Payment Card Rewards Programs and Consumer Payment Choice

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Abstract

We estimate the direct effects of rewards card programs on consumer payment choice for in-store transactions. By using a data set that contains information on consumer perceived attributes of payment methods and consumer perceived acceptance of payment methods by merchants, we control for consumer heterogeneity in preferences and choice sets. We conduct policy experiments to examine the effects of removing rewards from credit and/or debit cards. The results suggest that: (i) only a small percentage of consumers would switch from electronic to paper-based payment methods, (ii) the effect of removing credit card rewards is greater than that of removing debit card rewards, and consequently, (iii) removing rewards on both credit and debit cards would reduce credit card transactions, but increase debit card transactions.

Keywords: Consumer Choice, Payment Methods, Rewards Programs, Interchange fees

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INTRODUCTION

Credit and debit card payments have been growing rapidly. To continue the growth, payment card networks keep adding new merchants to their networks. But adding new cardholders is becoming more difficult because most consumers in the United States already have both credit and debit cards.[1] To increase their market shares and card usage by existing customers, many U.S. card issuers have been offering attractive rewards programs. Since launching the new rewards programs, many issuers have seen increases in spending on both credit and debit cards.[2]

However, we know little about the sources of these increases. It is unlikely that rewards card users simply increase their spending on their credit and debit cards without changing their spending habits involving other payment methods. What payment methods are replaced by rewards credit and debit cards? To what extent do rewards card transactions replace other forms of payment transactions? How do substitution patterns vary across retail types? Do substitution patterns depend on whether consumers carry credit card debt? We seek to answer these questions in this paper.

The answers to these questions are important for the public policy debates on the current fee structure of payment card networks. A typical fee structure for a credit or debit card transaction requires a merchant to pay a merchant discount fee to its acquirer, who processes card transactions for the merchant. The major part of the merchant discount fee covers the interchange fee, which is transferred from acquirers to card issuers. In some countries, including the United States, card issuers typically pass part of their interchange fee revenue to their cardholders as rewards. But in several countries, public authorities require the interchange fees to be set based on

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[1] According to 2001 Survey of Consumer Finance (SCF) conducted by the Federal Reserve, 76 percent of U.S. households hold at least one credit card and 70 percent hold an ATM/debit card.

cost-based benchmarks, which exclude the cost of providing rewards. It is observed that after these regulations have been implemented, rewards points values are significantly lower in these countries. The reasons for these regulations are that rewards lead to distorted price signals to consumers, and may cause some consumers to choose socially less efficient payment methods (e.g., Simon [2005]). Rewards might also have negative impacts on social welfare if most consumers simply substitute rewards credit (debit) card transactions for non-rewards credit (debit) card transactions. In this case, rewards would be just monetary transfers between merchants and cardholders, and hence would not improve their total welfare much, but the society would incur additional costs to maintain rewards programs. Critics of the credit card industry have also argued that credit card rewards could increase consumers' credit card debts. In contrast, proponents of rewards programs argue that rewards can reduce total costs to the economy by inducing enough consumers to switch from a more costly payment method, such as checks, to a less costly payment method, such as debit cards.[3] They can also increase a merchant's gross benefits by increasing the total number/value of transactions.[4] The exact welfare consequences of rewards programs depend on both the social costs of various payment methods and how rewards programs affect consumer payment choice. This paper will focus on the latter—providing empirical evidence on how rewards programs influence consumer payment choice.

To the best of our knowledge, this is the first study that empirically examines the effects of rewards on consumer payment choice. We exploit a unique consumer survey data set and estimate a series of multinomial logit models that explain how the following consumer characteristics are

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[2] See, for example, *ATM&Debit News*, August 25, 2005 and December 22, 2005.

[3] Reserve Bank of Australia [2007] found that checks are most expensive payment methods in Australia. According to Garcia-Swartz, Hahn and Layne-Farrar [2006], resource costs of checks are generally higher than those of card products in the U.S.

[4] There is evidence that payment methods may affect consumers' willingness-to-pay for goods they purchase at point-of-sale. For example, Prelec and Simester [2001] and Soman [2001] found that willingness-to-pay is higher if consumers use credit/debit cards, as opposed to cash/checks.

related to the payment choice across retail types: demographics, income, technology adoption, and most importantly, the presence or absence of rewards with credit cards and/or debit cards. By using our parameter estimates, we conduct several policy experiments to quantify the effects of removing reward features from payment cards on consumer payment choice. Our policy experiments allow us to shed light on the consequences of the current policy debates on interchange fees. According to the experiences of some countries, card issuers would likely reduce the value of rewards dramatically under the cost-based interchange fees that exclude rewards costs.

Our unique data set allows us to alleviate two problems when estimating the *direct* effects of rewards programs.[5] The first problem is deciding whether to obtain rewards payment cards could be endogenous. It is likely that a typical individual who chooses to obtain a rewards credit/debit card would use it relatively more often, regardless of whether the card offers rewards. In other words, the dummy variable indicating whether the card carried rewards may be correlated with unobserved consumer heterogeneity, such as, for instance, an individual's perception of how convenient a credit/debit card is. If our intuition is correct, this selection problem will cause the effect of rewards programs to be overestimated. To handle this problem, we adopt the method proposed by Harris and Keane [1999], who used attitudinal data to control for unobserved consumer heterogeneity.[6] Our data set provides detailed measures of individual perceptions toward each payment method in terms of speed, convenience, safety, whether it helps the budget,

[5] By direct effects, we mean the presence of rewards on credit/debit cards could change consumers' current utility of using credit/debit cards. Rewards could also induce consumers to experiment and learn the attributes of credit/debit cards – we will refer this to indirect effects of rewards. Section V will give more detailed explanations about direct and indirect effects.

6. Horsky, Misra and Nelson [2006] also show that one can improve parameter estimates of brand choice models after incorporating consumer attitudinal data.

etc. We use these measures to control for unobserved consumer heterogeneity in preferences for various payment methods.

The second problem is that some consumers may perceive that only a subset of payment methods is available to them at a retail store. In other words, the choice set may vary across consumers. Ignoring the variation of choice sets could lead to biased estimates of the parameters (Bronnenberg and Vanhonacker [1996]). Still, the economics literature has typically assumed that all alternatives are available for consumers to choose because choice sets are usually unobserved to researchers. If researchers have access to panel data, it is possible to take the choice set variation into account at the expense of making strong assumptions about the process of choice set formation (e.g., Mehta, Rajiv, and Srinivasan [2003]). Our data set, which provides information on each individual's choice set, allows us to bypass this hurdle and avoid the possibility of misspecifying a model of choice set formation.

Our results indicate that including attitudinal data and controlling for choice set variation produces a substantial improvement in model fit and interpretation of estimated parameters, particularly the effects of rewards programs. The results from the policy experiments suggest that removing rewards today would only cause a small percentage of consumers switching from electronic payment methods (credit/debit cards) to paper-based methods (cash/check). The majority of consumers who currently receive rewards on credit and/or debit cards would continue to use those payment methods even if rewards were no longer offered. The effect of removing credit card rewards is greater than that of removing debit card rewards, and consequently, removing rewards on both credit and debit cards would reduce credit card transactions, but increase debit card transactions. Although there are some variations, these results are consistent across five types of retail stores we examine in the paper.

The rest of the paper is organized as follows. Section II provides the industry background. Section III reviews previous literature. Section IV describes the data set. Section V discusses the empirical model. Section VI presents the results and discusses their implications. Section VII concludes the paper.

II. INDUSTRY BACKGROUND

The payment card industry is a two-sided market.[7] Two types of end-users—merchants and cardholders—use a common payment scheme (platform). The benefits of each payment card transaction are generated only when cardholders and merchants jointly consume the services from a common payment scheme. Therefore, a cardholder's benefit of holding the payment scheme's card depends on how many merchants accept that card, and vice versa.

In a typical two-sided market, one side pays more than the other side for the usage charges of the platform. The payment card industry is no exception. In fact, it has a rather extreme pricing structure, especially in the United States. Merchants pay merchant discount fees, which include interchange fees, to their acquirers. The acquirers pass interchange fees to the card issuers. The card issuers then pass part of their interchange fee revenue to their cardholders as rewards. Thus, cardholders who hold a rewards card pay *negative* fees for the payment card transaction.

Credit card rewards have more than twenty years of history. In 1984, Diner's Club first introduced a reward program which offered airline miles to cardholding customers. Since then credit cards that provide airline miles have become very popular. In the early 1990s, rewards programs have become more diversified. For example, some issuers offer a cash-back bonus based on the purchase volume; some offer discounts on products sold by co-branded card issuers;

and some let their cardholders donate rewards points to organizations, such as charities, alumni associations, or environmental groups. As competition for cardholders intensified, issuers started offering more generous rewards points. Today, some large issuers offer three to five percent cash back bonus on purchases at certain types of retailers and one percent on other purchases. Payment card networks, such as MasterCard and Visa, recently introduced a new credit card product category called World and Signature, respectively, that offers much greater rewards points than traditional product categories, such as Gold and Platinum.

In contrast, debit card rewards are relatively new. There are two types of debit card products in the United States. One is called PIN debit—consumers type their personal identification number at the point of sale to authorize the transaction, and the other is called signature debit—consumers sign the receipt to authorize the transaction. A typical U.S. debit card can carry out both PIN and signature debit transactions. However, consumers are more likely to receive rewards when they make signature debit transactions. According to a study by Dove Consulting [2007], 37 percent of depository institutions surveyed offered debit card rewards in 2006. Among them, 63 percent offered rewards for signature debit transactions only and the rest of them (37 percent) offered rewards for both PIN and signature debit transactions.

As rewards programs have become increasingly popular and generous, interchange fees charged to merchants have also increased. The total annual interchange fee revenue of MasterCard and Visa card issuers was estimated at around $30 billion in 2006;[8] and according to Dawson and Hugener [2006], rewards account for 44 percent of interchange fees in the United States. A merchant pays different interchange fee rates for credit card transactions: non-rewards cards have the lowest fee rates, while high-end rewards cards have the highest rates. For example,

[7] See Armstrong [2006] and Rochet and Tirole [2006] for formal definitions of two-sided markets.
[8] Green [2007] estimated around $23 billion and other sources, such as finextra.com, estimated more than $30 billion.

MasterCard and Visa set the interchange fee rates for a non-rewards credit card transaction at a retail store between 1.43 and 1.58 percent, while the interchange fee rates for a high-end rewards credit card transaction at a retail store are set between 1.53 and 2.2 percent. In contrast, interchange fee rates for debit card transactions do not vary by whether the card offers rewards or not. PIN debits have the lowest interchange fee rates, which range from around 0.3 to 0.75 percent. Moreover, PIN debit interchange fees have a cap around 65 cents. Interchange fee rates for a signature debit transaction range between 0.62 and 1.05 percent, which are lower than interchange fee rates for a credit card transaction.

The differences in interchange fees among card products reflect the differences in the level of rewards that these products offer to cardholders, because rewards are mostly (if not fully) financed by interchange fee revenues. Because of the variety of rewards programs and the complexity of reward structure, it is difficult to obtain average reward rates for credit cards and debit cards. But, according to industry experts, the value of rewards received by cardholders in a typical credit card rewards program is about one percent of the purchase value, while that in a typical debit card rewards programs is about a quarter of one percent.[9]

III. PREVIOUS LITERATURE

Previous studies highlighted three important sets of factors that affect consumer payment choice: consumer characteristics, transaction characteristics, and payment method attributes. Some studies (e.g., Kennickell and Kwast [1997], Stavins [2001], and Klee [2006a]) found that demographic and financial characteristics of consumers are correlated with the use of payment methods. Hayashi and Klee [2003] found that adoption of new technologies, such as online

[9] According to the remarks by Tony Hayes, a Vice President of Dove Consulting, at the *Consumer Behavior and Payment Choice* Conference at the Federal Reserve Bank of Boston in 2006. See page 23 of Carten, Littman, Schuh, and Stavins [2007].

purchases and direct deposits, influences a consumer's adoption decision for debit cards and online bill payments. They also found that transaction characteristics, such as value of transaction and physical environment, likely influence consumer payment choice. Hirschman [1982], Mantel [2000], Jonker [2005], and Klee [2006b] found that payment method attributes or those perceived by consumers are strongly correlated with consumer payment choice. When estimating the effects of rewards on consumer payment choice, our study will control for these three sets of factors.

Another important factor that could affect payment choice is the price of payment methods. Most previous studies did not include this factor because very few data sets contain price information in conjunction with consumer payment choice. There are a few exceptions: Humphrey, Kim, and Vale [2001] estimated price elasticity for various payment methods by using Norwegian aggregate level data; Amromin, Jankowski, and Poter [2005] examined how consumers respond to differentiated pricing of cash and electronic toll payment on the Illinois tollway; Borzekowski, Kiser, and Ahmed [forthcoming] examined how fees assessed by banks on debit card transactions affect consumer payment choice; and Zinman [2008] considered the price of a credit card charge is a critical margin and examined how it affects consumer payment choice between credit and debit cards. All of them suggest that consumers are price sensitive. Our paper investigates the impact of rewards programs on consumer payment choice. Although whether a consumer receives rewards is not price information per se, it can be viewed as a proxy for negative per-transaction fees of credit and/or debit cards. Thus, to some extent, our study estimates how sensitive consumers are with respect to the price of payment methods.

Merchant acceptance of payment methods is also an important factor that could affect consumer payment choice, but due to data limitation, previous studies did not consider this factor. Rysman [2007] is an exception. He found that a consumer's favorite card network is positively correlated with the number of local merchants who accept that network's cards. Our paper considers this factor in a different way. Since our data includes consumer perceived acceptance of payment methods by type of merchants, we control for consumer choice set of payment methods by using this information.

IV. DATA

Our data set is the 2005/2006 Study of Consumer Payment Preferences conducted by the American Bankers Association and Dove Consulting. Data were collected using paper and Web-based surveys sent to U.S. consumers in 2005. A total of 3,008 completed surveys were received. Of those, 2,350 were submitted via the Web, and 658 were submitted on paper. Although the survey sample is not nationally representative, the survey contains rich information about consumer payments, which is usually not available in nationally representative data sources.[10] Key features of our data are as follows.

First, our data set includes information on whether a consumer received rewards for using credit cards and debit cards, respectively. This allows us to examine whether credit/debit rewards receivers' payment choice is different from non-rewards receivers'.

Second, in addition to individual demographic characteristics, the survey asked each respondent to provide his/her perceptions toward each in-store payment method. Typically, a consumer's perceptions are not easily observed. Even when they are observed, empirical researchers rarely incorporate them into their econometric analysis. We will argue that this type of data allows us to control for unobserved consumer heterogeneity that could lead to severe bias in estimates of the effect of rewards programs.

[10] For instance, Survey of Consumer Finance (SCF), which is conducted triennially by the Federal Reserve, contains much less information on consumer payment than our data.

Third, the survey asked about the most frequently used payment method by retail type, which includes grocery stores, department stores, fast food restaurants, discount stores, and drug stores. A respondent chooses one out of five payment methods—cash, check, credit card, PIN-debit card, and signature-debit card. We interpret the most frequently used payment method as the payment method chosen by the consumer when estimating an individual level discrete choice model. Although our data set does not contain information on transaction characteristics, the variation of transaction characteristics may be limited conditioning on the retail type. For example, transaction values made in fast food restaurants are typically quite small. To some extent, this type of data allows us to control for the transaction characteristics.

Lastly, the survey asked about which payment method the respondent believes is accepted by merchants in each retail type. We assume that a payment method belongs to a consumer's choice set in a particular retail type if the consumer believes it is accepted by merchants in that retail type. This allows us to control for consumer heterogeneity of choice set, which could also lead to bias in parameter estimates.

We construct our sample by excluding consumers who have missing information regarding consumer characteristics, perceptions toward in-store payment methods, and card-related status, such as a balance on credit card and rewards on credit and/or on debit cards. We also exclude consumers who do not have a bank account or do not hold either a credit or debit card because our focus is to examine the difference in payment choice between rewards receivers and non-rewards receivers, not between cardholders and non-cardholders. This process leaves a total of 1,979 responses. Compared with the general U.S. population, income and educational levels are relatively higher in our sample (Table I). Finally, when estimating our multinomial logit models, we exclude responses with missing information about the most frequently used payment method in a given type of store. This leaves 1,915 responses for grocery stores; 1,798 for department stores; 1,761 for discount stores; 1,846 for drug store; and 1,813 for fast food restaurants.

Table I also compares the characteristics of rewards receivers (either on credit cards or debit cards) with those of the entire sample. Consumers who have higher income and higher educational levels are more likely to hold rewards cards. Rewards card holdings also vary by consumer gender, ethnicity, residential region, and technology adoption behavior. Age, however, seems to have no effects on rewards card holdings.

Table II shows statistics on reward receivers in our sample. About 36 percent of consumers receive rewards via either credit cards, debit cards, or both.[11] Approximately 32 percent of our sample receive rewards on credit cards and 14 percent receive rewards on debit cards. About 9 percent of our sample receive rewards on both credit and debit cards. Almost all consumers who receive rewards on debit cards receive rewards when they make signature-debit transactions and only half of them receive rewards when they make PIN-debit transactions.

Table III provides summary statistics on consumer perceived payment method attributes. We observe 11 attributes of each payment method perceived by consumers: Comfortable and Fast are measured by a scale of 0-5;[12] Convenient, Easy to use, Preferred by stores, Safe, (money) Taken right away, Help me budget, For small amounts, Control over money, and Easy-to-get refund are measured by dummy variables. Panel (A) shows the entire sample's average scores. Cash receives the highest score for nine out of 11 attributes (the exceptions are Taken right away and Easy-to-get refund); credit cards have the highest score for only one attribute (Easy-to-get refund), but have the second highest score for six attributes (Comfortable, Fast, Convenient, Easy

[11] We will discuss if the share of consumers who receive rewards in our sample is too low or too high and how it affects our results in Appendix A.

[12] For Comfortable and Fast, 0 means "not use;" 1 means "not comfortable/very slow;" and 5 means "completely comfortable/very fast."

to use, Preferred by stores and Safe); consumers tend to give the lowest score to checks, but they feel more comfortable with checks than with debit cards; and PIN-debit tend to receive higher scores than signature-debit for all attributes. Panel (B) shows the average scored by respondents' reward status. Not surprisingly, credit and signature-debit cards are perceived more positively by consumers with credit card rewards and signature-debit rewards, respectively, than consumers without those rewards. Compared with these two cards, the differences in scores for PIN-debit cards by consumers with and without PIN-debit rewards are less clear for variables other than Comfortable and Fast.

Table IV presents the percentage of consumers who perceive each payment method to be accepted by retail type. Cash is perceived to be the most widely accepted by grocery stores, discount stores, drug stores, and fast food restaurants. Credit cards are perceived to be the most accepted by department stores. PIN-debit cards are perceived to be less widely accepted than credit cards but more widely accepted than signature-debit cards. Interestingly, some consumers are not aware that almost all stores that accept credit cards also accept signature-debit cards—their differences in perceived acceptance rates range from 20 to 30 percentage points across retail types. The perceived acceptance rates of checks lie between those of cash and credit cards except at fast food restaurants, at which only 11 percent of them perceive checks to be accepted.

Figure I presents the share of consumers who chose a particular payment instrument as their most frequently used payment method by retail type. Consumers are grouped into eight groups, according to the status of their credit card balance, debit card rewards, and credit card rewards. Four observations can be made from this figure. First, perhaps the most noticeable observation is that the majority of group 6, which consists of individuals without a credit card balance, without debit card rewards, and with credit card rewards, choose credit cards as their most frequently used payment method at grocery, department, and discount stores. This group also has the highest credit card share at drug stores and fast food restaurants. Second, given the status of their credit card balance and debit card rewards, consumers who receive credit card rewards are more likely to choose credit cards as their most frequently used payment method than those who do not receive credit card rewards. Third, given the status of their credit card balance and credit card rewards, consumers who receive debit card rewards are more likely to choose debit cards than those who do not receive debit card rewards, except for consumers who carry a positive credit card balance and do not receive credit card rewards. Fourth, conditioning on receiving rewards on credit cards only, consumers who do not have a positive balance on credit cards are more likely to choose credit cards than those who have a positive balance.

These observations indicate that credit card rewards, debit card rewards, and credit card balance are correlated with consumer payment choice. However, it should be emphasized that these observations are merely statements regarding how the data look like from the perspective of an analyst—they are not statements about causality. In particular, one should not draw inference about the effects of rewards on payment choice from this figure because whether a consumer chooses to obtain a rewards credit card or rewards debit card may depend on his/her preference for credit cards or debit cards in the first place. The next section discusses how we address this endogeneity issue using the data on consumer perceived attributes of payment methods.

V. ESTIMATION

This section discusses the econometric model specifications. For each retail type, we estimate four specifications of a multinomial logit model that explains which payment method is chosen by a consumer as the most frequently used method.

We first discuss a specification by assuming a typical situation faced by econometricians, where the data on consumer perceptions toward each payment method were not available. This specification will help us explain the endogeneity problem of the rewards program. We assume that utility to consumer *i* from using payment method *j* when making a transaction at retail type *h* is defined as follows:

$$U_{ijh} = \alpha_{jh} + X_i \beta_{jh} + C_{ij} \delta_{jh} + \varepsilon_{ijh} + e_{ijh}, \tag{1}$$

where X_i is a vector of consumer characteristics; C_{ij} is a vector of card-related dummies; ε_{ijh} captures the unobserved consumer preferences for payment method *j* at retail type *h*; and e_{ijh} captures the measurement errors and is assumed to be *i.i.d.* α_{jh} measures the mean utility from payment method *j* at retail type *h*, regardless of consumer characteristics and card-related status. β and δ are vectors of utility weight for X_i and C_{ij}, respectively. In particular, δ captures the *direct* effect of the card-related dummies (including the rewards dummies). For each retail type *h*, consumer *i* chooses a payment method *j* to maximize his/her utility. There are five payment options: credit card, PIN-debit card, signature-debit card, check, and cash.

If C_{ij} is uncorrelated with ε_{ijh} and e_{ijh}, one can estimate this specification using a multinomial logit or probit model and obtain consistent estimates on the reward dummies. However, it is likely that the dummies for rewards programs are positively correlated with ε_{ijh}. This could be due to three reasons. First, some consumers choose to get a rewards credit/debit card because they had been using this payment method relatively more often due to higher ε_{ijh}. The benefits of obtaining rewards cards for them are relatively higher and hence they are more likely to spend search costs (or in some cases they may pay an annual fee) to join a rewards program that suits them well. Second, in order to compete for market shares, card issuers may send pre-approved rewards credit/debit card invitations to consumers who have been heavily using credit/debit cards. It is likely that these consumers have higher ε_{ijh}. Third, rewards programs may have an *indirect effect* on consumers' choice of credit/debit cards by improving consumers' attitudes toward those cards. Some consumers may have had seldom used credit/debit cards prior to receiving a rewards card, but the incentive of earning rewards may have induced them to use the card more often. Since then they may have learned the good features of credit/debit cards and changed their attitudes toward credit/debit cards more favorably (i.e., improving ε_{ijh}). Thus, consumers who have a rewards credit/debit card may have higher ε_{ijh} than consumers who do not have a rewards card. Because of this positive correlation between C_{ij} and ε_{ijh}, δ, which captures the direct effects of rewards, would probably be overestimated in this specification.

To handle this positive correlation, our approach here is to use the data on consumer perceptions toward payment methods as a proxy for ε_{ijh}. The idea is that if we can control for ε_{ijh}, then it is possible to obtain consistent estimates of the effect of rewards programs. As pointed out by Harris and Keane [1999] and Keane [2004], using consumer attitudinal data to control for unobserved consumer heterogeneity is an alternative to the conventional econometric approach of using instrumental variables.[13] But, unlike instrumental variables, this approach works in non-linear models, such as the multinomial logit model considered here. We use 11 consumer perceived attributes of each payment method discussed in section IV. It is important to note that (i) this type of attitudinal data is not typically observed and (ii) all of them are subjective measures reported by individual consumers, which could potentially capture a significant amount of consumer heterogeneity in preferences. In the full specification of our model, utility to consumer *i* from using payment method *j* when making a transaction at retail type *h* is defined as follows:

[13] Note that we use the term *attitudinal* data and *perception* data interchangeably in this paper.

(2) $$U_{ijh} = \alpha_{jh} + X_i \beta_{jh} + C_{ij} \delta_{jh} + Z_{ij} \gamma_h + e_{ijh},$$

where Z_{ij} is a vector of attributes of payment method *j* evaluated by consumer *i*. We normalize the utility of choosing cash as:

(3) $$U_{i\,\mathrm{cash}\,h} = Z_{i\,\mathrm{cash}} \gamma_h + e_{i\,\mathrm{cash}\,h}.$$

It is worth pointing out that we do not assume a priori that the attitudinal data are a good proxy for individual level preferences. Instead, we will let the choice model tell us whether the attitudinal data is informative or not. As shown in the next section, the attitudinal data improve the fit of our model significantly.

There are two limitations in our approach. First, the full specification does not capture the indirect effect of rewards, which improves ε_{ijh}. As discussed above, this indirect effect could be due to consumer learning of the good features of credit/debit card. To identify the indirect effect, one would need panel data, which follows individual consumers, and see how they have changed their perceptions over time. Since our data is cross-sectional, we cannot explicitly estimate the indirect effect of rewards here.

Another limitation of our econometric specification is that the coefficients for reward dummies (δ_{jh}) are assumed to be homogeneous across consumers. Conceivably, they could be heterogeneous and another selection problem may exist. Consumers who choose to obtain a rewards card are likely to be more sensitive to rewards (i.e., they have relatively high value of δ_{ijh}). This heterogeneity in δ_{ijh}, however, cannot be controlled for by using consumer perceptions because none of the survey questions asked about consumer perceptions toward rewards or how they value rewards. One way to address this selection problem is to make a distributional assumption on δ_{ijh} and model the consumer decision to get a rewards card explicitly. For example, one could model whether to get a rewards card and which payment method to use as a two-stage problem. In the first stage, consumers decide whether to get a rewards card or not. In the second stage, based on their first stage decision, consumers decide which payment method to use at different retail stores. One could then estimate this two-stage model by using simulation-based estimation methods. However, because the second stage consists of five retail types, estimating such a two-stage model requires us to estimate five choice models simultaneously. This is computationally very demanding, and beyond the scope of this paper.[14] If this selection problem is important, we may overestimate the mean effects of rewards. We therefore note that it is more appropriate to interpret our estimates on the reward dummies as the upper bound of the average direct effect of rewards on payment choice.

We estimate four model specifications. They depend on whether the specification includes consumer perceptions, and whether the set of payment methods available to consumers is homogeneous or heterogeneous across consumers. As for the homogeneous choice set, we assume that all consumers can select from five payment methods: credit card, PIN-debit card, signature-debit card, check, and cash. As for the heterogeneous choice set, we assume that an individual's choice set consists of payment methods that the individual believed are accepted at a given type of store.

Controlling the variation of individual's choice set is potentially important, but it is difficult to tell which specification—homogeneous or heterogeneous choice set—is more appropriate a priori. If a consumer's decision about which retail stores to visit does not depend on the payment methods accepted by the stores, modeling choice sets to be heterogeneous will be more accurate and help avoid misspecification bias. If, on the other hand, consumers choose which payment method to use before choosing which stores to visit (i.e., they only visit stores that

[14] For each retail type, there are 63 parameters. This implies that a two-stage model will have more than 315 parameters to be estimated jointly.

accept their most preferred payment method), then the homogeneous choice set will be more appropriate in capturing the consumer's choice behavior over payment methods. In general, the reality probably lies somewhere between these two extreme situations. This is why we estimate both specifications to see how robust the results are.

VI. RESULTS

VI.A. Estimation of the Most Frequently Used Payment Method by Retail Type

The estimation results for the perception variables and card related dummies are reported in Tables V, VI, and VII.[15] Table V shows the log-likelihood of all four specifications for the five types of retail stores. The table confirms that including attitudinal data improves the fit of our model significantly. Under the homogeneous choice set, including attitudinal data improves the log-likelihood the most for grocery stores (by 920) and the least for fast food restaurants (by 230). For department, discount, and drug stores, the log-likelihood is improved by about 600 to 700. This is also true when the choice set is allowed to vary by individual, although the magnitude of improvement is smaller. These results suggest that the consumer's perceptions toward each payment method capture a large amount of consumer heterogeneity in preferences for payment method at all five types of stores. The table also reveals that allowing for heterogeneous choice set improves log-likelihood significantly: Without consumer perception variables (specifications 1 and 3), the improvement in log-likelihood ranges from 442 (fast food restaurants) to 856 (discount stores); with consumer perception variables (specifications 2 and 4), the improvement in log-likelihood ranges from 281 (grocery stores) to 607 (discount stores). This indicates that including the information on choice set has also improved the goodness-of-fit significantly.

[15] Due to the space constraint and the focus of this paper, we do not discuss the estimates of the consumer characteristics. We report them in Appendix B.

Table VI presents coefficients for reward dummies as well as for a dummy that indicates whether a consumer has zero balance on credit cards or not. The results are consistent with our endogeneity arguments discussed in the previous section. Regardless of whether we model choice sets to be homogeneous or heterogeneous, these dummies have consistently become less significant across retail types after incorporating the perception variables (see specification 1 vs. 2 and 3 vs. 4). In particular, rewards on PIN-debit are significant in specifications 1 and 3 for grocery and drug stores, but they become insignificant in specifications 2 and 4. This suggests that the endogeneity problem is not merely a theoretical concern. The point estimates of the reward dummies have also consistently reduced after incorporating the perception variables. However, due to the non-linear nature of the multinomial logit model, we cannot interpret this as evidence that the reward dummies are overestimated if the perception variables are missing. In the following subsection, we will demonstrate the magnitude of the bias by showing how the choice probabilities change as we move from specifications without perception variables (specifications 1 and 3) to ones with perception variables (specifications 2 and 4).

Although the estimates have become less significant after controlling for the perception variables, the credit card reward dummy remains statistically significant for all types of retail stores and the signature-debit reward dummy remains significant for all retail types but fast food restaurants.[16] We interpret this as evidence that the existing rewards programs on credit cards and signature-debit cards increases consumers' likelihood of choosing these payment methods. After incorporating the perception variables, the dummy indicating zero balance on credit cards remains positive and significant for grocery stores, drug stores and fast food restaurants. This suggests that although carrying a credit card balance discourages consumers to use a credit card at these three retail types, it does not have any significant effects on their choice at department and discount stores. This may be because the transaction value at department and discount stores is typically larger than that at other retail types and consumers may feel natural to use a credit card to borrow from their future incomes when purchasing items that are relatively more expensive.

Finally, Table VII reports coefficients for perception variables, which are included in specifications 2 and 4. Comfortable and Fast are measured by 0-5 scale, while the other variables are dummies. For both specifications, all of the perception variables have expected signs and most of them are highly statistically significant across retail types except fast food restaurants. For fast food restaurants, only four out of 11 perception variables are significant at the 1 percent level. Overall, Comfortable and Convenient seem to be the most crucial perception variables that influence consumer payment choices. Fast is significant for all types of stores but the magnitude of the coefficient for Fast is much smaller than that for Comfortable. Interestingly, Safe is not a crucial variable and this may be because consumers feel safe to any payment methods at the point of sale nowadays.

It should be noted that for Comfortable/Fast variables we treat 0 as "least comfortable/slowest," and 5 as "completely comfortable/fastest," in the estimation. In the survey, however, 0 refers to "not use this payment method." Although our interpretation seems reasonable for Comfortable, it may be problematic for Fast. As a robustness check, we estimate specifications 2 and 4 for all retail types by excluding the Fast variable, and find that the estimation results have hardly changed.

The results confirm that the perception variables are able to control for a large extent of consumer heterogeneity in their preferences for payment methods. The coefficients in the

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[16] It seems reasonable that rewards on debit cards are insignificant at fast food restaurants because (i) rewards on debit cards are typically less generous than those on credit cards and (ii) the dollar value of transactions at fast food

specification with homogeneous choice set (i.e., specification 2) are remarkably similar to those in the specification with heterogeneous choice set (specification 4). This indicates that our results are robust regardless of how we model consumers' choice sets.

VI.B. The Effects of Removing Rewards

Our goal is to address the following question: how would consumers change their payment choice if their payment cards no longer offer rewards? The answer to this question is relevant to the current policy debates on interchange fees. Lately, regulatory authorities in several countries have regulated or scrutinized interchange fees.[17] Most notably, in 2003 the Reserve Bank of Australia mandated three credit card networks to set interchange fees based on the cost-based benchmark, which excludes the costs of providing rewards. As a result, interchange fees have been lowered substantially and the value of reward points has also been greatly reduced in Australia.[18] Since a substantial portion of the interchange fees is used to cover the costs of rewards programs in the United States, if this policy is implemented, it seems likely that the U.S. card issuers will also reduce the value of reward points dramatically. Our policy experiments, which remove the reward feature from payment cards, allow us to shed light on the consequences of a policy of disallowing card issuers to use interchange fees to cover the costs of their rewards programs.[19]

To quantify the effects of payment card rewards on payment choice, we conduct three policy experiments that remove the reward feature of (i) credit cards, (ii) debit cards, and (iii) both credit and debit cards. We use specification 4, which includes perception variables and assumes

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restaurants is usually small.

[17] See Bradford and Hayashi [2008] for the regulations in those countries.

[18] See Table 7 (p.12) of the 2006 Payments System Board Annual Report by the Reserve Bank of Australia.

[19] In March 2008, a bill entitled "Credit Card Fair Fee Act of 2008" was introduced by the U.S. House Judiciary Committee. And currently, the U.S. Congress is discussing whether and how to regulate interchange fees. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h5546ih.txt.pdf.

heterogeneous consumer choice set, because of its superior goodness-of-fit. We note that the results are robust even if we use specification 2, which includes perception variables and assumes homogeneous consumer choice set. Our key identification assumption is that consumer perceptions toward payment methods would remain unchanged after rewards were removed. We believe that this is a reasonable assumption. Some consumers may have improved their perceptions toward payment cards after joining a rewards program, which induces them to use payment cards more frequently. However, once they learned the cards' features, their perceptions or attitudes toward payment cards (such as Comfortable, Fast, etc) would likely remain unchanged even if consumers no longer receive rewards.

VI.B.1. The Effects of Removing Rewards on Credit Cards

We now discuss the results from our first policy experiment: what would happen if rewards on credit cards were removed today? Obviously, this policy experiment only affects consumers who currently receive rewards on credit cards. We divide these consumers into two groups: (i) consumers who receive rewards on credit card only (CC rewards only) and (ii) consumers who receive rewards on both credit and debit cards (CC&DC rewards). For each group, we calculate the average probability of choosing each of the five payment methods before and after the policy is implemented. Figure II shows the effect of the policy on these two groups of consumers in five types of retail stores separately: grocery (G), department (De), discount (Di), drug (Dr), and fast food (F). Each retail type is represented by a bar. The height of the entire bar represents the probability of choosing credit cards before the policy is implemented, and the blue area represents the probability of choosing credit cards after the policy is implemented. The red and yellow areas represent the increases in the probability of choosing either type of debit cards and the probability of choosing paper-based methods (cash and checks), respectively, after the policy is implemented. The left five bars show the effects on the first group of consumers and the right five bars show the effects on the second group.

Both groups of consumers would reduce their probabilities of choosing to pay with a credit card at all types of stores if rewards on credit cards were removed. The reductions range from 3.3 (F) to 11.4 (G) percentage points for consumers with CC rewards only, and from 2.5 (F) to 10.1 (De) percentage points for consumers with CC&DC rewards. The percentage point reduction in the probability of choosing credit cards is the smallest at fast food restaurants for both groups. This is probably because rewards are typically expressed in terms of percentage of the transaction value, and the average transaction value at fast food restaurants is much smaller than that at the other types of stores. Grocery and department stores have the largest percentage point reduction in the probability of choosing credit cards (around 10 percentage points). This probably reflects that the average transaction value at department stores is generally larger than that at the other types of stores, which results in higher average reward points earned per transaction. Overall, we find that the reductions in probability of choosing credit cards vary across retail types, and their magnitudes are moderate. Assuming that reward credit cardholders always receive rewards from their credit card transactions before the policy is implemented, and the number of transactions made by each consumer remains unchanged under this policy experiment, our results indicate that the majority of rewards credit card transactions would be replaced by non-rewards credit card transactions if rewards on credit cards were removed.

How do the substitution patterns vary between two groups of reward credit card holders and across types of stores? For consumers with CC&DC rewards, the likelihood of switching to debit cards is much higher than that to paper-based methods except at fast food restaurants. In contrast, for consumers with CC rewards only, the likelihood of switching to debit cards is slightly lower than that to paper-based methods except at department stores. This is quite intuitive because consumers with CC&DC rewards have more incentives to use a debit card than consumers with CC rewards only. These results are consistent with the common beliefs that consumers prefer cash for small value transactions and they prefer payment cards for large value of transactions.

We now turn to discuss what happens if we conduct the same policy experiment by using specification 3, which does not include perception variables (but assumes heterogeneous consumer choice set). By comparing the policy experiment results from specifications 3 and 4, we are able to quantify the importance of controlling for consumer heterogeneity in consumers' attitudes toward payment methods when examining the effect of removing rewards. Figure III shows the effects of the policy using specification 3. There are two key differences between specification 3 (Figures III) and specification 4 (Figure II). First, the predicted reductions in the probability of choosing credit cards due to the policy are much larger when using specification 3. At grocery stores, specification 3 predicts that more than half of the rewards credit card transactions are estimated to be replaced by debit cards and paper-based methods, almost double the prediction of specification 4. At the other four types of stores, specification 3 still predicts that the majority of the rewards credit card transactions would be replaced by non-rewards credit cards; however, the magnitudes are much smaller compared with specification 4. For example, in the case of department store transactions by consumers with CC rewards only, about 88 percent and 71 percent of rewards credit card transactions are replaced by non-rewards credit card transactions under specifications 4 and 3, respectively. Second, the estimated increases in the likelihood of choosing paper-based methods and debit cards are both higher under specification 3. The differences in the estimated increases in the likelihood of choosing these methods are slightly greater for consumers with CC rewards only: They range from 1.7 (F) to 4.2 (De) percentage points for paper-based methods, and from 0.4 (F) and 7.8 (De) percentage points for debit cards.

These findings confirm the importance of incorporating consumer perceptions toward payment methods. It also indicates that the policy experiments based on a model without perception variables could generate misleading policy implications. It is possible that specification 4, which incorporates perception variables, would suggest the policy of removing credit card rewards today would result in cost-saving for the society, while specification 3, which does not incorporate perception variables, would suggest that the same policy would lower the social welfare because it predicts that the policy would cause many more consumers to switch from credit cards to more-costly paper-based payment methods.

Critics of the credit card industry have argued that credit card rewards could increase consumers' credit card debts. In order to shed light on this public policy debate, we consider how consumer reaction to the policy of removing rewards from credit cards varies depending on whether consumers carry a positive credit balance or not. We divide consumers with rewards on credit cards only into two groups: (i) consumers with a positive credit card balance, and (ii) consumers without a balance. Figure IV presents the effects of removing credit card rewards on these two groups of consumers' average probability of choosing credit cards. In the figure, each type of stores has two bars: the left bar represents the consumers with a balance and the right bar represents the consumers without a balance. It should be highlighted that consumers with a balance are far less likely to choose a credit card at all types of stores before the policy is implemented. This suggests that consumers with a credit card balance may be discouraged to use credit cards because of their high interest rates. After implementing the policy, both groups would reduce their probability of choosing credit cards. In particular, consumers with a balance would reduce their probability by 3 (F) to 12 (De) percentage points. This may imply that the policy of removing credit card rewards could provide some non-trivial effects in reducing consumers' credit card debts. This, in turn, could increase the welfare for consumers who carry credit card balance, but reduce card issuers' revenue from interest charged on the balance.

VI.B.2. The Effects of Removing Rewards on Debit Cards

We now turn to discuss the results from the second policy, which removes rewards on debit cards. We divide consumers who would be affected by the policy into two groups: (i) consumers who receive rewards on debit card only (DC rewards only) and (ii) consumers who receive rewards on both credit and debit cards (CC&DC rewards). We calculate each group's average probabilities of choosing credit cards, debit cards, and paper-based methods before and after the policy is implemented. Similar to Figure II, Figure V shows the effect of the policy on the two groups of consumers. In this figure, the height of the bar (measured from 0 percent) represents the probability of choosing debit cards before the policy is implemented. The left five bars show the effects on consumers with DC rewards only, and the right five bars show the effects on consumers with CC&DC rewards.

At all types of stores except fast food restaurants, both groups of consumers would reduce their probability of choosing debit cards if rewards on debit cards were removed.[20] In general, the reductions are much smaller than those of choosing credit cards under the first policy. They range from 2.1 (Di) to 6 (Dr) percentage points for consumers with DC rewards only, and from 3.4 (Di) to 7.5 (De) percentage points for consumers with CC&DC rewards. This may reflect the fact that rewards on debit cards are typically much less generous than those on credit cards. Consumers with CC&DC rewards would be more likely to substitute credit cards than paper-based methods for debit cards, while consumers with DC rewards only would be more likely to do the opposite. The main message of this experiment is the same as the first experiment: the majority of rewards debit card transactions would be replaced by non-rewards debit card transactions if rewards on debit cards were removed.

VI.B.3. The Effects of Removing Rewards on both Credit and Debit Cards

Finally, we consider the third policy that removes rewards on both credit and debit cards. This policy affects three groups of consumers: (i) consumers with rewards on credit cards only, (ii) consumers with rewards on debit cards only, and (iii) consumers with rewards on both credit and debit cards. Because the effects of this policy on the first two groups of consumers have already been analyzed in the previous subsections, we will only consider the effects on the third group here. In Figure VI, two bars are shown for each type of stores: the left bar represents the probabilities of choosing credit cards, debit cards, and paper-based methods before the policy is implemented, and the right bar represents the probabilities after the policy is implemented.

Consumers with rewards on both credit and debit cards would reduce their probability of choosing credit cards at all types of stores; however, the reductions in the probability of choosing credit cards under this policy are much smaller than those under the first policy. For example, the probability of choosing credit cards at grocery store would be reduced by 6.9 percentage points under the first policy, while it would be reduced by 4.8 percentage points under this policy. On average, the probabilities of choosing debit cards would decrease at grocery and drug stores, while they would increase at department stores, discount stores, and fast food restaurants. The probability of choosing paper-based methods would increase at all types of stores, and the increases range from 1.0 (F) to 6.3 (Dr) percentage points. Similar to the first and second policies,

[20] The reason why the probability of choosing debit cards would increase at fast food restaurants is that debit reward

we find that most of the rewards credit (debit) cards users would keep using credit (debit) cards even if there were no rewards.

VI.B.4. The Overall Effects of Removing Rewards

We have shown how the policies that remove rewards on payment cards affect consumers who currently receive rewards. Policymakers and industry participants would also be interested in the overall effects of the policies—how the changes in these consumers' payment choice affect the entire payments market. However, aggregating the effects is very difficult. First, our analysis is limited to consumer payment choice for in-store transactions, but consumers also make payments for bills and online purchases. Second, even among the five retail types, it is still difficult to aggregate the effects of the policies because the number of transactions each consumer makes at each type of stores is not observed. Therefore, instead of examining the aggregate effects on the entire payments market, we focus on examining the aggregate effects at each of the five retail types. The analysis is still useful for policymakers because transactions at these five retail types account for a large share of the in-store transactions. For each retail type, we calculate the average probabilities of choosing certain payment methods (credit cards, debit cards, or cash and checks) of all consumers in our sample before and after implementing the policy. If we assume that all consumers make the same number of transactions at a given type of stores, then the average probabilities can be translated into the share of certain payment methods at each type of stores. Although this is a strong assumption, this gives us an idea of how the policies impact the payment transaction share at each type of stores. Combined with costs of various payment methods at each type of stores, one could extend our results to measure the end-users' welfare changes due to the policies of removing rewards.

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dummies are estimated to be negative, although they are statistically insignificant.

Table VIII presents how the average probabilities of choosing credit cards, debit cards, and paper-based methods would change after the policy is implemented. Removing rewards on credit cards (policy 1) would reduce the credit card share by just above 3 percentage points at grocery and department stores, by about 2 and 2.4 percentage points at drug and discount stores, respectively, and by 1 percentage point at fast food restaurants. The reductions in credit card transactions are: (i) distributed almost equally between debit card and paper-based transactions at grocery and discount stores; (ii) replaced more by debit card transactions at department stores; and (iii) replaced more by paper-based transactions at drug stores and fast food restaurants. The share of paper-based transactions would increase by at most 1.65 percentage points. Removing rewards on debit cards (policy 2) would reduce the debit card share by less than 1 percentage point.[21] The substitution patterns—whether the reduced card transactions are replaced more by the other type of card transactions or by paper-based transactions—are similar to those under policy 1. Under this policy, the share of paper-based transactions would increase by no more than 0.55 percentage points. Removing rewards on both credit and debit cards (policy 3) would decrease the credit card shares but increase debit card share at all types of stores. The reduction in credit card share would be no more than 3 percentage points and the increase in paper-based methods share would be slightly over 2 percentage points at most.

Overall, our results suggest that removing rewards today would not reduce the aggregate share of payment cards transactions much. At a given type of stores, the percentage of transactions that would be switched from electronic payment method to paper-based method is likely quite small (at most slightly over 2 percentage points) if rewards were removed from credit cards and/or debit cards.

[21] It is estimated that removing rewards on debit cards would increase debit card transactions by 0.12 percentage points at fast food restaurants. This is due to the negative coefficients for debit card reward dummies, which are

Three limitations of this analysis should be noted. First, our sample excludes consumers who do not hold any bank accounts, credit cards, or debit cards and these consumers are mainly cash users. If we include them in the analysis, the aggregate effects of removing rewards would likely be even smaller. Second, it seems implausible that all consumers distribute their transactions across the five retail types in one common way. If rewards card holders tend to make more transactions than the rest of consumers at certain types of stores, then the effect at those types of stores may potentially be underestimated. Third, the share of rewards card holders in our sample is relatively small compared with a few other surveys. It is possible that some respondents who hold rewards cards reported otherwise. If this is the case, the effect could be underestimated. We address this measurement issue and conduct robustness check in Appendix A. Our robustness check suggests that the extent of the underestimation caused by this measurement problem would be quite small.

VII. CONCLUSION

This paper estimated the direct effect of credit and debit card rewards on consumer payment choice. By using a unique data set that contains rich information on consumer perceived attributes of each payment method and consumer perceived payment method acceptance by each type of retail store, we are able to control for consumer heterogeneity in preferences and choice sets. Our results show that including perceived payment method attributes produces a substantial improvement in model fit and allows us to alleviate the endogeneity problem of rewards.

Our policy experiments suggest that removing rewards today would only cause a small percentage of consumers to switch from electronic payment methods (credit/debit cards) to paper-based methods (cash/checks) at five types of retail stores. The majority of consumers who

statistically insignificant.

currently receive rewards on credit/debit cards would continue to use credit/debit cards even if rewards were no longer offered. The results could potentially be further strengthened if we were able to control for consumer heterogeneity in terms of their sensitivity toward rewards. Since our attitudinal data does not allow us to do so, our estimated average direct effect of rewards might be upward biased and the policy simulation results should be interpreted as an upper bound of how removing rewards would affect payment choice. In other words, the actual effects of removing rewards on payment choice could be smaller than what we reported here.

Interestingly, our findings are consistent with the experiences in Australia, where Bankcard, MasterCard, and Visa were mandated to reduce their interchange fees in 2003. Although the value of the rewards points for these three networks has been reduced dramatically since the reform, we observed that the usage pattern of credit cards has remained essentially unchanged. Credit card transactions, in terms of volume and value, have continued to increase after the regulation took effect. Considering the payment card market as a whole, the regulated networks' combined market share (in terms of volume) has declined slightly from 46.7 percent in 2003 to 43.5 percent in 2006, while the other credit card networks have increased their combined share slightly from 5 to 6 percent during this period.[22, 23] These trends suggest that the majority of credit cardholders do not change their payment choice even though the value of the rewards points they receive has dropped significantly since 2003.

More comprehensive analysis is needed in order to fully understand how payment card rewards affect overall consumer payment choice. Since we found that the effects of payment card

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[22] The market shares of Bankcard, MasterCard and Visa measured in transaction values are very similar.
[23] These market shares are calculated by using statistics from the Reserve Bank of Australia posted on the Web site: http://www.rba.gov.au/PaymentsSystem/PaymentsStatistics/payments_data.html. Our calculation does not include Visa Debit, another debit card network in Australia, because the statistics are not available. According to the information furnished by the Building Society to the Reserve Bank of Australia, EFTPOS share of the overall debit network is roughly 90 percent, while Visa Debit's is roughly 10 percent.

rewards vary by retail type, their effects to consumer payment choice over Internet transactions and bill payments could be different from in-store transactions. It is also important to examine how payment card rewards affect the overall number of transactions or overall consumer spending. More detailed information on rewards and fees may allow us to quantify price elasticity of demand for a certain payment method. More detailed information on consumer payment card usage—which network's card they use—may allow us to gain a better understanding of consumer homing behavior within credit/debit cards. Combined with cost studies, our results could be extended to analyze the cost effectiveness and social welfare of removing rewards programs.

APPENDIX

A. A potential measurement issue in credit card rewards receivers

In our sample, about 32 percent replied that they receive rewards on credit cards, which seems to be lower than that in three other surveys: 1996 Survey of Consumer Attitudes and Behavior (56 percent), 2003/2004 Study of Consumer Payment Preferences (53 percent), and 2006 Visa Payment System Panel Study (69 percent). However, Armstrong [2003] reported, "According to *the Nilson Report*, only 35 million of the 300 million active credit and debit card holders in the U.S. participate in a rewards program (in 2003)," and Kiviat [2004] reported that the number of credit card accounts offering rewards jumped from 35 million to 56 million in 2004. Therefore, it is hard to tell if the share of consumers who receive rewards on credit cards in our sample is too small or too large.

We believe it is very unlikely that our sample is subject to severe measurement errors in the data on whether someone receives rewards. Below are the actual survey question and a table (Table IX) comparing average in our sample and "national" average from various sources.

Which of the following statements are true? (Check all that apply)

- ☐ *I have funds deposited electronically into my account by an employer or government agency (direct deposit).*
- ☐ *I receive rewards (e.g., miles, points, cash-rebate) for using my credit card for purchases.*
- ☐ *I regularly carry a balance on my credit card (do not pay off the balance in full).*
- ☐ *I have internet access at home.*
- ☐ *I have internet access at work.*
- ☐ *I use online banking with my bank/credit union.*
- ☐ *I have a mobile phone.*

Five out of seven questions were checked more than national average. Those questions are about direct debit, internet at home, internet at work, online banking and mobile phone. One question—credit card with balance—was checked less than national average, but since our sample includes more affluent consumers than national average, this may be a natural outcome. By taking these responses into consideration, it seems very unlikely that the respondents in our sample missed to check only the question about credit card rewards.

As a robustness check, we estimate payment choice by using the 2003 Dove sample, in which the share of consumers with rewards credit cards is 53 percent. Because there are a lot of missing values in perceived attributes and acceptance of payment methods in the 2003 sample, only specification 1 can be estimated. Then, we conduct a policy experiment that removes rewards on credit cards. Table X compares specification 1 results of the 2003 and 2005 samples at grocery stores. It also presents the 2005 results of specification 4, which is more appropriate than specification 1.

The effect of removing credit card rewards on consumers who receive credit card rewards is smaller for the 2003 sample: The percentage point reduction by consumers who receive rewards on credit cards only is estimated to be 22 for the 2003 sample and 26 for the 2005 sample, and that by consumers who receive rewards on both credit and debit cards is estimated to be 17 for the 2003 sample and 18 for the 2005 sample. However, the overall effect of removing credit card rewards is greater for the 2003 sample, because of the greater share of consumers who receive rewards on credit cards. As the results for the 2005 sample suggest, the percentage point reduction in probability of choosing credit cards for the 2003 sample would be at least halved if we could use specification 4. That is, the reduction in the share of credit cards would be no more than 6 percentage points and the increase in the share of paper-based methods would likely be no more than 3 percentage points.

These suggest that our main results are robust even if our sample measures the share of consumers who receive rewards on credit cards lower than actual—removing rewards today would only cause a small percentage of consumers switching from electronic payment methods to paper-based methods at least at five types of retail stores.

Table IX: Comparison between Our Sample and National Average

	Our sample	National average
Direct deposit	.780	.700
Credit card rewards	.322	n.a.
Credit card with balance	.429	.442
Internet at home	.865	.589
Internet at work	.477	.423
Online banking	.560	.370
Mobile phone	.762	.573

TABLE X: Effects of Removing Rewards

(Unit: percentage points)

	2003 Specification 1			2005 Specification 1			2005 Specification 4		
	Credit	debit	paper	credit	debit	paper	credit	debit	Paper
Overall	-11.51	6.15	5.36	-7.36	4.91	2.74	-3.25	1.60	1.65
CC rewards only	-21.88	11.51	10.37	-26.01	15.78	10.23	-11.35	4.92	6.43
CC&DC rewards	-17.20	10.78	6.42	-18.10	13.93	4.17	-6.92	5.03	1.88

B. Estimation results: coefficients for consumer characteristics

Table XI shows the coefficients for consumer characteristics under specification 4. Age, race, and technology adoption dummies are more significant than education and income.

TABLE XI: Multinomial Logit Model: Coefficients for Consumer Characteristics (Specification 4)

		Grocery		Department		Discount	
Credit	Constant	2.393	(1.695)	-0.103	(1.535)	1.174	(1.369)
	Female	0.482**	(0.217)	0.386*	(0.222)	-0.043	(0.201)
	Education	-0.185	(0.747)	1.415*	(0.734)	-0.051	(0.643)
	Education^2	0.073	(0.105)	-0.160	(0.113)	0.054	(0.097)
	Income	0.033	(0.079)	0.012	(0.116)	0.003	(0.078)
	Income^2	-0.001	(0.004)	0.004	(0.008)	0.003	(0.005)
	Age	-0.126***	(0.046)	-0.051	(0.048)	-0.026	(0.041)
	Age^2	0.001**	(0.000)	0.001	(0.001)	0.000	(0.000)
	Direct deposit	0.717***	(0.266)	0.454*	(0.246)	0.584**	(0.250)
	Online banking	0.420*	(0.224)	0.439**	(0.223)	0.428**	(0.205)
	Asian	-0.098	(0.370)	0.909	(0.651)	0.507	(0.447)
	Other race	-0.829***	(0.295)	-1.071***	(0.250)	-1.183***	(0.247)
PIN debit	Constant	2.344	(1.396)	-0.983	(1.715)	0.055	(1.557)
	Female	0.482***	(0.179)	0.157	(0.237)	0.019	(0.203)
	Education	0.266	(0.616)	1.211	(0.798)	0.493	(0.738)
	Education^2	0.011	(0.090)	-0.152	(0.121)	-0.011	(0.110)
	Income	0.028	(0.068)	-0.008	(0.119)	0.028	(0.082)
	Income^2	0.000	(0.004)	0.003	(0.008)	0.002	(0.005)
	Age	-0.058	(0.042)	0.024	(0.053)	-0.026	(0.043)
	Age^2	0.000	(0.000)	0.000	(0.001)	0.000	(0.000)
	Direct deposit	0.638***	(0.205)	0.382	(0.268)	1.035***	(0.244)
	Online banking	0.351*	(0.183)	0.633***	(0.249)	0.317	(0.210)
	Asian	-1.489***	(0.423)	0.163	(0.717)	0.037	(0.555)
	Other race	-0.735***	(0.203)	-0.771***	(0.258)	-0.812***	(0.224)
Signature debit	Constant	-1.793	(1.937)	-2.462	(1.988)	-2.935	(2.055)
	Female	0.591***	(0.229)	0.407	(0.252)	0.171	(0.248)
	Education	1.136	(0.861)	1.000	(0.905)	1.119	(0.907)
	Education^2	-0.111	(0.126)	-0.094	(0.137)	-0.088	(0.132)
	Income	0.057	(0.101)	-0.003	(0.132)	-0.039	(0.096)
	Income^2	-0.003	(0.006)	0.000	(0.009)	0.003	(0.005)
	Age	0.005	(0.059)	0.089	(0.066)	0.055	(0.064)
	Age^2	0.000	(0.001)	-0.001*	(0.001)	-0.001	(0.001)
	Direct deposit	0.868***	(0.300)	0.850***	(0.293)	1.001***	(0.298)
	Online banking	0.327	(0.242)	0.374	(0.258)	0.382	(0.262)
	Asian	-1.255*	(0.645)	0.476	(0.753)	-0.250	(0.738)
	Other race	-0.907***	(0.257)	-1.045***	(0.272)	-1.001***	(0.280)
Check	Constant	0.148	(1.685)	-1.316	(1.901)	-2.435	(1.849)
	Female	1.012***	(0.227)	0.203	(0.275)	0.646***	(0.234)
	Education	-0.124	(0.674)	0.415	(0.844)	0.470	(0.816)
	Education^2	0.046	(0.101)	-0.037	(0.129)	-0.041	(0.118)
	Income	0.221**	(0.092)	-0.054	(0.133)	0.034	(0.089)
	Income^2	-0.010*	(0.006)	0.005	(0.010)	0.003	(0.005)
	Age	0.024	(0.058)	0.099	(0.065)	0.098*	(0.059)
	Age^2	0.000	(0.001)	-0.001	(0.001)	-0.001*	(0.001)
	Direct deposit	0.253	(0.262)	0.351	(0.312)	0.605**	(0.276)
	Online banking	0.041	(0.240)	0.309	(0.284)	0.545**	(0.244)
	Asian	-0.284	(0.562)	1.052	(0.757)	-0.193	(0.685)
	Other race	-0.750**	(0.303)	-0.807**	(0.341)	-1.258***	(0.330)

Note: ***, **, *: Significant at .01, .05, and .1 level, respectively.

TABLE XI: Multinomial Logit Model: Coefficients for Consumer Characteristics (cont'd) (Specification 4)

		Drug		Fast Food	
Credit	Constant	0.479	(1.470)	0.428	(2.134)
	Female	0.153	(0.185)	-0.391	(0.290)
	Education	0.403	(0.641)	-0.532	(0.958)
	Education^2	-0.006	(0.090)	0.101	(0.131)
	Income	0.102	(0.068)	-0.144	(0.089)
	Income^2	-0.004	(0.004)	0.007*	(0.004)
	Age	-0.112***	(0.040)	0.086	(0.053)
	Age^2	0.001***	(0.000)	0.001	(0.001)
	Direct deposit	0.282	(0.233)	0.543	(0.359)
	Online banking	0.123	(0.192)	0.254	(0.312)
	Asian	0.379	(0.389)	0.351	(0.399)
	Other race	-0.244	(0.243)	1.163***	(0.335)
PIN debit	Constant	1.762	(1.342)	-0.751	(2.033)
	Female	0.259	(0.170)	0.078	(0.251)
	Education	0.451	(0.582)	0.546	(0.813)
	Education^2	-0.036	(0.085)	-0.092	(0.121)
	Income	0.159**	(0.064)	0.216	(0.152)
	Income^2	-0.006*	(0.003)	-0.011	(0.010)
	Age	-0.101***	(0.039)	-0.100*	(0.060)
	Age^2	0.001**	(0.000)	0.001	(0.001)
	Direct deposit	0.304	(0.210)	0.201	(0.319)
	Online banking	0.015	(0.177)	0.029	(0.286)
	Asian	-0.719*	(0.409)	0.135	(0.644)
	Other race	-0.369*	(0.200)	0.596**	(0.282)
Signature debit	Constant	-1.237	(1.590)	-4.332*	(2.386)
	Female	0.306	(0.204)	-0.241	(0.286)
	Education	1.007	(0.695)	2.391**	(1.108)
	Education^2	-0.109	(0.103)	-0.261*	(0.159)
	Income	0.118	(0.080)	-0.048	(0.118)
	Income^2	-0.006	(0.004)	0.000	(0.006)
	Age	-0.039	(0.051)	-0.075	(0.067)
	Age^2	0.000	(0.001)	0.001	(0.001)
	Direct deposit	0.981***	(0.264)	1.014**	(0.460)
	Online banking	0.020	(0.217)	-0.193	(0.300)
	Asian	-0.900	(0.636)	-1.313	(1.143)
	Other race	-0.696***	(0.251)	0.253	(0.306)
Check	Constant	-0.965	(1.937)	-13.200	(10.268)
	Female	0.379*	(0.222)	-0.233	(0.831)
	Education	0.278	(0.762)	5.861	(5.222)
	Education^2	-0.015	(0.112)	-0.904	(0.882)
	Income	0.095	(0.093)	0.211	(1.171)
	Income^2	-0.006	(0.006)	-0.104	(0.190)
	Age	0.044	(0.059)	0.200	(0.200)
	Age^2	0.000	(0.001)	-0.002	(0.002)
	Direct deposit	0.209	(0.262)	0.943	(1.029)
	Online banking	-0.365	(0.231)	-0.748	(0.879)
	Asian	-1.325	(0.881)	0.972	(3.253)
	Other race	-0.775***	(0.336)	-0.905	(1.656)

Note: ***, **, *: Significant at .01, .05, and .1 level, respectively.

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TABLE I: Summary Statistics on Consumer Characteristics

	Census	Our sample	
		All	Reward receivers
Demographic			
Female	.514	.491	.458
Race			
African American	.123	.117	.100
Asian	.042	.067	.090
Caucasian	.669	.703	.725
Hispanic	.144	.070	.055
Other	.022	.043	.029
Age			
18-34	.312	.269	.282
35-44	.197	.253	.259
45-54	.191	.174	.161
55-64	.136	.208	.196
65 and over	.165	.096	.103
Education			
Less than high school	.160	.011	.006
High school	.510	.536	.429
College	.250	.311	.359
Some graduate school	.080	.142	.207
Financial (income)			
$0 - $40,000	.463	.352	.244
$40,000 - $59,999	.178	.240	.219
$60,000 - $99,999	.209	.282	.333
$100,000 and over	.151	.126	.204
Census division			
New England	.051	.050	.065
Mid-Atlantic	.142	.118	.141
South Atlantic	.191	.209	.200
ES Central	.061	.050	.037
EN Central	.105	.106	.087
WS Central	.160	.168	.180
WN Central	.069	.072	.074
Mountain	.058	.070	.067
Pacific	.163	.158	.148
Technology adoption			
Direct deposit	.673[a]	.776	.816
Online banking	.370[b]	.573	.642
		N=1979	N=721

Notes: [a]2001 Survey of Consumer Finance. [b]Online Banking Report March 2005

TABLE II: Rewards Card Holders

N=1979

	Sample size	Percent of sample	Percent of rewards card holders
Rewards card holders	721	36.43	100
Rewards credit	634	32.03	87.93
Rewards debit	269	13.59	37.31
Rewards PIN debit	131	6.62	18.17
Rewards signature debit	242	12.28	33.56
Rewards credit & debit	182	9.20	25.24

TABLE III: Summary Statistics on Consumer Perceived Payment Method Attributes

(A) All Consumers

Attribute	Scale	Cash	Check	Credit card	PIN-debit	Signature-debit
Comfortable	0: not use, 1: lowest, 5: highest	4.63	3.69	3.98	3.49	3.41
Fast		4.53	2.42	3.81	3.34	3.11
Convenient	0: no 1: yes	0.84	0.21	0.68	0.57	0.46
Easy to use		0.85	0.22	0.69	0.55	0.46
Preferred by stores		0.76	0.07	0.58	0.41	0.32
Safe		0.56	0.22	0.39	0.38	0.30
Taken right away		0.26	0.12	0.12	0.75	0.50
Helps me budget		0.60	0.30	0.18	0.44	0.33
For small amounts		0.89	0.11	0.11	0.28	0.19
Control		0.62	0.34	0.25	0.47	0.37
Easy-to-get refund		0.57	0.17	0.66	0.41	0.37

(B) By Reward Status

	Credit card		PIN-debit		Signature-debit	
Attribute	w/ rewards	w/o rewards	w/ rewards	w/o rewards	w/ rewards	w/o rewards
Comfortable (0-5)	4.49	3.74	4.18	3.45	4.43	3.27
Fast (0-5)	4.13	3.66	3.99	3.29	4.03	2.98
Convenient	0.82	0.61	0.54	0.57	0.61	0.44
Easy to use	0.84	0.61	0.55	0.55	0.62	0.44
Preferred by stores	0.65	0.54	0.38	0.41	0.43	0.30
Safe	0.54	0.33	0.39	0.38	0.46	0.28
Taken right away	0.12	0.13	0.72	0.75	0.58	0.48
Helps me budget	0.27	0.14	0.50	0.43	0.50	0.31
For small amounts	0.14	0.10	0.29	0.28	0.27	0.18
Control	0.39	0.18	0.51	0.47	0.53	0.35
Easy-to-get refund	0.80	0.59	0.33	0.41	0.53	0.34

TABLE IV: Consumer Perceived Acceptance of Payment Methods by Retail Type

Type of stores	Cash	Check	Credit card	PIN-debit	Signature-debit
Grocery	89.3%	77.0%	81.0%	81.6%	58.1%
Department	84.9%	72.3%	90.3%	64.7%	60.2%
Discount	85.3%	64.9%	74.0%	63.4%	44.1%
Drug	88.8%	65.8%	81.6%	67.9%	52.8%
Fast food restaurants	96.1%	11.2%	55.5%	35.7%	34.1%

TABLE V: Multinomial Logit Model: Log-likelihood

		Specifications			
		1	2	3	4
	Perceptions	no	yes	no	Yes
	Choice set	homogeneous	homogeneous	heterogeneous	Heterogeneous
Retail types	Grocery	-2570.88	-1650.80	-2008.14	-1369.60
	Department	-2266.67	-1637.62	-1733.26	-1336.83
	Discount	-2487.85	-1885.18	-1631.47	-1278.67
	Drug	-2559.81	-1856.88	-1883.21	-1479.99
	Fast food	-1242.72	-1010.97	-800.77	-682.24

TABLE VI: Multinomial Logit Model: Coefficients for Reward Dummies

		Specifications			
		1	2	3	4
	Perceptions	no	yes	no	Yes
	Choice set	homogeneous	homogeneous	heterogeneous	heterogeneous
Grocery	Rewards on credit	1.632***	1.013***	1.579***	1.019***
		(0.145)	(0.174)	(0.159)	(0.192)
	on PIN-debit	0.563***	0.150	0.452**	0.085
		(0.201)	(0.237)	(0.225)	(0.253)
	on signature-debit	1.626***	1.187***	1.507***	1.092***
		(0.174)	(0.208)	(0.199)	(0.231)
	Zero balance on credit	0.800***	0.516***	0.847***	0.558***
		(0.147)	(0.175)	(0.161)	(0.191)
Department	Rewards on credit	1.324***	0.720***	1.203***	0.720***
		(0.123)	(0.145)	(0.135)	(0.156)
	on PIN-debit	0.469*	0.034	0.343	0.007
		(0.258)	(0.287)	(0.304)	(0.313)
	on signature-debit	1.434***	0.821***	1.344***	0.843***
		(0.176)	(0.204)	(0.198)	(0.222)
	Zero balance on credit	-0.061	-0.049	0.020	-0.008
		(0.107)	(0.125)	(0.120)	(0.138)
Discount	Rewards on credit	1.094***	0.516***	0.991***	0.541***
		(0.125)	(0.145)	(0.152)	(0.179)
	on PIN-debit	0.195	-0.241	0.174	-0.226
		(0.225)	(0.246)	(0.302)	(0.300)
	on signature-debit	1.244***	0.656***	1.063***	0.658***
		(0.192)	(0.207)	(0.228)	(0.245)
	Zero balance on credit	0.114	-0.009	0.210	0.052
		(0.120)	(0.134)	(0.142)	(0.161)
Drug	Rewards on credit	1.284***	0.656***	1.136***	0.633***
		(0.136)	(0.164)	(0.151)	(0.177)
	on PIN-debit	0.499**	0.233	0.573**	0.388
		(0.216)	(0.237)	(0.271)	(0.292)
	on signature-debit	1.299***	0.808***	1.198***	0.771***
		(0.181)	(0.207)	(0.207)	(0.228)
	Zero balance on credit	0.717***	0.593***	0.769***	0.571***
		(0.134)	(0.156)	(0.147)	(0.169)
Fast food	Rewards on credit	1.008***	0.614***	0.825***	0.531**
		(0.202)	(0.227)	(0.238)	(0.274)
	on PIN-debit	0.354	0.241	-0.291	-0.170
		(0.348)	(0.389)	(0.466)	(0.465)
	on signature-debit	0.555**	0.100	0.147	-0.120
		(0.268)	(0.295)	(0.325)	(0.346)
	Zero balance on credit	0.604***	0.539**	0.759***	0.559**
		(0.225)	(0.245)	(0.253)	(0.279)

Note: ***, **, *: Significant at .01, .05, and .1 level, respectively.

TABLE VII: Multinomial Logit Model: Coefficients for Perceptions

		Specifications			
		2		4	
	Perceptions	yes		Yes	
	Choice set	homogeneous		Heterogeneous	
Grocery	Comfortable	0.670^{***}	(0.060)	0.680^{***}	(0.066)
	Fast	0.323^{***}	(0.052)	0.308^{***}	(0.060)
	Convenient	0.809^{***}	(0.129)	0.702^{***}	(0.143)
	Easy-to-use	0.650^{***}	(0.131)	0.618^{***}	(0.148)
	Preferred by stores	0.275^{***}	(0.090)	0.337^{***}	(0.099)
	Safe	0.132^{*}	(0.080)	0.125	(0.088)
	Money taken right away	-0.041	(0.093)	-0.113	(0.100)
	Help me budget	0.328^{***}	(0.090)	0.279^{***}	(0.098)
	For small amount	0.239^{**}	(0.098)	0.301^{***}	(0.108)
	Control over money	0.567^{***}	(0.095)	0.565^{***}	(0.104)
	Easy-to-get refund	0.153^{*}	(0.085)	0.113	(0.093)
Department	Comfortable	0.585^{***}	(0.055)	0.557^{***}	(0.064)
	Fast	0.281^{***}	(0.056)	0.292^{***}	(0.066)
	Convenient	0.511^{***}	(0.129)	0.421^{***}	(0.143)
	Easy-to-use	0.429^{***}	(0.131)	0.504^{***}	(0.146)
	Preferred by stores	0.318^{***}	(0.095)	0.225^{**}	(0.105)
	Safe	0.175^{**}	(0.086)	0.131^{*}	(0.095)
	Money taken right away	-0.115	(0.100)	-0.142	(0.107)
	Help me budget	0.232^{**}	(0.097)	0.136	(0.107)
	Small amount	0.020	(0.102)	0.096	(0.112)
	Control over money	0.565^{***}	(0.105)	0.543^{***}	(0.115)
	Easy-to-get refund	0.385^{***}	(0.089)	0.400^{***}	(0.098)
Discount	Comfortable	0.548^{***}	(0.053)	0.557^{***}	(0.065)
	Fast	0.161^{***}	(0.046)	0.204^{***}	(0.058)
	Convenient	0.541^{***}	(0.120)	0.437^{***}	(0.144)
	Easy-to-use	0.288^{**}	(0.120)	0.346^{**}	(0.150)
	Preferred by stores	0.319^{***}	(0.088)	0.219^{**}	(0.108)
	Safe	0.158^{**}	(0.075)	0.123	(0.094)
	Money taken right away	0.020	(0.090)	-0.075	(0.105)
	Help me budget	0.301^{***}	(0.085)	0.319^{***}	(0.102)
	For small amount	0.143	(0.095)	0.205^{*}	(0.115)
	Control over money	0.407^{***}	(0.090)	0.449^{***}	(0.108)
	Easy-to-get refund	0.169^{**}	(0.080)	0.225^{**}	(0.095)
Drug	Comfortable	0.649^{***}	(0.060)	0.648^{***}	(0.069)
	Fast	0.203^{***}	(0.049)	0.186^{***}	(0.057)
	Convenient	0.667^{***}	(0.120)	0.577^{***}	(0.132)
	Easy-to-use	0.395^{***}	(0.125)	0.320^{**}	(0.138)
	Preferred by stores	0.309^{***}	(0.082)	0.292^{***}	(0.091)
	Safe	0.243^{***}	(0.070)	0.204^{***}	(0.079)
	Money taken right away	-0.031	(0.086)	-0.060	(0.096)
	Help me budget	0.158^{*}	(0.084)	0.096	(0.094)
	For small amount	0.316^{***}	(0.089)	0.356^{***}	(0.100)
	Control over money	0.398^{***}	(0.086)	0.392^{***}	(0.096)
	Easy-to-get refund	0.274^{***}	(0.076)	0.227^{***}	(0.085)
Fast food	Comfortable	0.341^{***}	(0.063)	0.368^{***}	(0.081)
	Fast	0.223^{***}	(0.065)	0.234^{***}	(0.077)
	Convenient	0.466^{***}	(0.168)	0.547^{***}	(0.199)
	Easy-to-use	0.199	(0.186)	-0.047	(0.224)
	Preferred by stores	0.158	(0.120)	0.156	(0.139)
	Safe	0.110	(0.102)	0.062	(0.117)
	Money taken right away	-0.134	(0.122)	-0.088	(0.136)
	Help me budget	0.241^{**}	(0.116)	0.267^{**}	(0.134)
	For small amount	0.706^{***}	(0.108)	0.614^{***}	(0.136)
	Control over money	0.197	(0.121)	0.138	(0.142)
	Easy-to-get refund	0.207^{*}	(0.114)	0.295^{*}	(0.132)

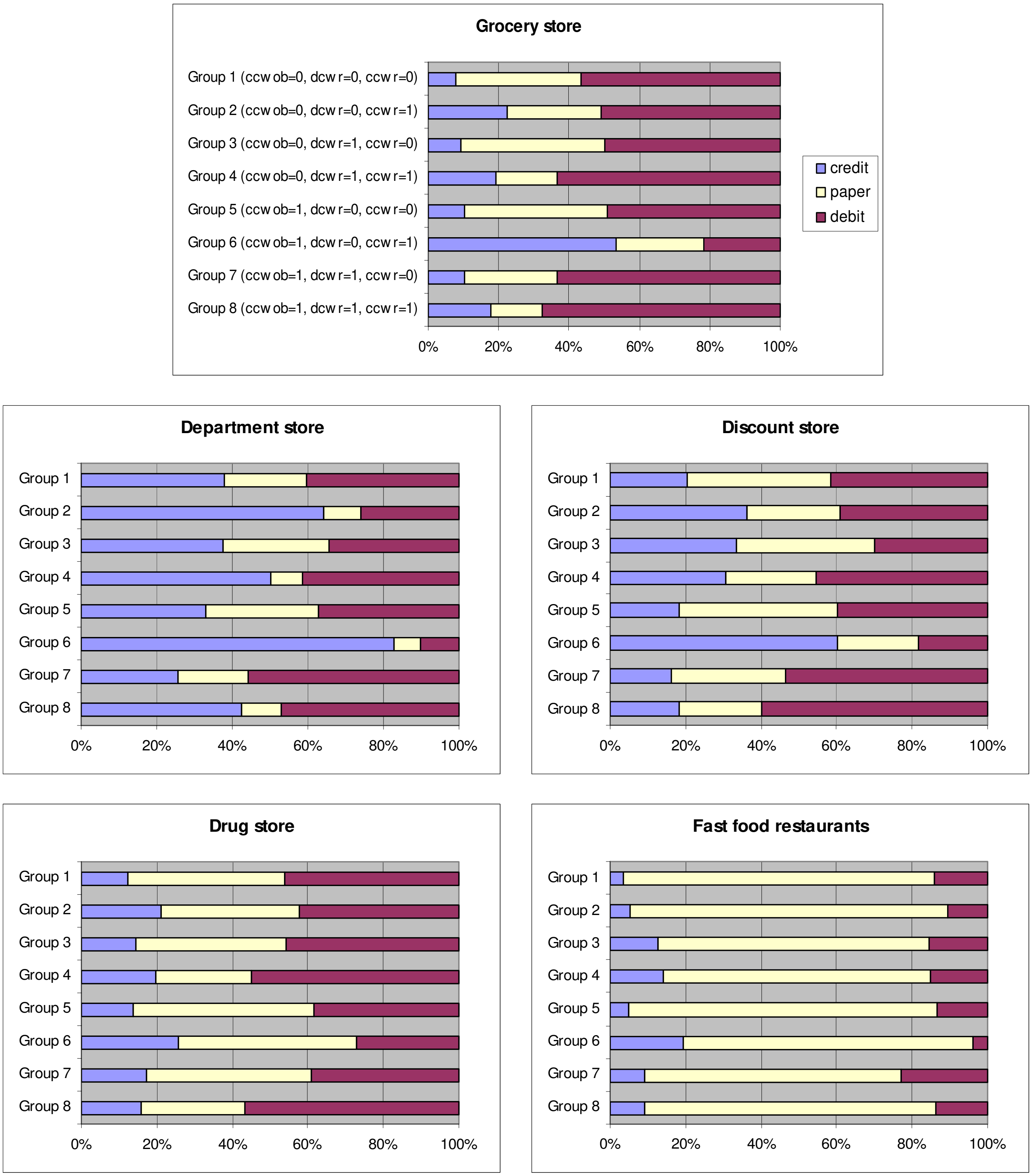
Note: ***, **, *: Significant at .01, .05, and .1 level, respectively.

TABLE VIII: Overall Effects of Removing Rewards

(Unit: percentage points)

	Policy 1 Removing credit card rewards			Policy 2 Removing debit card rewards			Policy 3 Removing both credit and debit card rewards		
	Credit	debit	paper	credit	debit	paper	credit	debit	paper
Grocery	-3.25	1.60	1.65	0.38	-0.82	0.44	-3.00	0.86	2.14
Department	-3.12	1.93	1.18	0.74	-0.95	0.20	-2.42	0.98	1.44
Discount	-2.02	1.00	1.02	0.22	-0.40	0.19	-1.83	0.60	1.23
Drug	-2.43	0.99	1.44	0.34	-0.89	0.55	-2.17	0.12	2.04
Fast food	-1.01	0.16	0.85	-0.02	0.12	-0.09	-1.03	0.27	0.75

FIGURE I: Share of the Payment Method as the Most Frequently Used Method



Notes: ccwob=1, if consumers do not carry a credit card balance; ccwob=0, otherwise.
dcwr=1, if consumers receive debit card rewards (either PIN-based, signature-based, or both); dcwr=0, otherwise.
ccwr=1, if consumers receive credit card rewards; ccwr=0, otherwise.

FIGURE II: The Effects of Removing Credit Card Rewards Using Specification 4 (with Perception Variables)

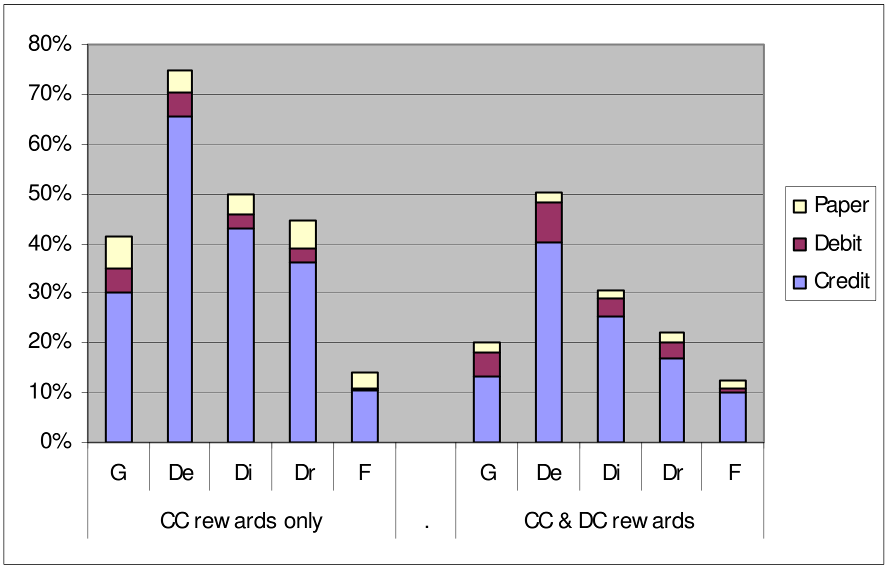


FIGURE III: The Effects of Removing Credit Card Rewards Using Specification 3 (without Perception Variables)

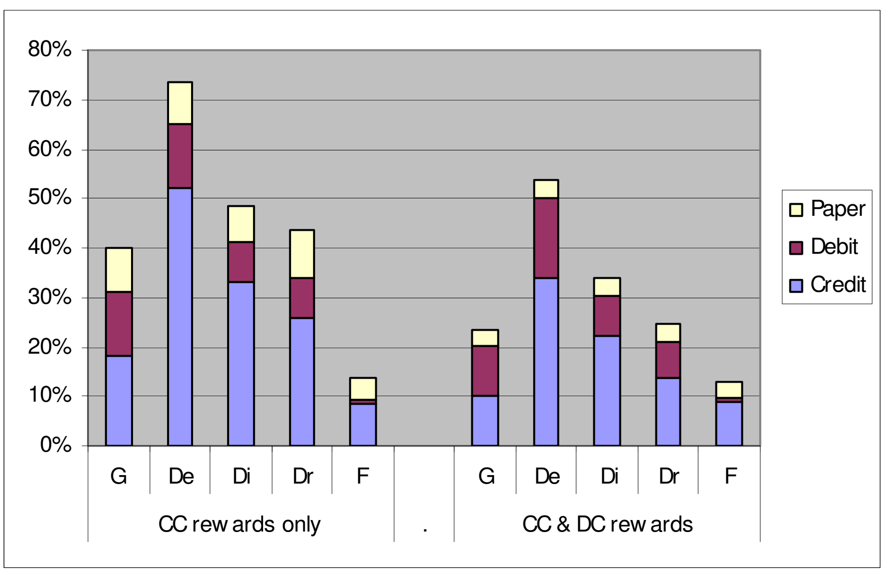
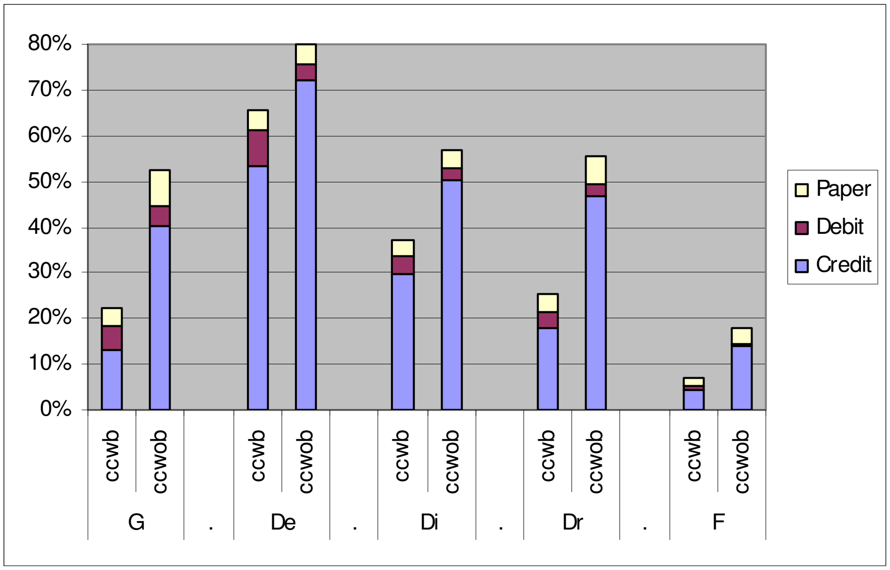


FIGURE IV: The Effects of Removing Credit Card Rewards on Consumers with and without Credit Card Balance



Notes: ccwb: consumers with a balance on credit cards.
ccwob: consumers without a balance on credit cards.

FIGURE V: The Effects of Removing Debit Card Rewards

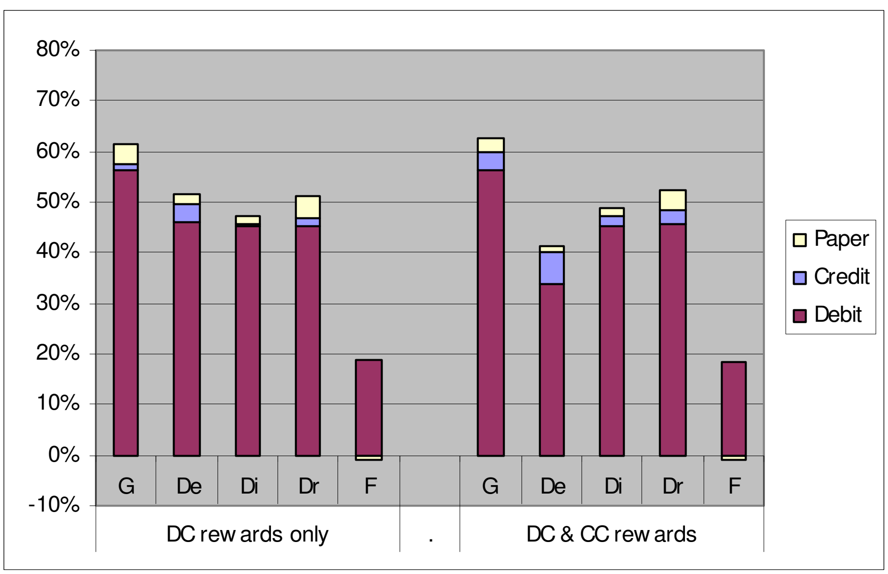


FIGURE VI: The Effects of Removing Credit and Debit Card Rewards