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How Do Consumers Make Their Payment Choices?

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Abstract:
Payment transformation has generated a shift from paper to cards and electronic payments in the United States, but there is also a large degree of heterogeneity among consumers in how they pay. We present factors affecting consumer payment behavior, show data on how consumers pay in the United States, and summarize existing literature on consumer payment choice. On the supply side, technology, regulation, and cost affect payment behavior. On the demand side, consumer demographics and income, consumer preferences, and consumer assessments of payment method attributes have all been found significant. We focus on price differentiation by payment method by merchants and the effect of such price incentives on payment method use, and on the effect of demographics and of perceptions of payment characteristics on consumer payment choice, emphasizing the effect of security. The studies mentioned here utilize a growing number of data sources, including several surveys and diaries on consumer behavior conducted in the United States and in other countries. We also identify gaps where more research is needed to understand consumer payment choices.

Keywords: consumer payments, consumer surveys, payment behavior
JEL Classification: E41, D14, D12

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CPRC CONSUMER PAYMENTS Research Center

I. Introduction

After several decades of writing billions of paper checks every year, U.S. consumers have been gradually shifting from checks to card and electronic payments over the past 20 years. The exact timing of when this transformation of consumer payments in the United States started is not well known, as the data on the number of consumer payments by payment method were scarce until the year 2000. It is known that as the number of checks written declined, the number of card and electronic payments increased. We now have much better data on the aggregate number of payments by payment instrument in the United States. More recently, more detailed data on payments by consumers have been collected separately from data on payments by other sectors, namely, payments made by businesses and by the government.

The data on individual consumer transactions are still very limited. Nevertheless, a growing body of literature has analyzed how consumers pay, and a few papers have addressed the question of why consumers pay the way they do. In this paper, we present data on the payment transformation in the United States and describe several factors affecting consumer payment behavior, both on the supply side and on the demand side. The data include information on the payment instruments consumers adopt, as well as the number of transactions they conduct with each payment instrument. The literature analyzing consumer payment behavior included here is not exhaustive, but it exemplifies the major factors influencing consumers' payment decisions. Most of the paper deals with consumer payment behavior in the United States, although we also mention studies based on data collected in other countries.

We focus on a few major factors that affect consumer payment choice and review the relevant literature. On the supply side, we discuss the effect of cost on payment choice. In particular, we focus on price differentiation by payment method by merchants and the effect of such price incentives on payment method use. On the demand side, we summarize the

literature on the effect of demographics and of perceptions of payment characteristics on consumer payment choice, with a particular emphasis on security.

The remainder of this paper is as follows. Section II shows aggregate payment trends in the United States, combining all sectors—consumers, merchants, and the government. Section III discusses supply-side factors affecting consumer payments and mentions some studies that focus on the supply side. Section IV discusses demand-side factors affecting consumer payments and separates them into exogenous and endogenous factors with respect to consumer payment behavior. Section V shows more detailed data on how consumers pay in the United States, by payment instrument as well as by type and value of transaction. It also discusses how unbanked and underbanked consumers pay. Section VI presents a few studies based on international data, and Section VII concludes.

II. U.S. Payment Trends over Time

The transformation of retail payments in the United States has shifted transactions from paper checks to cards and electronic payments. The transformation has been driven in part by changes in technology that facilitated improvements, but also by changes in consumer demand, as consumers have become more familiar with the methods available to them. Although paper checks continue to exist and the vast majority of U.S. consumers still have checks, the number of checks written has been declining, starting in the 1990s. Over the past 20 years, paper checks have gradually been replaced by other methods of payment, including debit cards and electronic payments, such as online banking bill payments.

Figure 1 shows the annual number of noncash retail payments in the United States by all sectors—consumers, businesses, and government, based on the data collected by the Federal Reserve Board as part of the tri-annual Federal Reserve Payments Study (FRPS). The FRPS data have been collected since 2000, and therefore provide a 15-year perspective on aggregate retail payments in the United States. Prior to the year 2000, the data on the number of payments were

scarce and not very reliable. Only a few earlier data points exist, and only for the number of checks written.

As Figure 1 shows, the decline in paper checks has been accompanied by a simultaneous increase in the number of debit card, credit card, and automated clearing house (ACH) payments. ACH payments are paid directly out of a payor's bank account, for example, with automated bill payments for home mortgage, insurance, or electric and gas utility bills.[1] Although check, debit card, and ACH payments differ in the way a payor initiates a transaction—by writing a check, swiping a card, or paying online—all three payment instruments access the payor's bank account to make a payment. As Figure 1 shows, the sum of payments that access a bank account—checks, debit card, and ACH—has continued to rise over time, approximately following the earlier increase in the number of checks written. This suggests that at least to some extent, paper checks in the United States have gradually been replaced by cards and electronic payments.

[1] ACH payments include some online banking bill payments (OBBP) and bank account number payments (BANP). OBBP is an electronic payment made directly from a bank account to a merchant via the bank's online banking website, while BANP is a payment made by providing a bank account number to a third party, such as a utility company.

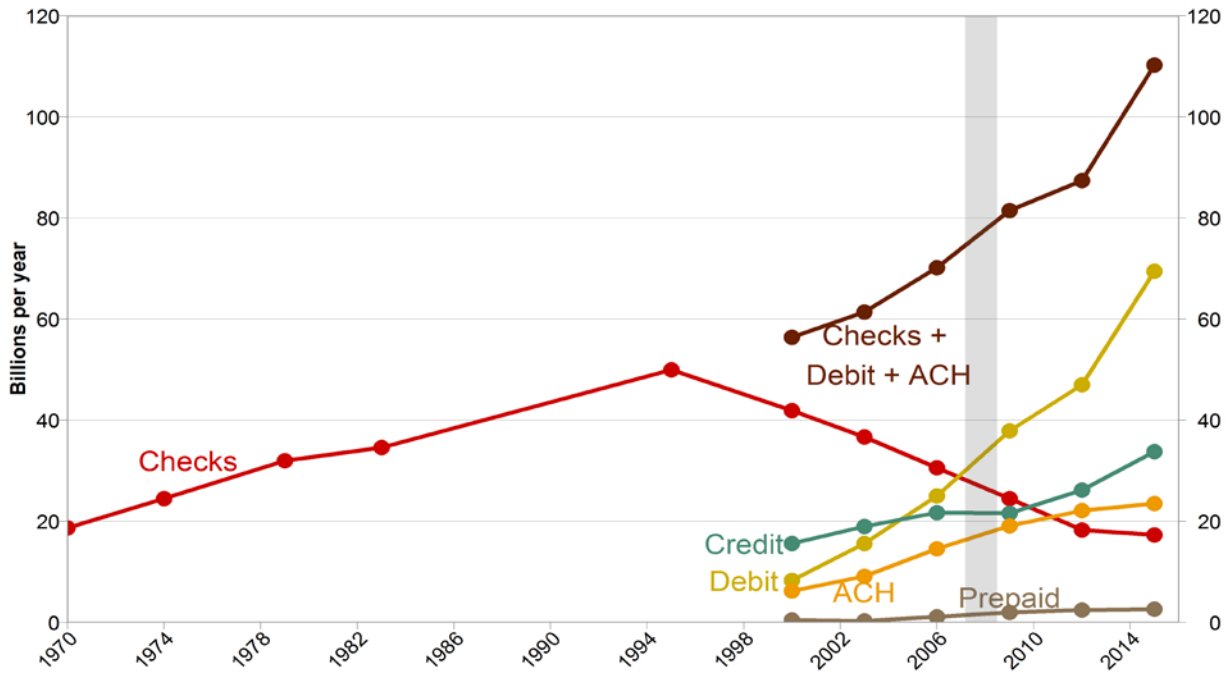

Figure 1: Number of transactions per year by payment instrument in the United States.

Note: 2015 data are preliminary and subject to revision.
Source: Benton et al. (2007) and Federal Reserve Payments Study.

Figure 2 uses the same data to show the noncash shares of transactions made with each payment instrument. As suggested in Figure 1, the share of noncash payments made from a bank account has remained relatively stable over the years, hovering around 70 percent of all noncash payments.

While the dashed lines in Figure 2 are based on the FRPS data for the nation as a whole, the solid lines show the shares of noncash transactions made with each payment instrument by consumers only. The data on consumer payments are from the Survey of Consumer Payment Choice (SCPC). The SCPC is an annual survey of U.S. consumers on the adoption and use of payment instruments. The SCPC asks consumers what payment methods they have and how they pay, including at the point-of-sale, online, and for bill payments. The SCPC data have been collected by the Federal Reserve Bank of Boston annually since 2008.[2]

[2] See https://www.bostonfed.org/publications/survey-of-consumer-payment-choice.aspx for details.

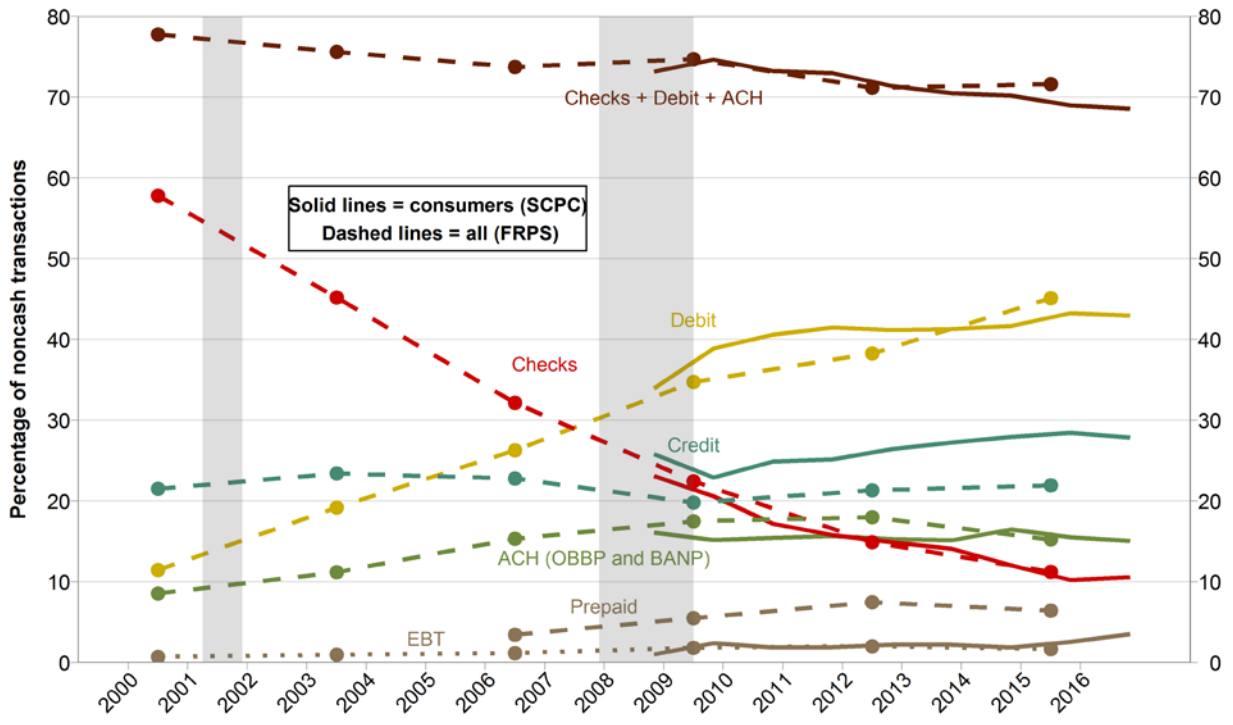

Figure 2: Share of noncash retail payments in the U.S.

Source: Federal Reserve Payments Study (all sectors, dashed lines) and Survey of Consumer Payments Choice (consumers only, solid lines). Data from the 2016 Survey of Consumer Payment Choice and 2015 FRPS are preliminary and subject to revision.

Although the trends in shares of payments made by consumers (solid lines) resemble those for the entire economy (dashed lines), there are a few notable differences. In particular, consumers rely more heavily on credit cards than the other sectors do. Debit cards have been the most heavily used noncash payment instrument during recent years. Cash is not shown in the chart, but we show cash shares below, when we discuss transactions by payment instrument in greater detail.

In the section below, we focus on a few supply-side factors affecting the way consumers pay.

III. Supply-Side Factors Affecting Consumer Payment Choice

Although consumers make their payment choices based in part on personal preferences, they are constrained by supply-side factors. In particular, cost, technology, regulation, and merchant acceptance of payment instruments (or lack thereof) constrain consumers' choices of how to pay. Technological innovations in payments expand the choice set; for example, mobile payments and digital currencies offer new ways to pay (Rysman and Schuh 2016). But technological improvements are necessary but not sufficient to explain payment evolution. Cost has been shown to be a very important factor affecting consumer payment behavior (Schuh and Stavins 2010, 2013; Koulayev et al. 2016). More specifically, explicit differences in the cost of using different payment methods may affect consumers' decisions of how to pay. For example, recent research shows that merchants' decisions to discount or surcharge based on payment method can influence how consumers pay (Shy and Stavins 2015, Stavins and Wu, forthcoming). We discuss these factors below, focusing primarily on cost differentiation by offering discounts or imposing surcharges.

A. Technology

Technology encompasses the way a payment is initiated by the payer, the way money is transferred from the payer to the payee, and the instrument used in the process. Technology makes a given payment method feasible—and is therefore a necessary but not a sufficient condition for consumers to adopt it. For example, Hayashi and Klee (2003) find that consumer awareness of electronic payments can help predict whether the consumers are more likely to use such payments. However, the awareness of technology is only a piece of the complete payment choice, and the authors find that characteristics of the transaction also affect payment choice.

Over time, technology has expanded the number of options for consumers to make payments. Figure 3 shows the number and type of payment instruments available to consumers over the years, starting in 1939. While technology adds new payment instruments to the

existing stock, all of the previously introduced payment instruments remain available, therefore expanding the choice set of how to make transactions over time. Soman (2001) finds that the evolving technology of payment instruments has affected consumer behavior, not only in terms of the choice of payment instruments, but even in terms of the amount spent. This is because technology facilitates easier ways of conducting transactions, and consumers may not readily keep track of their expenses when transactions are easy to conduct.

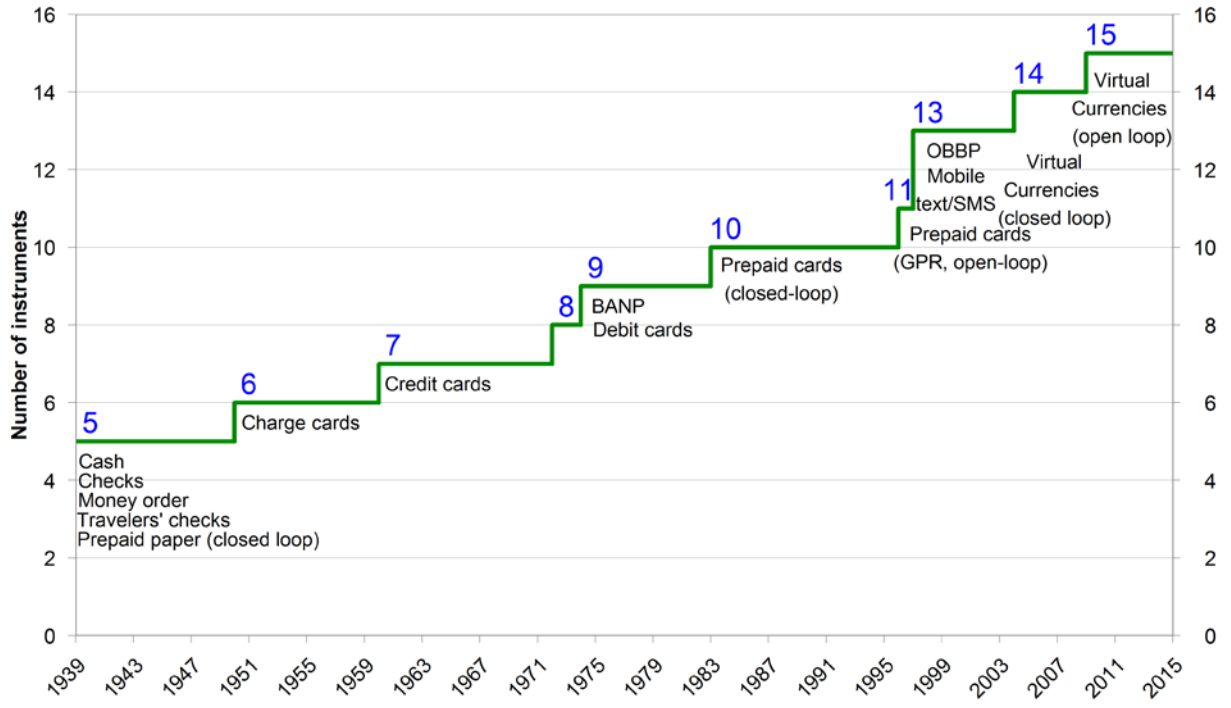

Figure 3: Availability of payment instruments in the United States over time.
Source: Author's research.

B. Regulation

Regulation can affect consumer payment decisions in many ways. In most cases, consumers are affected only indirectly, as the regulation is typically aimed directly at financial institutions or merchants. In this section, we discuss a few important recent changes in payment regulation that have had an impact on consumers. In the United States, the 2010 Dodd-Frank Wall Street

Reform and Consumer Protection Act[3] required the card networks to allow merchants to provide discounts based on whether payment is made by cash, check, debit card, or credit card. In addition, on July 13, 2012, the Eastern District Court of New York was asked to approve a class settlement between Visa and MasterCard and a large group of merchants that would allow merchants in the United States to impose surcharges on card transactions.[4] In a more recent Supreme Court case, merchants in states that still prohibit credit card surcharging are trying to eliminate those restrictions.[5]

However, as we discuss below, few merchants have taken advantage of their freedom to price differentiate. It is likely that competitive pressure and lack of full disclosure play a role here as well. Schuh et al. (2012) evaluates the 2010 settlement between the U.S. Department of Justice and Visa and MasterCard allowing merchants to discount or surcharge credit card transactions. The authors of that paper found that merchants could not take advantage of their freedom to differentiate prices at checkout based on the payment method because of lack of full information on credit card merchant fees. Very limited incidence of steering through price differentiation in the United States makes it difficult to study the effect of payment cost on consumer behavior. However, evidence from Australia shows that consumers may be influenced by merchant efforts to "steer" payment choice through discounts or surcharges (Reserve Bank of Australia 2014).

In the United States, part of the Dodd-Frank Wall Street Reform and Consumer Protection Act, signed into law in July 2010, requires the Federal Reserve to regulate interchange fees on debit card transactions (the Durbin Amendment). The Durbin Amendment requires the Federal Reserve to regulate the interchange fees on debit cards, based on bank variable costs. The current policy, which became effective on October 1, 2011, sets the fee

[3] https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf

[4] The title of this settlement is Final Judgment as to Defendants Mastercard International Inc. and Visa Inc., Civil Action No. CV-10-4496 (E.D.N.Y. Oct. 4, 2010). Available at http://www.justice.gov/atr/cases/f262800/262875.htm.

[5] Expressions Hair Design v. Schneiderman.

substantially below previously observed interchange fees, particularly for signature debit cards.[6]

The decline in interchange fees on debit cards following the Durbin Amendment means that—on average—issuing banks receive lower fees per debit card transaction. In order to offset the reduction in fees, some large U.S. banks briefly introduced monthly fees charged to all debit card users. Because of the strong adverse reaction by consumers, the banks quickly retreated from that policy. However, it is informative to consider potential effects of debit card fees, as they constitute one of the few examples of explicit payment cost in the United States. Stavins (2011) found that youngest, least-educated, and lowest-income consumers would be most affected by an increase in debit card fees, and are also most likely to change their payment behavior in response to such a fee. Koulayev et al. (2016) shows that if debit card fees were introduced, consumers would switch away from debit cards toward credit cards, cash, and checks, based on the 2008 U.S. survey data.

Since the enactment of the Durbin Amendment, banks have at least partially offset their lost revenues by reducing access to free checking, raising monthly fees on accounts that were not free, raising other monthly fees, and increasing the minimum balance required to qualify for free checking (Zywicki, Manne, and Morris 2014; Kay, Manuszak, and Vojtech 2014). They have also eliminated rewards on debit cards, although reward debit cards were not nearly as common as reward credit cards even prior to the regulation. Moreover, no evidence exists so far to indicate that the reduction in costs to merchants due to lower merchant fees has led to any drop in retail prices to consumers.

C. Cost – supply

The cost of payment methods affects all parties involved in the transactions, although the cost varies across participants and is not always transparent to consumers or to merchants. The cost to consumers of having and using payment instruments can be either a direct monetary cost or

[6] See the Board of Governors' Final Rule, Regulation II, Debit Card Interchange Fees and Routing (http://www.federalreserve.gov/newsevents/press/bcreg/20110629a.htm).

an indirect cost of effort or time. On the supply side, merchants and financial institutions can influence either type of cost. The monetary cost can also be negative, as is the case with credit card rewards or cash back on credit card transactions. The reaction to a change in cost or to differences in cost among payment instruments also varies across the parties involved in transactions. Wright (2012) develops a model where merchants pay too much for the use of payment card networks and consumers pay too little. Despite the high cost of card acceptance, merchants internalize that cost, and most accept cards. Depending on the level of pass-through, retail prices faced by consumers include the merchants' cost of credit card processing. There are at least two reasons why most U.S. merchants accept cards: (1) competitive pressure induces them to meet consumer demand for card acceptance, and (2) accepting cards may actually increase their net revenues, as several studies have shown that consumers spend more when paying with cards than when paying with cash. Prelec and Simester (2001) and Prelec (2009) show the results of an experiment where consumers were willing to pay up to twice as much when paying with a credit card compared to paying with cash.

In Bounie, François, and Van Hove (2016), tax regimes (another form of pricing) may affect merchant acceptance of payment methods. They argue that merchants classified as "micro-firms" fall under different tax regimes, and as such have more room for tax evasion. Micro-firm merchants are less likely to accept cards so as to avoid having to report their revenues.

Example: Discounts and surcharges based on payment methods

While price differentiation based on payment method in the United States has been rare, there is some evidence from other countries that consumers respond to differentiated prices. Using data from Norway and the Netherlands, Bolt, Humphrey, and Uittenbogaard (2008) find a significant and positive effect of price incentives (price differentiation) on the demand for electronic payments, while controlling for terminal availability. Bolt, Jonker, and van Renselaar (2010) find that Dutch consumers opted for cash when faced with small surcharges on debit card transactions. The paper shows that consumers are sensitive to price incentives, regardless of their payment preferences. When differentiated pricing is allowed, merchants can—to some

extent—successfully steer consumers to the payment instrument merchants prefer the most. Schuh et al. (2012) describes an experiment conducted by the Swedish furniture company IKEA, where consumers in the United Kingdom were surcharged for credit card payments, while consumers in the United States were given a discount for debit card payments. Both experiments led to changes in payment behavior, with a large shift away from credit cards in the United Kingdom, and a smaller shift toward debit cards in the United States. The surcharge and discount results are not perfectly comparable because of the different countries and time periods, but the results generally support the notion that consumers respond more to surcharges than to discounts.

In the United States, merchants were recently allowed to offer price discounts and other incentives to steer customers to pay with methods that are less costly to merchants. However, very few merchants have utilized those privileges thus far. Shy and Stavins (2014, 2015) used data from the Federal Reserve Bank of Boston's Diary of Consumer Payment Choice (DCPC) to examine the effect of a change in regulation on payment behavior. When granted the ability to provide incentives against credit card use, merchants did not respond. Only a very small fraction of transactions received a cash or debit card discount, and even fewer were subjected to a credit card surcharge. Shy and Stavins attributed this finding in part to the merchants' fear of alienating consumers, who may not view the steering attempts as an "acceptable norm." Transactions at gasoline stations were more likely to receive either cash discounts or credit card surcharges than transactions in other sectors. Transactions over $20 were significantly more likely to receive a cash discount.

Stavins and Wu (forthcoming) used data from the 2015 DCPC to analyze price incentives. They tested whether consumers are likely to deviate from their preferred payment methods in order to get a discount or to avoid a surcharge. They found that price incentives continued to be rare in 2015, but consumers who preferred other payment methods had a significant probability of switching to cash because of cash discounts, after controlling for merchant category and dollar value of the transaction. Thus, steering by merchants may be

effective under some circumstances. Both merchants' reluctance to offer price discounts and consumers' limited response to them lead to the low observed occurrences of such incentives.

While supply-side factors may have a significant effect on consumer payment choices, they constitute only one side of the landscape. Below, we examine some of the important factors on the demand side of payments.

IV. **Demand-Side Factors Affecting Consumer Payment Choice**

In addition to the supply-side considerations mentioned above, several demand-side factors influence consumers' payment behavior. While many or most supply-side factors are exogenous with respect to consumers, the same may not be true for demand-side factors. Some of the factors that can be assumed to be exogenous with respect to consumer payment behavior include demographic attributes. Income may be taken as given in the short run for many consumers. In other words, while demographic and financial attributes influence a consumer's payment choices, her payment choices do not in turn affect her demographic or financial characteristics.[7] Modeling demand-side factors' effect on payment behavior is therefore more straightforward, as the measures of payment behavior can be modeled as a function of demographic attributes and income. However, consumer preferences have also been found to have a strong effect on payment choice, as we discuss below. Even though consumer preferences have been modeled as exogenous with respect to payment behavior in the literature, that assumption may not always be correct. Nevertheless, at any point in time, or in cross-sectional models, consumer preferences can be viewed as exogenous with respect to payment behavior. We consider the exogenous factors first, followed by a discussion of the effect of consumer preferences on payment behavior.

[7] That assumption may not be correct if the consumer borrows on her credit cards, thereby substantially increasing her consumer debt and—in turn—lowering her net assets. However, we are concerned here with credit cards as a payment method to conduct transactions.

A. Payment behavior and demographics

The correlation between demographics and payment behavior has been studied extensively, and ample evidence shows that the effect of demographic attributes on payment use is significant. Previous papers showing that income and demographic attributes, such as education and age, are correlated with consumers' payment behavior include: Stavins (2001), Hogarth, Anguelov, and Lee (2004), Kim, Widdows, and Yilmazer (2005), Klee (2006), Bertaut and Haliassos (2006), Zinman (2009), and Mester (2012). All of the above studies used data from the Survey of Consumer Finances (SCF), a tri-annual survey of U.S. consumers' financial conditions. Carow and Staten (1999) used data from their own 1992 survey of gasoline credit card holders to show that demographic attributes affect a decision to use credit cards at gasoline stations, and Mantel (2000) used data from a single consumer survey on bill payment instruments to show that demographic and income characteristics are correlated with payment choice. Rysman (2007) and Herbst-Murphy (2010) used data from a proprietary Visa Payment Panel Study to analyze payment card use by demographic characteristics, while Henry et al. (2015) used data from the Bank of Canada's Method of Payment Survey to show the correlation between demographic attributes and payment use in Canada. Bagnall et al. (2016) showed that there are similarities across the industrialized countries in the correlation between the use of cash and the demographic characteristics of consumers, such as income or education.

Mann (2011) used data from the 2008 Survey of Consumer Payment Choice (SCPC) to show that there are significant differences in payment behavior between white and black consumers, and among consumers of various ages. Based on data from five consecutive annual SCPC surveys from 2009 to 2013, Connolly and Stavins (2015) confirmed a strong cross-sectional relationship between demographic characteristics and payment behavior, but observed very few significant changes in payment behavior by demographics over the five-year period. This suggests that payment behavior evolves slowly over time and that the effect of demographics and income does not vary in the short to medium run.

Connolly and Stavins (2015) found that age, education, and income are especially strongly correlated with both adoption and use of most payment instruments in the United

States, while race was strongly correlated with use. Cash was used most heavily by young, black, least-educated and lowest-income consumers, while credit cards were used mostly by older, wealthier, and more-educated individuals. Schuh and Stavins (2010, 2013) used Heckman's (1976) two-stage econometric model to estimate the adoption of payment instruments (stage 1, extensive margin) and use conditional on adoption (stage 2, intensive margin). Koulayev et al. (2016) applied a structural model, where consumers adopt a bundle of payment instruments and determine the use of those payment instruments simultaneously. Schuh and Stavins (2010, 2013) and Koulayev et al. used data from a single-year's SCPC survey data, and all three studies show that demographics and income have significant effects on the adoption and use of payment instruments. Using data from the Michigan Survey of Consumers, Borzekowski and Kiser (2008) and Borzekowski, Kiser, and Ahmed (2008) show that demographics are strongly correlated with debit card use.

Stavins (2016) uses panel data to estimate a random effects model with sample selection. She finds that the effect of income and demographic attributes on consumer payment behavior remains fairly stable over a multi-year period, even after controlling for all the other attributes. In particular, age is correlated with check use, but is inversely correlated with debit card use. As Connolly and Stavins (2015) showed based on summary statistics, regression results indicate that black consumers use more cash and prepaid cards, but use credit cards less. Education has a very strong effect on the use of cash (negative) and credit cards (positive). Men use cash much more intensively than women do.

Most of the studies mentioned here consistently find that younger people use more debit, older people use more checks, and higher-income consumers tend to rely more heavily on credit cards. What has not yet been established in the literature is whether the age effects on payment use are related to biological age or to the birth cohort. For example, are people born in 1990 likely to remain heavy users of debit cards as they get older, will they shift toward the payment habits of their older relatives, or will they adopt some new payment technology? Longer time-series of micro data on payment behavior are needed to address such questions in the future. Although Stavins (2016) shows that the effect of age on payment behavior remains

stable between 2009 and 2013, the period is not long enough to separate the birth cohort effects from the age effects.

B. Assessment of characteristics

Although the correlation and effects of demographics and income on payment behavior have been more thoroughly researched, there is also a body of literature linking consumers' payment behavior to their assessment of payment method attributes. However, unlike demographic attributes, assessments of characteristics may be endogenous with respect to payment behavior. In that case, estimating reduced-form regressions of payment behavior as a function of such assessments could yield biased results.

Wakamori and Welte (2017) argue that preferences broadly speaking affect payment behavior, and Huynh, Schmidt-Dengler, and Stix (2014) show that cash preferences affect cash use. Several papers show how characteristics of payment instruments affect consumer payment adoption and/or use (Koulayev et al. 2016; Schuh and Stavins 2010, 2013, 2015; Stavins 2013; Rysman 2010). All of these papers control for consumer demographic and income attributes, and find that assessments of characteristics significantly affect payment behavior even after controlling for all the other factors. In this section, we list some of the specific characteristics and briefly summarize research papers that show whether and how those characteristics affect consumer behavior.

i. Cost/rewards – demand

Above we discussed the importance of merchants' cost in affecting consumers' payment behavior. Here, we focus on the heterogeneity among consumers in their cost of acquiring or using various payment methods. Whatever the cost of accepting and processing a given payment instrument is for the merchants, different consumers may face a different cost of using that payment instrument. The cost of payment instruments is one of the most important characteristics affecting payment choice. Most of the papers analyzing the cost of payments do so in the context of credit cards. That is because credit cards differ from the other payment instruments in that they allow cardholders to borrow funds and therefore can also serve as a

source of credit. The cost of using credit cards—namely, interest charges and fees—has been analyzed in the context of payment behavior. Zinman (2009) shows that the cost of revolving on credit cards influences consumers' choice between credit and debit. Klee (2008) shows that various types of cost are significant in explaining consumers' choice of payment method: opportunity cost (that is, interest rates), transaction costs, and handling costs. Borzekowski, Kiser, and Ahmed (2008) show that fees on credit cards help explain the use of debit cards. Credit card rewards, which can be treated as a negative cost of using credit cards for transactions, have been found to be an important factor influencing consumer payment decisions, as found in Arango, Huynh, and Sabetti (2011), Simon, Smith, and West (2010), and Ching and Hayashi (2010).

ii. Security

Payment security has become increasingly prominent in the United States for all the parties involved in payment transactions: policymakers, consumers, merchants, and financial institutions. Payment policy improvement plans for the Federal Reserve have focused specifically on security in recent years. The Federal Reserve Financial Services strategic plan identifies security improvements as one of its top initiatives for payment system policy in the United States (Stavins 2013, Federal Reserve System 2015). In almost every annual Survey of Consumer Payment Choice, consumers select security as the most important aspect of payments, above cost, convenience, and other attributes (Stavins 2013).

Even though consumers choose security as the most important attribute of payment instruments, the research showing how perceptions of security affect payment behavior is limited. In models of consumer payment behavior, security assessment has been found to significantly affect payment use, although the effect is not as large as the effect of cost or convenience assessment. Nevertheless, there is some evidence that perceptions of security significantly affect adoption and use of payment instruments: Koulayev et al. (2016), Schuh and Stavins (2015), and Stavins (2013).

Kahn and Liñares-Zegarra (2015) show that experiencing identity theft affects consumers' payment behavior. Kahn, Liñares-Zegarra, and Stavins (2017) find that consumers tend to be influenced by their neighbors' perceptions of payment instrument security, evidence of social spillovers in payment markets: others' perceptions of security of payment instruments exert a positive influence on one's own payment security perceptions. The results imply that a consumer's assessments of security converge to his peers' average assessment: a 10 percent change in the divergence between one's own security rating and peers' average rating will result in a 7 percent change in one's own rating in the next period. The spillovers are stronger for people who experience an exogenous shock to security perception, people who have more social interactions, and younger consumers, who are more likely to be influenced by social media. However, social spillovers have only a small impact on payment behavior, as others' perceptions seem to affect one's own payment behavior mainly indirectly through the effect on one's own perceptions.

Earlier papers find inconclusive results for the effect of security perceptions on consumer payment behavior. Mantel (2000) found that several factors affected the adoption of electronic bill payments, but preferences for security and privacy were not significant in the regressions. Kosse (2013) studied the impact of consumers' perception of safety on debit card and cash use, based on consumer survey data from the Netherlands. The paper found that Dutch consumers' assessment of safety was itself influenced by personal preferences for payment instruments. In addition, risk aversion, personal characteristics, and personal experiences were all significant.

Exogenous shocks, such as widely publicized security breaches, may significantly affect consumer perceptions of payment security. Greene and Stavins (2016) found that the ratings for the security of personal information of debit cards collected after the Target breach in late 2013 were lower than ratings collected before the breach was reported.

More research needs to be done to establish conclusive evidence on the effect of payment method security on consumer behavior. In particular, there is a lack of objective, quantitative measures of security. Although subjective perceptions are very important—and

ultimately consumers act upon their subjective beliefs—more data on the probability of fraud and theft would help researchers measure the effect of the actual likelihood of security breaches on consumer behavior.

iii. Other characteristics

In addition to cost and security, other characteristics of payments have been found significant in affecting consumers' payment choice. In particular, convenience, speed, and acceptance for payment influence how consumers pay. Speed at checkout is especially important for point-of-sale transactions (Schuh and Stavins 2015, Arango et al. 2011, Borzekowski and Kiser 2008, Klee 2006), although there is no consensus as to which payment instrument leads to fastest transactions. Some studies find that cash is faster than cards, while others find the opposite .

Although acceptance of payment instruments for transactions could be described as a supply-side factor, it can also be viewed as another payment characteristic. Acceptance has been shown to be an important factor in payment selection. Bounie, François, and Van Hove (2016) show that consumer preferences affect card acceptance. Huynh, Schmidt-Dengler, and Stix (2014) discuss the importance of payment method acceptance in the context of payment choice. In Arango et al. (2011), cash dominates low-value transactions, due to limited acceptance of other payment instruments. Rysman (2007) discusses homing related to acceptance.

Of course, although acceptance is a necessary condition for payment use, it is not sufficient. In Wakamori and Welte (2017), findings imply that debit cards would not fully replace cash even in the case of universal debit acceptance.

V. How Consumers Pay

Above, we discussed selected supply-side and demand-side factors affecting how consumers pay. It is not always easy to isolate specific factors, and what we observe is the intersection of all the factors—technology, cost, acceptance, and regulation on the supply side, and preferences and socio-demographic characteristics of consumers on the demand side.

A. Transactions by payment instrument

In the United States, consumers hold a wide variety of different combinations of payment methods, even though they mostly use cash, debit cards, and credit cards for their transactions. Figure 4 shows just the most popular bundles of payment instruments held by U.S. consumers, based on the 2016 Survey of Consumer Payment Choice. Although almost 15 percent of consumers held the same combination of seven payment instruments, the fraction of consumers holding each specific bundle quickly drops to low single digits.

Number of PI.	Cash	Check	Money Order	Credit Card	Debit Card	Prepaid Card	OBBP	BANP	Percent of Consumers
7	X	X		X	X	X	X	X	14.5
6	X	X		X	X		X	X	9.5
6	X	X		X	X	X		X	8.0
5	X	X		X	X			X	7.8
5	X	X		X	X		X		3.4
6	X	X		X	X	X	X		3.2
4	X	X		X	X				2.6
8	X	X	X	X	X	X	X	X	2.3
5	X	X		X	X	X			1.9
2	X					X			1.9
3	X		X			X			1.9
4	X	X		X				X	1.9
									58.9

Figure 4: Most popular bundles of payment instruments held by consumers.
Source: 2016 Survey of Consumer Payment Choice. Data from the 2016 Survey of Consumer Payment Choice are preliminary and subject to revision.

Figure 5 shows the use shares of transactions conducted with individual payment instruments by U.S. consumers from 2008 to 2016, based on the SCPC survey data. As the figure shows, the share of paper check has declined over time, but no other payment instrument share has exhibited a monotonic change during that period. The share of credit card transactions dropped initially—possibly due to the financial crisis, as indicated by the gray-shaded time period in the graph—but later increased, although the change from year to year was not always statistically significant. The share of cash transactions moved in the opposite direction from credit cards—it

rose initially and later dropped. Even though the share of electronic payments (online banking bill pay or OBBP and bank account number pay or BANP) increased slightly over time, neither of them approached cash, debit, or credit cards in their share of consumer transactions.

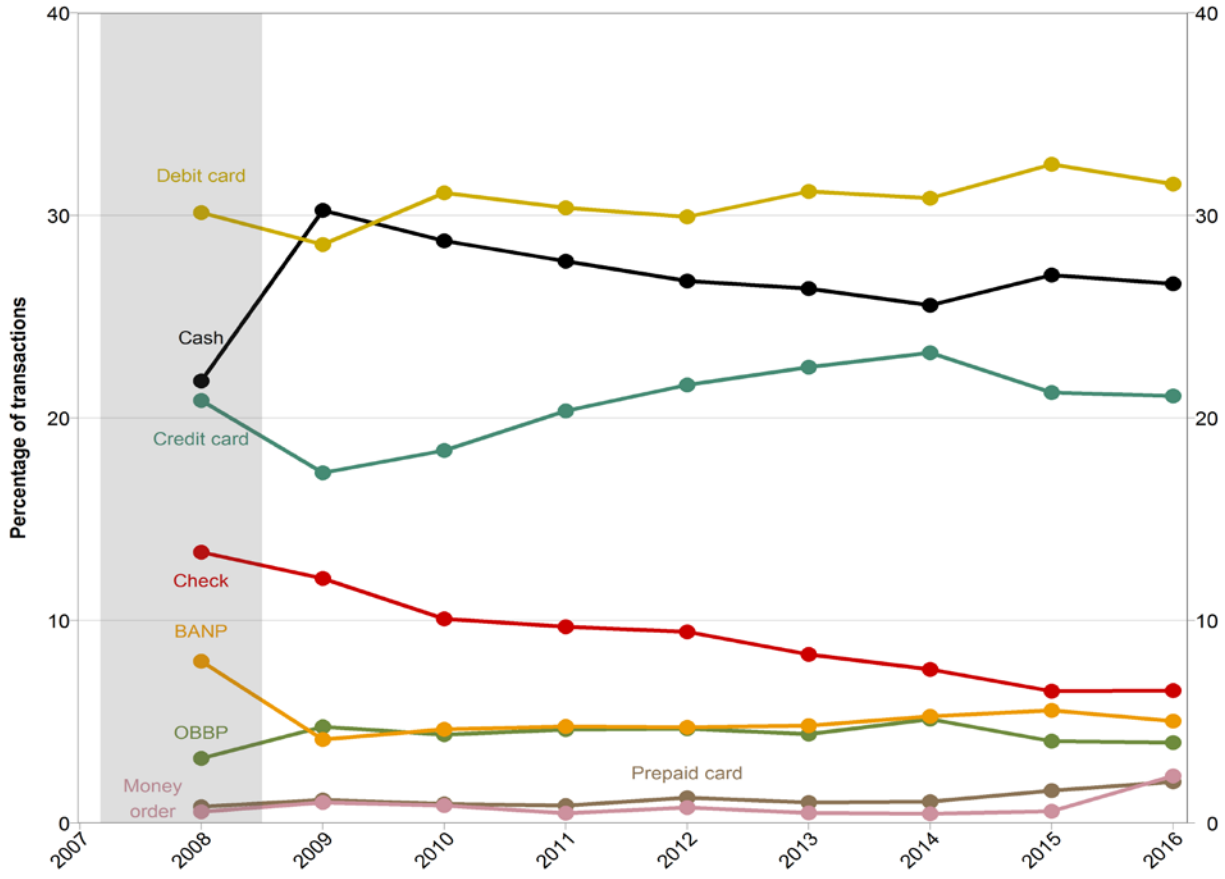

Figure 5: U.S. consumers' shares of transactions by payment instrument.
Source: Survey of Consumer Payment Choice, 2008–2016. Data from the 2016 Survey of Consumer Payment Choice are preliminary and subject to revision.

B. Homing on a single payment instrument

Shy (2013), Rysman (2007), and Cohen and Rysman (2013) discuss the issue of homing, namely the concentration of all or most of the transactions conducted by a consumer with a single payment instrument. There is evidence that a significant fraction of consumers use a single

payment method, such as debit or credit cards, to conduct the vast majority of their transactions. Shy (2013) finds that consumers tend to concentrate the majority of their transactions (in terms of both the number and value of transactions) on a single type of card, that is, either credit or debit cards. Moreover, consumers concentrate their spending on one of the card networks, such as Visa or MasterCard. Cohen and Rysman (2013) use scanner data on grocery purchases for a large panel of households to show that households focus most of their expenditures on one, or at most two, payment instruments in choosing among using cash, check, or card, and they very rarely switch from their preferred method.

C. Payments by type and value of transaction

On average, U.S. consumers conduct approximately 70 transactions every month (Survey of Consumer Payment Choice). Some of those transactions are for retail purchases of goods and services—either in person or online—and some are for bill payments. Consumers may use different payment instruments depending on the type of transaction and depending on the value of transaction.

The dollar value of a transaction has a significant impact on payment choice. Although, so far, theoretical literature has not explained why transaction size affects payment choice, several papers have shown that consumers choose a different payment method for transactions of different value. Typically, low-value transactions tend to be conducted in cash, and the share of cash diminishes as the value of the transaction rises. This phenomenon has been observed based on data from the United States, Canada, and some European countries (Bagnall et al. 2016; Cohen and Rysman 2013; Arango, Huynh, and Sabetti 2011; Klee 2008, Bounie and François 2006; Hayashi and Klee 2003). Klee (2008) used data from a grocery store chain to find a strong correlation between payment choice and transaction value: cash transactions were very concentrated at low-value sales (median value $14.20), followed by debit cards ($26.35), credit cards ($30.85), and, finally, paper checks ($34.60). Among card payments, debit card transactions were more concentrated at lower values, while credit card transactions had a broader distribution.

Moreover, the relationship between transaction value and payment instrument may also differ across types of transaction. Briglevics and Schuh (2014) show that the probability of using cash declines much faster with transaction value for in-person purchases than for bill payments. Figure 6 shows the distribution of the probability of using different payment instruments by the value of transaction, based on the data from the 2015 Diary of Consumer Payment Choice. The left chart shows the distribution for in-person transactions, while the right chart shows the distribution for not-in-person transactions. As Figure 6 shows, in-person cash transactions are much more concentrated at low values, and the probability of using cash drops with value. The reverse is observed for paper check: in-person transactions are more likely to be paid by check as the value of transaction rises. Debit and credit cards both have an inverted u-shaped distribution, with the probability rising initially, but then dropping above a certain value threshold. For not-in-person transactions, the probability of using cards declines much more gradually with the value of transaction. Low-value transactions are more likely to be conducted with debit or credit, while transactions above $150 are most likely conducted with paper checks. One possible explanation for the differences between the two charts is that consumers are more likely to face supply-side restrictions for not-in-person transactions, while for in-person transactions they are more likely to pay based on their own preferences. For example, cash is usually used only in person.

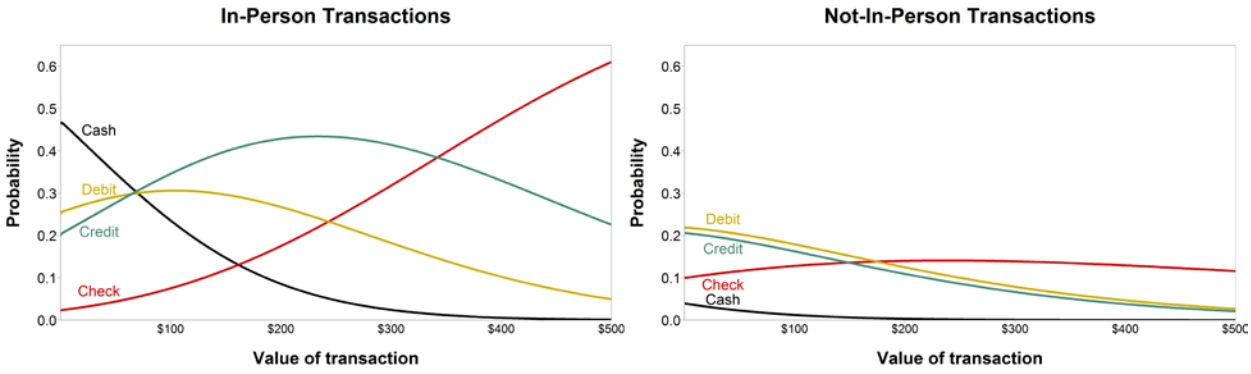

Figure 6: Payment instrument choice of in-person transactions (left) and not-in person transactions (right).

Source: 2015 Diary of Consumer Payment Choice. Data from the 2015 Diary of Consumer Payment Choice are preliminary and subject to revision.

Other factors influencing payment choice are type of merchant and interface. In some cases, lack of merchant acceptance dictates payment choices feasible for consumers. For example, cash cannot be used for online transactions, and consumers often use different payment instruments at different type merchants. Wang and Wolman (2016) use transaction-level data from a large discount retail chain and find strong effects of location, time, and size of transaction on consumer payment choices. Zhang (2016) finds that consumer payment behavior is very different for rental payments than for other types of payments.

Approximately two-thirds of transactions conducted by U.S. consumers are for retail goods and services, while about one-third are for bill payments. Although the number of online transactions increased slightly over time, the payment evolution has been slow, and annual changes tend to be statistically insignificant. The composition of transactions—in person, online, by mail—has remained more or less steady over the past several years (Figure 7).

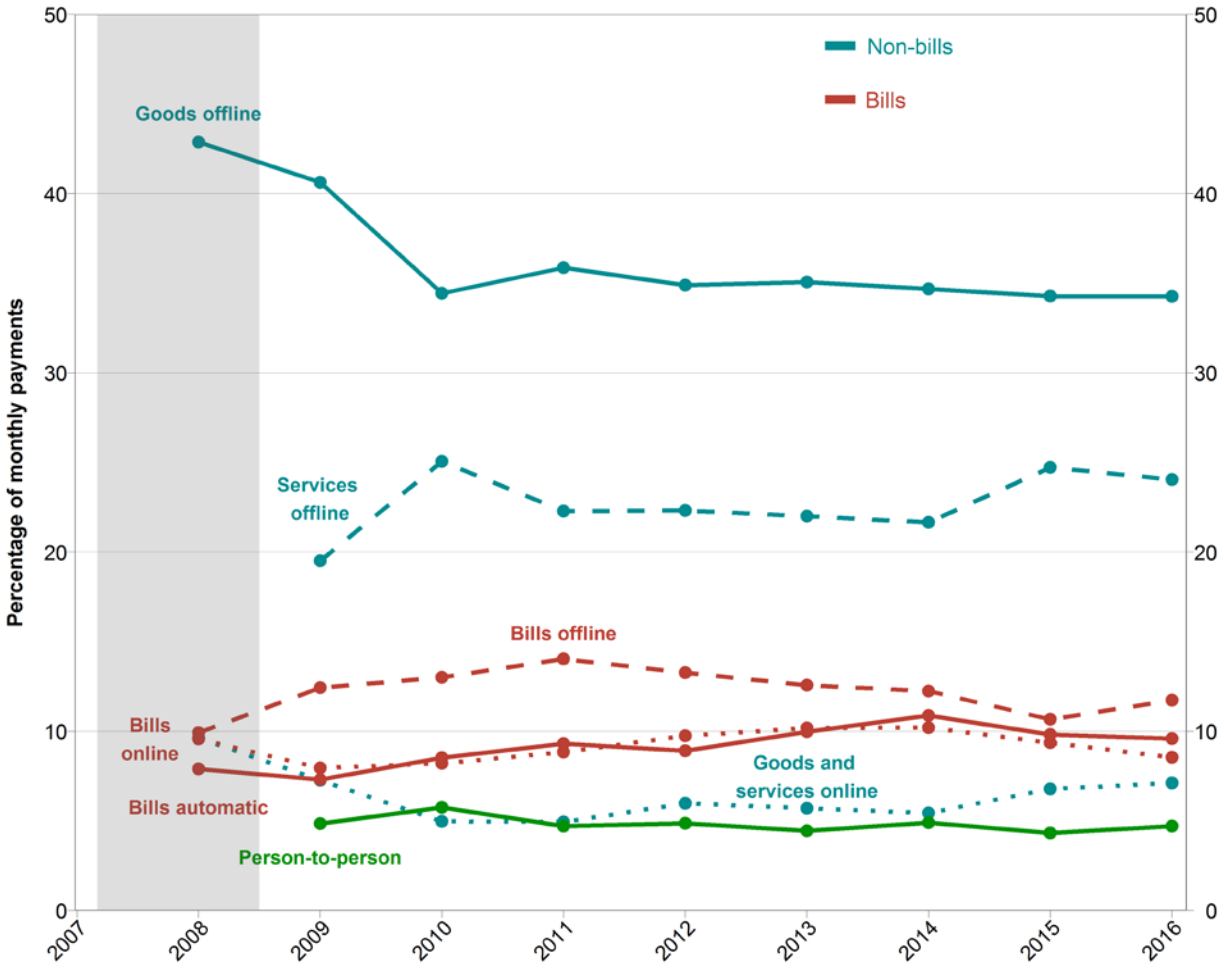

Figure 7: Composition of consumer payments by type of transaction.
Source: SCPC, 2008–2016. Data from the 2016 Survey of Consumer Payment Choice are preliminary and subject to revision.

D. Mobile banking and payments

Compared with some other developed and developing countries, the United States has seen relatively slow growth of mobile payments. There are still many obstacles preventing mobile payments from being used more widely. Crowe, Rysman, and Stavins (2010) discuss supply-side and demand-side reasons why the growth of mobile payments in the United States has not been more rapid.

Nevertheless, mobile banking and mobile payments have become more common in the United States over the past few years. As Figure 8 shows, mobile banking and mobile payments

became much more widely used by U.S. consumers in 2013 than in earlier years (the survey did not ask about mobile payments in 2014 or 2015). The adoption of mobile banking, the use of mobile payments, and the use of mobile payments by text messages increased significantly from 2012 to 2013. In 2013, almost half of all U.S. consumers used mobile banking, and the most common use of mobile banking was to check the user's account balance or recent transactions. The percentage of consumers who used any form of mobile payments increased from 18 percent in 2012 to 35.9 percent in 2013, a statistically significant increase.

For comparison, Figure 8 also displays data from the Federal Reserve Board's Survey of Consumers' Use of Mobile Financial Services (CMFS) from 2011 to 2016 (Federal Reserve System 2016). The CMFS data also indicate an increase in the adoption of mobile banking and in the use of mobile payments. Based on the most recent annual survey of consumers' use of mobile financial services (Federal Reserve System 2016), 43 percent of all mobile phone owners with a bank account (41 percent of all consumers) used mobile banking in 2015. However, mobile payments remain less common than mobile banking: only 24 percent of all mobile phone owners and 28 percent of smartphone users (23 percent of all consumers) report having made a mobile payment in 2015.

The vast majority of mobile payments, as well as online payments, access a consumer's bank account via a more traditional method, such as a credit card, a debit card, or ACH. However, the payment interface itself is an important attribute that may affect both merchants' acceptance of and consumers' demand for a given payment method. For example, a new interface may require an additional device at the checkout, changing both the cost and the security of the affected payment method(s) for merchants and for consumers. Therefore, it is important to distinguish between the access channel and the payment method.

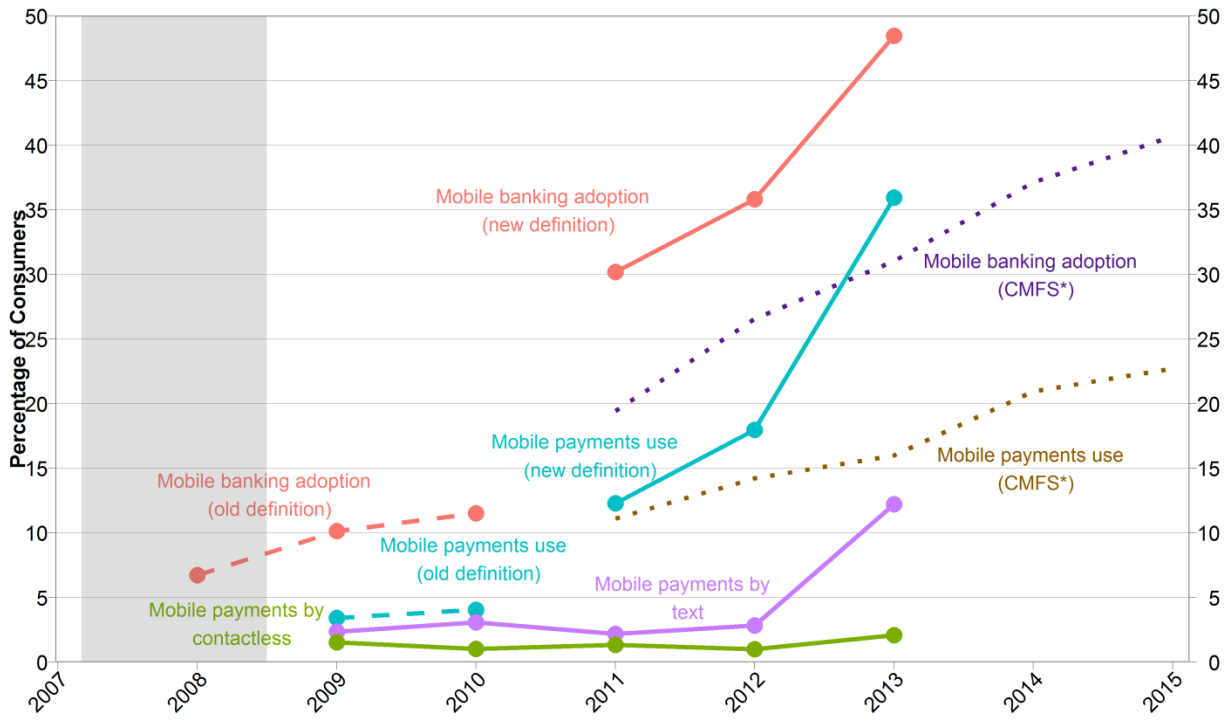

Figure 8: Mobile banking and payments

Source: 2008–2013 Survey of Consumer Payment Choice.

* CMFS: Federal Reserve Board's Survey of Consumers' Use of Mobile Financial Services 2011–2016.

Note: The shaded area indicates recession as defined by the NBER.

Mobile payments constitute an example of a relatively new technology adopted for payments by consumers. As with any type of new technology, there is a lag between the time the technology is available and the time when it becomes widely adopted. There are several reasons for this lag:

- Acceptance: merchants may not accept the new forms of payments
- Network effects on the supply side: both merchants and consumers have to adopt the payment instruments (markets with this characteristic are often referred to as two-sided markets)
- Network externalities on the demand side: consumers are more likely to adopt a new technology the more widespread it is among other consumers, especially for person-to-person payments
- Cost: marginal cost versus average cost. Although the marginal cost of a single transaction may be lower with the new technology, it may require a fixed cost of new technology adoption, and the average cost may therefore be higher for the new technology than for the existing methods. Consumers and merchants compare the average cost of the new methods to the average cost of existing payment methods, which may be free (for example, paper checks from some financial institutions) or even pay rewards (credit cards). Network owners may charge hidden fees that increase the cost of banking or of goods and services.
- Security concerns: new technology may raise more security concerns, especially if the liability for fraudulent transactions is not clearly defined. For example, in a recent SCPC survey, 58 percent of consumers said that mobile payments are risky or very risky, compared with about 20 percent for online, by mail, or by phone payments.

E. Unbanked and underbanked consumers

The fraction of consumers without a bank account has been under 10 percent in several recent SCPC surveys. In the 2015 SCPC, 8.2 percent of consumers were unbanked and 24.2 percent were underbanked. Following the FDIC definition, the SCPC defines consumers as underbanked if they have a bank account, but have also purchased services from a nonbank

institution (money order, cashier's checks, check cashing, remittances, and/or payday loans), and/or have used personal property to secure a loan at a pawn shop, used rent-to-own services, or taken out a tax refund anticipation loan. The unbanked and the underbanked consumers are primarily low-income and minority (Cole and Greene 2016, Greene and Shy 2015).

Although the SCPC cannot determine whether the lack of bank account access is caused by supply-side or demand-side reasons, the survey asks respondents why they do not have a bank account. Every year, the most commonly stated reason why people do not have a bank account has been "I don't like dealing with banks." This would suggest that for a large fraction of unbanked consumers, the reason is related to demand, and not caused by supply-side restrictions.

Because most payment instruments access a bank account, unbanked consumers have a very limited set of choices for ways to conduct their transactions. It is not surprising therefore that the unbanked pay very differently from the way people with a bank account pay. In the 2014 SCPC, 82 percent of the transactions for the unbanked were paid with cash, and 11 percent were paid with a prepaid card. In contrast, the shares for U.S. consumers with a bank account were 25 percent with cash and 1.0 percent with a prepaid card (Cole and Greene 2016).

VI. International Comparison

In this section, we provide a brief overview of the literature that shows how U.S. consumers compare with consumers in other countries. Central banks in several other developed countries have conducted surveys or diaries of consumer payment behavior. Although the survey formats vary across countries, there are many similarities among them. In fact, researchers have frequently collaborated on the survey design, with such collaboration ranging from informal discussions to sharing the details on the survey format and the exact wording of the survey or diary questionnaires.

Despite the cross-country heterogeneity in payment behavior, many of the patterns described above can be observed in other countries. For example, even though European consumers do not typically rely on credit cards or checks to the extent that U.S. consumers do, in several other countries researchers have noted a relationship between the dollar value of a transaction and the probability of a consumer's using cash. Low-value transactions are more likely to be paid in cash, and as the value rises, so does the probability of using a card for payment. Likewise, differences across the demographic cohorts have been observed in many countries, where younger, lower-income, and lower-education consumers tend to use cash more heavily than other consumers. Differences across countries cannot always be attributed to differences in the cost structure or market structure on the supply side. Rather, heterogeneity in consumer preferences across countries may be causing some of the differences in payment behavior.

Survey and diary data have been collected in several countries other than the United States. Studies that have analyzed consumer payment behavior in other countries include Bagnall et al. (2016), Hernandez, Jonker, and Kosse (2016), van der Cruijsen, Hernandez, and Jonker (2017), Huynh, Schmidt-Dengler, and Stix (2014), Arango, Huynh, and Sabetti (2011), Bounie, François, and Van Hove (2016), and Bounie and François (2006).

Bagnall et al. (2016) analyzes consumers' use of cash based on diary surveys from seven countries: Canada, Australia, Austria, France, Germany, the Netherlands, and the United States. They find that even though cash use differs across countries, the shares of cash transactions remain high in all the countries, especially for low-value transactions, even when several other payment methods are available everywhere. In all the countries studied, the use of cash is strongly correlated with transaction size, demographics, and point-of-sale characteristics, such as merchant card acceptance and venue, just as in the United States, as shown in this study.

Hernandez, Jonker, and Kosse (2016) and van der Cruijsen, Hernandez, and Jonker (2017) discuss payment behavior in the Netherlands. Hernandez, Jonker, and Kosse (2016) shows that consumers find debit cards to be more useful for monitoring their household finances than cash. van der Cruijsen, Hernandez, and Jonker (2017) find that consumer payment

habits tend to be persistent, explaining why the substitution from cash to debit cards in the Netherlands has been slower than previously expected. Again, similar patterns of slow payment evolution have been found in the United States.

Huynh, Schmidt-Dengler, and Stix (2014) use detailed payment diary data from Austrian and Canadian consumers to show that lack of card acceptance at the point-of-sale is the reason why cash continues to have a large market share in those countries. They find that cash use falls with an increase in card acceptance.

Arango, Huynh, and Sabetti (2011) use the Bank of Canada 2009 Method of Payment Survey, a two-part survey of adult Canadians, containing a detailed questionnaire and a three-day shopping diary, to analyze consumer payment behavior in Canada. In an approach similar to that of Schuh and Stavins (2010, 2013), they estimate the effect of consumer socioeconomic characteristics, payment instrument attributes, and transaction features on the probability of using cash, debit card, or credit card at the point-of-sale. They find that cash is still used intensively for low-value transactions, due to speed, merchant acceptance, and low costs, while debit and credit cards are used more frequently for higher transaction values, due to safety, record keeping, the ability to delay payment, and credit card rewards.

Bounie, François, and Van Hove (2016) use data from a shopping diary to measure French consumers' payment preferences and match these with data from a French merchant survey. They find that consumer preferences can influence merchant card acceptance—the higher the probability that the transaction is paid for by a card, the higher the probability that the merchant will accept cards. The study provides empirical evidence for the existence of network externalities in the card market.

Bounie and François (2006) use detailed transaction data from a French shopping diary to estimate the effect of transaction characteristics on the use of payment instruments. Controlling for individual consumer characteristics, they find that the probability of a transaction being paid by cash, check, or card at the point-of-sale is influenced by transaction

size, by type of good, and by type of merchant. The probability of a transaction being paid in cash is very high for low-value transactions, and declines as the value of a transaction increases.

VII. **Conclusion**

Consumer payment behavior is a complex intersection of supply-side factors, such as cost, technology, regulation, and merchant acceptance, and demand-side factors, including individual consumer demographics and income, consumer preferences, consumers' assessments of payment method attributes, and network effects stemming from the behavior of peers. Although explaining the exact causes of payment patterns is challenging, there exists both theoretical and empirical literature addressing many of those factors. The studies summarized here use a growing number of available data sources, including several surveys and diaries of consumer behavior conducted in the United States and elsewhere. Nevertheless, more work needs to be done to understand not just *how* consumers make their payment choices, but *why* they pay as they do.

References

Arango, Carlos, Kim P. Huynh, and Leonard Sabetti. 2011. "How Do You Pay? The Role of Incentives at the Point-of-Sale." ECB Working Paper no. 1386. October.

Bagnall, John, David Bounie, Kim P. Huynh, Anneke Kosse, Tobias Chmidt, Scott Schuh, and Helmut Stix. 2016. "Consumer Cash Usage: A Cross-Country Comparison with Payment Diary Survey Data." *International Journal of Central Banking* 12(4).

Benton, Marques, Krista Blair, Marianne Crowe, and Scott Schuh. 2007. "The Boston Fed Study of Consumer Behavior and Payment Choice: A Survey of Federal Reserve System Employees." Federal Reserve Bank of Boston Public Policy Discussion Paper No. 07–1.

Bertaut, Carol C., and Michael Haliassos. 2006. "Credit Cards: Facts and Theories." Bertola, Guisseppe, Richard Disney, and Charles Grant, eds., *The Economics of Consumer Credit.* Cambridge, MA: MIT Press, pp. 181–237.

Bolt, Wilko, David Humphrey, and Roland Uittenbogaard. 2008. "Transaction Pricing and the Adoption of Electronic Payments: A Cross-Country Comparison." *International Journal of Central Banking*, March.

Bolt, Wilko, Nicole Jonker, and Corry van Renselaar. 2010. "Incentives at the Counter: An Empirical Analysis of Surcharging Card Payments and Payment Behavior in the Netherlands." *Journal of Banking & Finance* (34): 1738–1744.

Borzekowski, Ron, and Elizabeth K. Kiser. 2008. "The Choice at the Checkout: Quantifying Demand Across Payment Instruments." *International Journal of Industrial Organization* 26: 889–902.

Borzekowski Ron, Elizabeth K. Kiser, and Shaista Ahmed. 2008. "Consumers' Use of Debit Cards: Patterns, Preferences, and Price Response." *Journal of Money, Credit, and Banking* 40(1): 149–172.

Bounie, David, and Abel François. 2006. "Cash, Check or Bank Card? The Effects of Transaction Characteristics on the Use of Payment Instruments." Telecom Paris Economics and Social Sciences Working Paper No. ESS-06-05. March.

Bounie, David, Abel François, and Leo Van Hove. 2016**.** "Consumer Payment Preferences, Network Externalities, and Merchant Card Acceptance: An Empirical Investigation." *Review of Industrial Organization* 1–34, December.

Briglevics, Tamás, and Scott Schuh. 2014. "This is What's in Your Wallet... and Here's How You Use It." Federal Reserve Bank of Boston Working Paper No. 14-5.

Carow, Kenneth A., and Michael E. Staten. 1999. "Debit, Credit, or Cash: Survey Evidence on Gasoline Purchases." *Journal of Economics and Business* 51: 409–21.

Ching, A., and Fumiko Hayashi. 2010. "Payment Card Rewards Programs and Consumer Payment Choice." *Journal of Banking and Finance* 34(8): 1773–1787, August.

Cohen, Michael, and Marc Rysman. 2013. "Payment Choice with Consumer Panel Data." Federal Reserve Bank of Boston Working Paper No. 13-6.

Cole, Allison, and Claire Greene. 2016. "Financial Inclusion and Consumer Payment Choice." Federal Reserve Bank of Boston Research Data Report No. 16–05.

Connolly, Sean, and Joanna Stavins. 2015. "Payment Instrument Adoption and Use in the United States, 2009–2013, by Consumers' Demographic Characteristics." Federal Reserve Bank of Boston Research Data Report No. 15-6.

Crowe, Marianne, Marc Rysman, and Joanna Stavins. 2010. "Mobile Payments at the Retail Point of Sale in the United States: Prospects for Adoption." *Review of Network Economics* 9(4).

Federal Reserve System. 2015. "Strategic Plan 2016–19." October.

Federal Reserve System. 2016. "Consumers and Mobile Financial Services 2016." March.

Greene, Claire, and Oz Shy. 2015. "How Are U.S. Consumers Using General Purpose Reloadable Prepaid Cards? Are They Being Used as Substitutes for Checking Accounts?" Federal Reserve Bank of Boston Working Paper No. 15-3.

Greene, Claire, and Joanna Stavins. 2016. "Did the Target Data Breach Change Consumer Assessments of Payment Card Security?" Federal Reserve Bank of Boston Research Data Report No. 16-1.

Hayashi, Fumiko, and Elizabeth Klee. 2003. "Technology Adoption and Consumer Payments: Evidence from Survey Data." *Review of Network Economics* 2(20): 175–190, June.

Heckman, J.J. 1976. "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models." F *Annals of Economic and Social Measurement 5:* 475–492.

Henry, Christopher S., Kim P. Huynh, and Q. Rallye Shen. 2015. "2013 Methods-of-Payment Survey Results." Bank of Canada Discussion Paper 2015-4.

Herbst-Murphy, Susan. 2010. "Trends and Preferences in Consumer Payments: Lessons from the Visa Payment Panel Study." Federal Reserve Bank of Philadelphia Payment Cards Center Discussion Paper, May.

Hernandez, L., N. Jonker, and A. Kosse. 2016. Cash versus Debit Card: The Role of Budget Control. *Journal of Consumer Affairs* 51(1): 91–112, June.

Hogarth J., C. Anguelov, and J. Lee. 2004. "Why Don't Households Have a Checking Account?" *Journal of Consumer Affairs* 38(1): 1–34.

Huynh, Kim P., Philipp Schmidt-Dengler, and Helmut Stix. 2014. "The Role of Card Acceptance in the Transaction Demand for Money." CEPR Discussion Paper No. DP10183, October.

Kahn, Charles M., and José Manuel Liñares-Zegarra. 2015. Identity Theft and Consumer Payment Choice: Does Security Really Matter*? Journal of Financial Services Research* 1–39.

Kahn, Charles M., José Manuel Liñares-Zegarra, and Joanna Stavins. 2017. "Are There Social Spillovers? Security Assessments of Payment Instruments." *Journal of Financial Services Research* 1–30.

Kay, Benjamin S., Mark D. Manuszak, and Cindy M. Vojtech. 2014. "Bank Profitability and Debit Card Interchange Regulation: Bank Responses to the Durbin Amendment." Finance and Economics Discussion Series 2014-77, Board of Governors of the Federal Reserve System.

Kim, Byoung-Min, Richard Widdows, and Tansel Yilmazer. 2005. "The Determinants of Consumers' Adoption of Internet Banking." Consumer Behavior and Payment Choice Conference Proceedings, Federal Reserve Bank of Boston, online.

Klee, Elizabeth. 2006. "Families' Use of Payment Instruments during a Decade of Change in the U.S. Payment System." Finance and Economics Discussion Paper No. 2005-01, February.

Klee, Elizabeth. 2008. "How People Pay: Evidence from Grocery Store Data." *Journal of Monetary Economics* 55(3): 526–541.

Kosse, Anneke. 2013. "The Safety of Cash and Debit Cards: A Study on the Perception and Behaviour of Dutch Consumers." *International Journal of Central Banking* 9(4): 77–98.

Koulayev, Sergei, Marc Rysman, Scott Schuh, and Joanna Stavins. 2016. "Explaining Adoption and Use of Payment Instruments by U.S. Consumers." *RAND Journal of Economics* 47 (2): 293–325, Summer.

Mann, Ronald J. 2011. "Adopting, Using, and Discarding Paper and Electronic Payment Instruments: Variation by Age and Race." Federal Reserve Bank of Boston Public Policy Discussion Paper No. 11-2.

Mantel, Brian. 2000. "Why Do Consumers Pay Bills Electronically? An Empirical Analysis." Federal Reserve Bank of Chicago Economic Perspectives, Fourth Quarter, 32–47.

Mester, Loretta J. 2012. "Changes in the Use of Electronic Means of Payment: 1995–2010." Federal Reserve Bank of Philadelphia Business Review Q3:25–36.

Prelec, Drazen. 2009. "Consumer Behavior and the Future of Consumer Payments." in *Moving Money: The Future of Consumer Payment* R. E. Litan and M. N. Baily (eds.), New York and Washington D.C.: Brookings Foundation.

Prelec, Drazen, and Duncan Simester. 2001. "Always Leave Home without It: A Further Investigation of the Credit-Card Effect on Willingness to Pay." *Marketing Letters* 12(1): 5–12.

Reserve Bank of Australia. 2014. Payment System Board Annual Report.

Rysman, Marc. 2007. "An Empirical Analysis of Payment Card Usage." *The Journal of Industrial Economics* 55(1): 1–36, March.

Rysman, Marc. 2010. "Consumer Payment Choice: Measurement Topics," in *The Changing Retail Payments Landscape: What Role for Central Banks?* An International Payment Policy Conference Sponsored by the Federal Reserve Bank of Kansas City: 61–81.

Rysman, Marc, and Scott Schuh. 2016. "New Innovations in Payments" in *Innovation Policy and the Economy, volume 17,* edited by Josh Lerner and Scott Stern. University of Chicago Press. 27–48.

Schuh, Scott, Oz Shy, Joanna Stavins, and Robert Triest. 2012. "An Economic Analysis of the 2011 Settlement Between the Department of Justice and Credit Card Networks." *Journal of Competition Law and Economics* 8(1): 107–144; doi: 10.1093/joclec/nhr020.

Schuh, Scott, and Joanna Stavins. 2010. "Why Are (Some) Consumers (Finally) Writing Fewer Checks? The Role of Payment Characteristics." *Journal of Banking and Finance* 34: 1745–1758.

Schuh, Scott, and Joanna Stavins. 2013. "How Consumers Pay: Adoption and Use of Payments." *Accounting and Finance Research* 2(2).

Schuh, Scott, and Joanna Stavins. 2015. "How Do Speed and Security Influence Consumers' Payment Behavior?" *Contemporary Economic Policy* doi: 10.1111/coep.12163.

Shy, Oz. 2013. "How Many Cards Do You Use?" Federal Reserve Bank of Boston Working Paper No. 13-3.

Shy, Oz, and Joanna Stavins. 2014. "Merchant Steering of Consumer Payment Choice: Lessons Learned from Consumer Surveys**."** *Survey Methods: Insights from the Field.* Retrieved from http://surveyinsights.org/?p=3008.

Shy, Oz, and Joanna Stavins. 2015. "Merchant Steering of Consumer Payment Choice: Evidence from a 2012 Diary Survey." *Journal of Behavioral & Experimental Economics* 55.

Simon, J., K. Smith, and T. West. 2010. "Price Incentives and Consumer Payment Behavior" *Journal of Banking and Finance* 34: 1759–1772.

Soman, Dilip. 2001. "Effects of Payment Mechanism on Spending Behavior: The Role of Rehearsal and Immediacy of Payments." *Journal of Consumer Research* (27): 460–474, March.

Stavins, Joanna. 2001. "Effect of Consumer Characteristics on the Use of Payment Instruments." *New England Economic Review* 2001(3): 19–31.

Stavins, Joanna. 2011. "Potential Effects of an Increase in Debit Card Fees." Federal Reserve Bank of Boston Public Policy Brief No. 11-3.

Stavins, Joanna. 2013. "Security of Retail Payments: The New Strategic Objective." Federal Reserve Bank of Boston Working Paper No. 13-9.

Stavins, Joanna. 2016. "The Effect of Demographics on Payment Behavior: Panel Data with Sample Selection." Federal Reserve Bank of Boston Working Paper No. 16-5.

Stavins, Joanna, and Huijia Wu. (forthcoming), "Payment Discounts and Surcharges: The Role of Consumer Preferences."

van der Cruijsen, Carin, Lola Hernandez, and Nicole Jonker. 2017. "In Love with the Debit Card but Still Married to Cash." *Applied Economics* 49(30): 2989–3004.

Wakamori, Naoki, and Angelika Welte. 2017. "Why Do Shoppers Use Cash? Evidence from Shopping Diary Data" *Journal of Money, Credit and Banking* 49(1): 115–169.

Wang, Zhu, and Alexander L. Wolman. 2016. "Payment Choice and the Future of Currency: Insights from Two Billion Retail Transactions." *Journal of Monetary Economics* 84: 94–115, December.

Wooldridge, Jeffrey. 1995. "Selection Corrections for Panel Data Models under Conditional Mean Independence Assumptions." *Journal of Econometrics* 68(1): 115–132.

Wright, J. 2012. "Why Payment Card Fees are Biased against Retailers." *The RAND Journal of Economics* 43: 761–780. doi: 10.1111/1756-2171.12007.

Zhang, David H. 2016. "How Do People Pay Rent?" Federal Reserve Bank of Boston Research Data Report No. 16-2.

Zinman, Jonathan. 2009. "Where Is the Missing Credit Card Debt? Clues and Implications." *Review of Income and Wealth* 55: 249–265.

Zywicki, Todd J., Geoffrey A. Manne, and Julian Morris. 2014. "Price Controls on Payment Card Interchange Fees: The U.S. Experience." George Mason University Law and Economics Research Paper Series No. 14-18.