



## Payments System Research Working Papers Archive

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Payments System Research staff produce a series of working papers that cover a range of topics, including types of payments methods, developments in payments networks, and various participants' roles in the payments system.

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### 2016

#### **Chargebacks: Another Payment Card Acceptance Cost for Merchants**

By *Fumiko Hayashi*

*RWP 16-01, January 2016*

Although chargebacks are perceived as one of the major cost components for merchants to accept card payments, little research has been conducted on them. To fill that gap, this paper describes the current chargeback landscape by generating detailed statistics on chargebacks for signature-based transactions. Our data are from merchant processors, which, altogether, processed more than 20 percent of all signature-based transactions in the United States. For Visa and MasterCard transactions, chargebacks merchants receive are, on average, 1.6 basis points (bps) of sales number and 6.5 bps of sales value. About 70 to 80 percent of chargebacks are resolved as merchant liability. The most common chargeback reason is fraud, which accounts for about 50 percent of the total chargebacks. The merchant fraud loss rate is 0.7 bps in number and 2.6 bps in value. For American Express and Discover transactions, the total and fraud chargeback rates are somewhat lower. For all of the four networks, the total and fraud chargeback rates are significantly higher for card-not-present transactions than for card-present transactions. They also vary by merchant category. Our fraud results are generally consistent with other available fraud statistics.

### 2015

#### **Driver of Choice? The Cost of Financial Products for Unbanked Consumers**

By *Fumiko Hayashi, Josh Hanson and Jesse Leigh Maniff*

*RWP 15-15, November 2015*

This paper examines whether some of the unbanked consumers' choice of general purpose reloadable (GPR) prepaid cards over checking accounts and alternative financial service (AFS) products can be explained by the cost incurred by those consumers. We compare the three types of products by constructing consumer models based on the actual behavior of GPR prepaid

cardholders and applying those models to the fee schedules of actual products offered in the market. Overdrafts are a major factor affecting the cost rankings. For consumers who regularly or occasionally overdraw their accounts, checking accounts are more costly than GPR cards or AFS products. In contrast, for consumers who do not need overdraft capability and short-term credit, GPR cards are more costly than checking accounts. The cost difference across the products clearly explains the former type of consumers' choice of financial products, while it does not explain the latter type of consumers' choice.

## **Faster Payments in the United States: How Can Private Sector Systems Achieve Public Policy Goals?**

By *Fumiko Hayashi*

*RWP 15-03, June 2015*

Consumers and businesses are increasingly expecting faster payments. While many countries have already developed or are in process of developing faster payments, the availability of these payments is fragmented in the United States. The recently released paper by the Federal Reserve encourages private sector participants to provide faster payment services. However, private-sector faster payments systems will face significant challenges in achieving public policy goals of ubiquity, safety, and efficiency unless system governance represents broad public interests. One way to better align private-sector interests with those of the public is for the Federal Reserve to influence governance of the private-sector systems through its leadership role.

## **2014**

### **Recurrent Overdrafts: A Deliberate Decision by Some Prepaid Cardholders?**

By *Fumiko Hayashi* and *Emily Cuddy*

*RWP 14-08, October 2014; updated October 2015*

A small percentage of prepaid cardholders regularly make overdraft transactions and incur fees. They also spend and load more funds on the card and use the card longer than cardholders who have never overdrawn their account.

### **General Purpose Reloadable Prepaid Cards: Penetration, Use, Fees and Fraud Risks**

By *Fumiko Hayashi* and *Emily Cuddy*

*RWP 14-01, February 2014*

Prepaid card use varies by account and local demographic characteristic. Cards funded by third-party direct deposits are used longest and most intensively. Fraud rates are highest for signature and card-not-present transactions.

**2012**

**Effects of Credit Scores on Consumer Payment Choice**

By *Fumiko Hayashi* and Joanna Stavins

*RWP 12-03, February 2012*

Credit scores significantly influence consumer payment behavior, especially debit and credit card use. Evidence suggests that this is due to supply-side constraints, such as the effect of credit scores on the cost of credit and access to credit.

**2008**

**Spin-offs: Theory and Evidence from the Early U.S. Automobile Industry**

By Luis Cabral and Zhu Wang

*RWP 08-15, December 2008; updated July 2009*

This paper provides a "passive learning" model of firm entry by spin-off and predicts a high correlation between spin-offs and parent exit. The theoretical findings are tested and confirmed on a unique data set of the U.S. automobile industry.

**Product Innovation and Network Survival in the U.S. ATM and Debit Card Network Industry**

By *Fumiko Hayashi* and Zhu Wang

*RWP 08-14, December 2008; updated January 2011*

This paper studies product innovation and network survival in the U.S. ATM/debit card industry.

**Why Do Card Issuers Charge Proportional Fees?**

By Oz Shy and Zhu Wang

*RWP 08-13, December 2008; updated January 2010*

This paper explains why payment card companies charge consumers and merchants fees which are proportional to the transaction values instead of charging a fixed per-transaction fee.

## **The Economics of Two-Sided Payment Card Markets: Pricing, Adoption and Usage**

*By James McAndrews and Zhu Wang*

*RWP 08-12, December 2008*

This paper provides a new theory to explain pricing, adoption and usage in two-sided payment card markets.

## **The Economics of Payment Card Fee Structure: Policy Considerations of Payment Card Rewards**

*By Fumiko Hayashi*

*RWP 08-08, November 2008*

First in a series of three papers on payment card fees: What is the optimal balance between merchant fees and cardholder rewards?

## **The Economics of Payment Card Fee Structure: What Drives Payment Card Rewards**

*By Fumiko Hayashi*

*RWP 08-07, November 2008; updated March 2009*

Second in a series of three papers on payment card fees: What market forces result in cardholder rewards?

## **The Economics of Payment Card Fee Structure: What is the Optimal Balance Between Merchant Fee and Payment Card Rewards?**

*By Fumiko Hayashi*

*RWP 08-06, November 2008*

Third in a series of three papers on payment card fees: What public policy options might improve the efficiency and welfare distribution in the U.S. retail payment systems?

## **Nonbanks and Risk in Retail Payments: EU and U.S.**

*By Terri Bradford, Fumiko Hayashi, Christian Hung, Simonetta Rosati, Richard J. Sullivan, Zhu Wang and Stuart E. Weiner*

*June 2008*

This paper documents the importance of nonbanks in retail payments in the United States and in 15 European countries and analyses the implications of the importance and multiple roles played by nonbanks on retail payment risks. Nonbanks play multiple roles along the entire payment processing chain. They are prominent in the United States and their presence is high and growing in Europe as well, although there are differences among the various countries and payments classes. Nonbanks' presence has shifted the locus of risks in retail payments towards greater relevance of operational and fraud risk. The paper reviews the main safeguards in place, and concludes that there may be a need to reconsider some of them in view of the growing role of nonbanks and of the global reach of risks in the electronic era.

**2007**

### **Nonbanks and Risk in Retail Payments**

*By Members of the European Central Bank Oversight Division and Members of Federal Reserve Bank of Kansas City Payments System Research Function*

*Working Paper 07-02, November 2007*

This paper documents the importance of nonbanks in retail payments in the United States and in 15 European countries and analyzes the implications of the importance and multiple roles played by nonbanks on retail payment risks. This paper also reviews the main regulatory safeguards in place, and concludes that there may be a need to reconsider some of them in view of the growing role of nonbanks and of the global reach of risks in the electronic era.

[Abridged version](#)

### **Nonbanks in the Payments System: European and U.S. Perspectives**

*By Members of the European Central Bank Oversight Division and Members of Federal Reserve Bank of Kansas City Payments System Research Function*

*Working Paper 07-01, May 2007*

This paper presents the initial results of a joint study undertaken by staff at the European Central Bank and the Federal Reserve Bank of Kansas City to document and analyze nonbanks in the payments system. The focus is on electronic (non-paper) retail payment services in the European Union and the United States. The results show that nonbanks are making their presence felt at all stages of the payments chain. And, at this time, nonbanks appear most prominent in the United States, but are prominent in many European countries as well. And, most importantly, nonbank presence appears to be increasing in virtually all countries.

2006

## Pricing and Welfare Implications of Payment Card Network Competition

By *Fumiko Hayashi*

Working Paper 06-03, December 2006

This paper examines how competition among payment card networks—three-party scheme networks and four-party scheme networks—affects pricing as well as the welfare of various parties. A competing network has an incentive to provide rewards to its card users. By providing more generous rewards than its rival networks, the network can increase its own card transactions because multihoming cardholders—who hold multiple networks’ cards—choose to use its card instead of using its rivals’. Although a monopoly network does not have such an incentive, in a monopoly four-party scheme network, competition among card issuers likely makes issuers provide rewards. Due to rewards, the merchant fees under competition can be higher than the merchant fees set by a monopoly network, unless the majority of cardholders are multihoming. Generally, cardholding consumers are better off under network competition. In contrast, non-cardholding consumers are better off only when network competition reduces merchant fees lower than those under monopoly. The results suggest that policies that simply encourage network competition will likely increase cardholder rewards but will not necessarily lower merchant fees in the U.S. payment card market. Several empirical indicators may possibly tell which direction the U.S. payments system needs to go.

## Market Structure and Credit Card Pricing: What Drives the Interchange?

By *Zhu Wang*

This paper provides a new theory to explain empirical puzzles regarding credit card interchange fees. Our model departs from the existing two-sided market theories by arguing card adoption externalities are less important in a mature card market. Instead, we focus on card issuer entry, elastic consumer demand and the role of card transaction value. Our analysis suggests that card networks demand higher interchange fees to maximize member issuers’ profits as card payments become more efficient and convenient. At equilibrium, consumer rewards and card transaction values increase with interchange fees, while consumer surplus and merchant profits may not. Based on the theoretical framework, we discuss pros and cons of policy interventions.

## Payment Card Rewards Programs and Consumer Payment Choice

By *Andrew Ching and Fumiko Hayashi*

Working Paper 06-02, July 2006

This paper seeks to analyze the effects of payment card rewards programs on consumer payment choice, by using consumer survey data. The results suggest that (i) consumers with credit card rewards use credit cards much more exclusively than those without credit card rewards; (ii) even among those who carry a credit card balance, consumers with credit card rewards use a credit card more often than those without rewards; (iii) among consumers who receive credit card rewards, those who receive credit card rewards as well as debit card rewards tend to use debit cards more often than those who receive credit card rewards only; and (iv) reward card transactions seem to replace not only paper-based transactions but also non-reward card transactions.

**2005**

### **Internet Banking: An Exploration in Technology Diffusion and Impact**

*By Richard J. Sullivan and Zhu Wang*

This paper studies endogenous diffusion and impact of a cost-saving technological innovation -- Internet Banking. When the innovation is initially introduced, large banks have an advantage to adopt it first and enjoy further growth of size. Over time, as the innovation diffuses into smaller banks, the aggregate bank size distribution increases stochastically towards a new steady state. Applying the theory to a panel study of Internet Banking diffusion across 50 US states, we examine the technological, economic and institutional factors governing the process. The empirical findings allow us to disentangle the interrelationship between Internet Banking adoption and growth of average bank size, and explain the variation of diffusion rates across geographic regions.

### **Network Competition and Merchant Discount Fees**

*By Fumiko Hayashi*

*Working Paper 05-04, November 2005; updated March 2006*

Pricing in two-sided markets has not been fully understood yet. Especially, investigations of how competition in these markets affects the price structure or levels are still underway. This paper takes the payment card industry as an example of two-sided markets and examines whether two networks' competition lowers one of the prices in the industry, merchant discount fees, and if it does, how much it lowers equilibrium merchant fees compared with the fee set by a monopoly network. If some cardholders hold only one card and the other cardholders hold two different cards, whether network competition lowers the fees and by how much the fees will be lowered depends on various factors, such as the share of multihoming cardholders in the total cardholder base, the merchants' transactional benefit, each network's net transactional benefit to its card users, the difference in the two networks' cardholder bases, and the share of cardholders in the total customer base. Numerical examples

with various parameter values suggest that typically, if the share of multihoming cardholders is 20 percent or less, networks can act as if they are monopolies; and if the share is around 50 percent, the average equilibrium merchant fee is reduced from the monopolistic merchant fee by 25 percent.

### **Competition and Credit and Debit Card Interchange Fees: A Cross-Country Analysis**

By *Fumiko Hayashi* and *Stuart E. Weiner*

*Working Paper 05-03, September 2005; updated November 2005*

This paper seeks to provide a bridge between the theoretical and empirical literatures on interchange fees. Specifically, the paper confronts theory with practice by asking, to what extent do existing models of interchange fees match up with actual interchange fee practices in various countries? For each of four countries—Australia, the Netherlands, the UK, and the United States—models that "best" fit the competitive and institutional features of that country's payment card market are identified, and the implications of those model are compared to actual practices. Along what competitive dimensions is there alignment? Along what competitive dimensions is there not alignment? What country-specific factors appear to be important in explaining deviations from theoretical predictions? The results suggest that a theory applicable in one country may not be applicable in another, and that similar interchange fee arrangements and regulations may well have different implications in different countries.

### **Technological Innovation and Market Turbulence: The Dotcom Experience**

By *Zhu Wang*

*October 2006*

This paper explains market turbulence, such as the recent dotcom boom/bust cycle, as equilibrium industry dynamics triggered by technology innovation. When a major technology innovation arrives, a wave of new firms enter the market implementing the innovation for profits. However, if the innovation complements existing technology, some new entrants will later be forced out as more and more incumbent firms succeed in adopting the innovation. It is shown that the diffusion of Internet technology among traditional brick-and-mortar firms is indeed the driving force behind the rise and fall of dotcoms as well as the sustained growth of e-commerce. Empirical evidence from retail and banking industries supports the theoretical findings.



## **Interchange Fees in Various Countries: Developments and Determinants**

*By Stuart E. Weiner and Julian Wright*

*Working Paper 05-01, April 2005; updated November 2005*

Interchange fees and related issues in credit and debit card markets have been the focus of considerable attention in recent years. The academic community has begun to address the economics of these markets. Public officials have begun to address the policy implications of developments in these markets. Meanwhile, these markets continue to experience dynamic change as credit, and especially debit, transactions account for an ever-growing share of overall payments. This paper provides an overview of interchange fee developments and issues in a number of countries. It also presents a preliminary analysis of some possible contributing factors. The principal conclusion of the paper is that interchange arrangements vary considerably across countries, and while existing economic theory provides some insight into fee levels and movements, much remains to be explained. A number of complex and interrelated factors, many country-specific, play a role in interchange developments.

## **2004**

### **A Puzzle of Card Payment Pricing: Why Are Merchants Still Accepting Card Payments?**

*By Fumiko Hayashi*

*Working Paper WP04-02, December 2004*

This paper presents models that explain why merchants accept payment cards even when the fees they face exceed the transactional benefits they receive from a card transaction. Such merchant behaviors can be explained by competition among merchants and/or the effectiveness of the merchant's card acceptance in shifting cardholders' demand for goods upward. The prevalent assumption used in payment card literature—merchants accept cards only when their transactional benefits are higher than the fees they pay—holds only for a monopoly merchant who faces an inelastic consumer demand. A card network that wants all merchants in a given industry to accept cards sets a lower merchant fee initially and then gradually increases it to the highest possible level, which may be higher than the sum of the merchant's transactional benefit and the merchant's initial margin without cards. Such merchant fees potentially create inequality between cardholders and non-cardholders.

## **Income Distribution, Market Size and the Evolution of Industry**

*By Zhu Wang*

*Working Paper 04-01; updated January 2006*

An industry typically experiences initial mass entry and later shakeout of producers over its life cycle. It can be explained as a competitive equilibrium outcome driven by the dynamic interaction between technology progress and demand diffusion.

When a new product is introduced, high-income consumers tend to adopt it first. Technology then improves with cumulative output and demand growth generates S-shaped diffusion as the product penetrates lower-income groups. Eventually fewer new adopters are available and the number of firms starts to decline. It is shown that faster technological learning, higher mean income or larger market size contributes to faster demand diffusion and earlier industry shakeout. Empirical studies on the US and UK television industries as well as ten other US industries confirm the theoretical findings.

## 2003

### **Community Bank Access to Payment Card Networks: Has It Become More Expensive?**

By *Fumiko Hayashi*

*Working paper WP 03-02, December 2003*

The payment industry is undergoing significant change. Consolidations among payment networks and processors have been seen in every payment service area and technological advances provide incentives for even larger financial institutions to outsource their transaction processing. As a result, a smaller number of networks or processors are competing more vigorously for larger financial institutions. In doing so, volume-based pricing or volume discounts are commonly practiced in the industry. This paper examines whether the change in fee structure of networks and processors make community banks' access to the payment card networks more expensive. Although community banks pay relatively higher fees per transaction to the networks than their larger counterparts, their fees per transaction have not increased for most of the payment services. Processing fees that community banks pay to their processors have likely decreased. In addition, new processing arrangements have evolved so that community banks can take advantage of the change in processors fee structure.

### **Financial Innovations, Strategic Real Options and Endogenous Competition: Theory and an Application to Internet Banking**

By *Richard J. Sullivan and David Nickerson*

*Working paper WP 03-01, July 2003; updated November 2003*

Innovations in financial services continuously influence the scope of financial intermediation and the nature of competition between intermediaries. This paper examines the optimal exercise of strategic real options to invest in such an innovation, Internet banking technology, within a two-stage game, parameterized by the distribution of bank size and uncertainty over the profitability of investment, and empirically tests the results on a novel data set. Unlike traditional options, in which the distribution of the future value of the underlying asset is exogenous and the timing of exercise affects only the return to the option holder, the timing of the exercise of real options in a strategic context allows the option holder to manipulate the

distribution of returns to all players. The value of the strategic investment option in our model, as a consequence, depends on both expected future profits as well as the variance of those profits. Expected profits to an entrant depend, in equilibrium, on its size, as measured by existing market share (concentration) or total assets, relative to its rivals. Conditional on the degree of uncertainty, larger banks should, as a consequence, exercise their options earlier than smaller banks, for purely strategic advantages, and act as market leaders in the provision of Internet banking services. Like ordinary options, however, the value of the strategic investment option to both large and small banks increases in uncertainty, implying that early exercise will be more likely the more information is available about potential demand. We test these hypotheses on investment in Internet banking services with data from a sample of 1,618 commercial banks in the tenth Federal Reserve District during 1999. Evidence indicates that relative bank size, as measured by either market share or asset size, positively influences the likelihood of entry into Internet banking, and trend-adjusted variation in income per person (a proxy for uncertainty of demand) negatively influences the likelihood of entry into Internet banking. In addition, market concentration of a bank's competitive rivals has a negative relationship with the likelihood of entering the market for Internet banking services. These relations are evident in both bivariate analysis and in multivariate logit regression analysis.

## 2002

### **Technology Adoption and Consumer Payments: Evidence from Survey Data**

By *Fumiko Hayashi* and *Elizabeth Klee*

Consumers pay for hundreds of goods and services each year, but across households and across goods, consumers do not choose to pay the same way. This paper posits that payment choices depend in part on consumers' propensity to adopt new technologies and in part on the nature of the transaction. To test this hypothesis, this paper analyzes consumer's payment instrument use at the point of sale and for bill payment. The sample includes consumers surveyed in 2001, who are primarily users of the Internet. The results indicate that consumers who use new technology or computers are more likely to use electronic forms of payment, such as debit cards and electronic bill payments. Particularly, the use of direct deposit is a significant predictor of electronic payment use. Furthermore, the results indicate that payment choice depends on the characteristics of the transaction, such as the transaction value, the physical characteristics of the point of sale, and a bill's frequency and value variability.

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