG	Exclude Derived CHAR	Exclude Derived and Original CHAR	Exclude Original CHAR from model of DEMOG and Original CHAR
Check	1131	.00	.00	--	--
Credit Card	1057	.00	.00	.00	.00
Debit Card	1019	.00	.00	.00	.00
ACH	1038	.07	.00	.00	.00
Internet Banking	951	.17	.45	.00	.00

Source: 2004 Boston Fed Consumer Payment Survey

Figure 1

Total Volume of Checks Processed
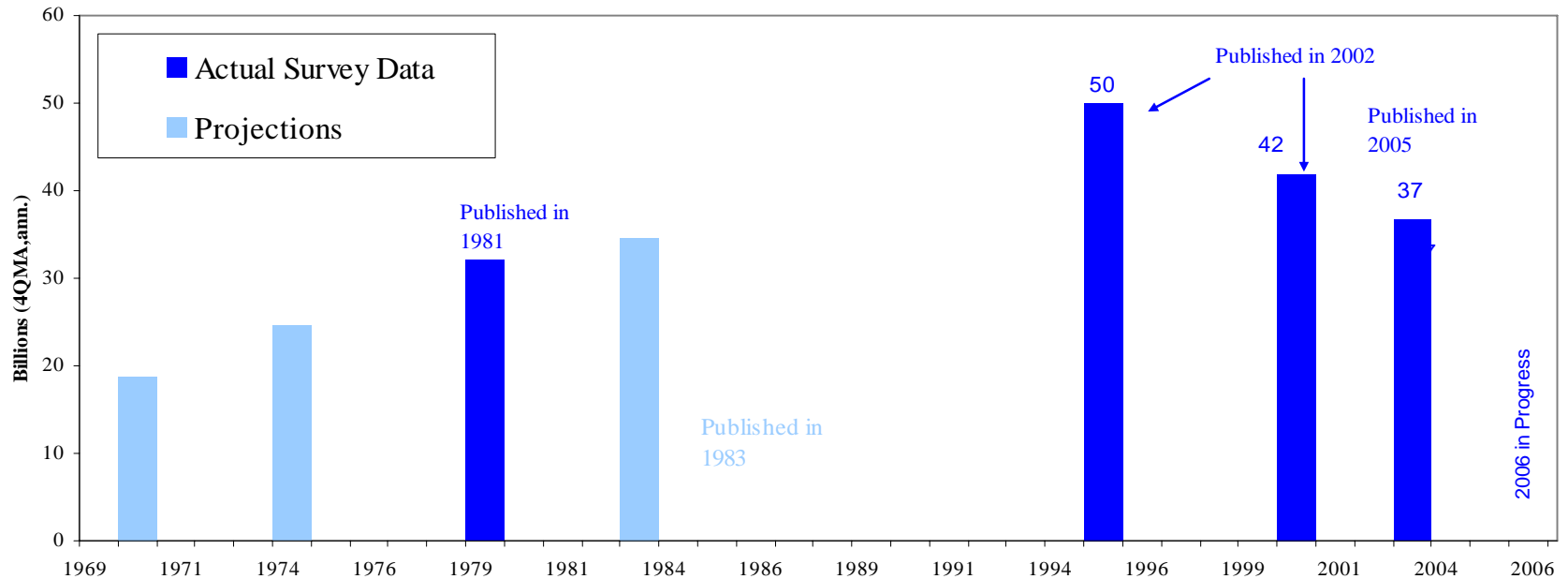
SOURCE: Benton, Blair, Crowe, and Schuh (2007).

Figure 2

Electronic Payment Adoption
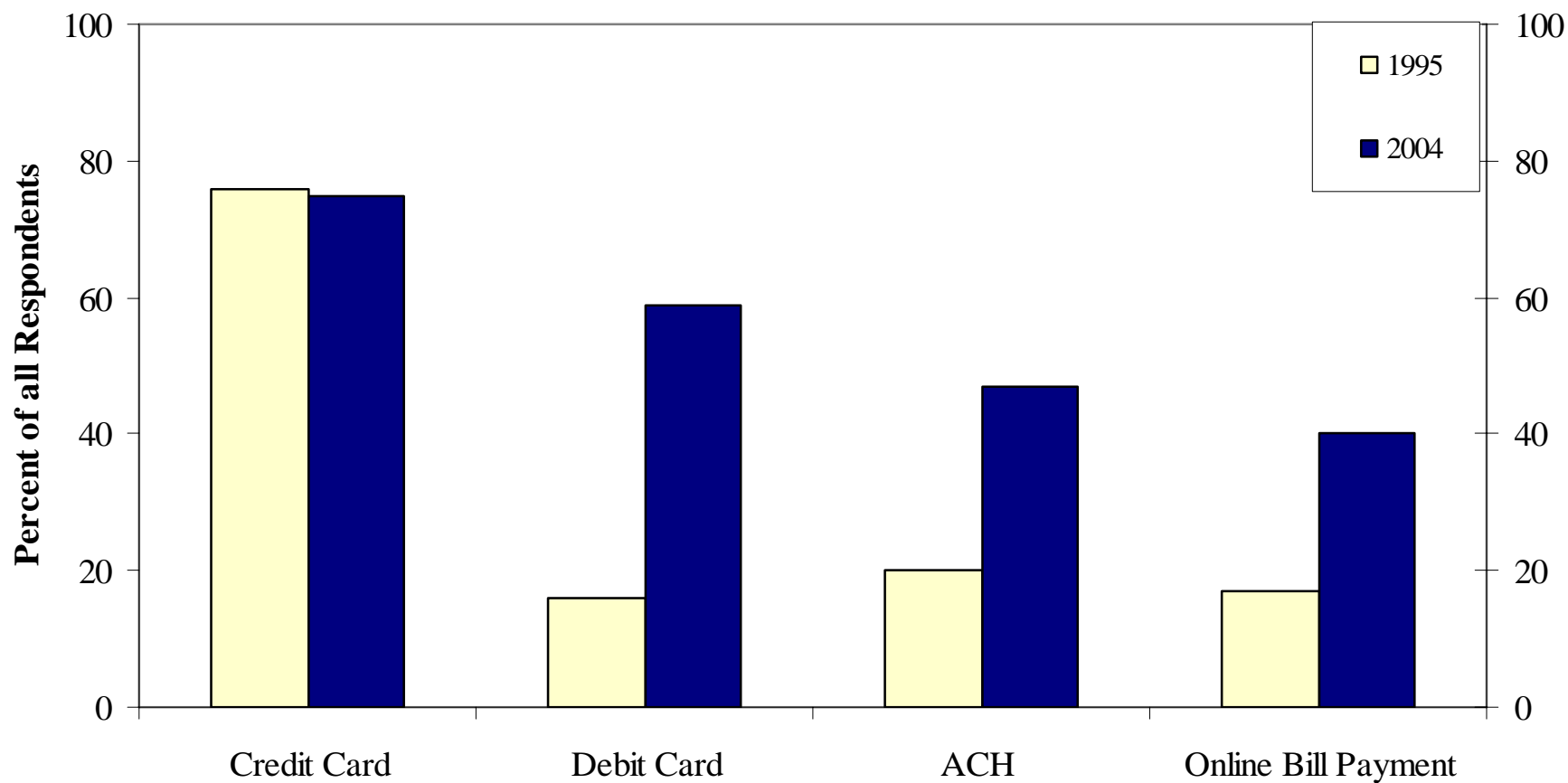
SOURCE: Survey of Consumer Finance (1995, 2004).