# Lessons Learned from Measuring and Modeling Consumer Payment Choice

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# Disclaimers

- The views expressed in this presentation do not necessarily represent the views of the Federal Reserve Bank of Boston or the Federal Reserve System.

# Overview

- Boston Fed consumer payment data program
  - SCPC and DCPC
- *Lessons learned*:
  - Theory
  - Measurement
  - Survey methodology
  - Recent research

# Introduction

*Much experience has yielded many lessons.*

| Year | Survey | Diary (linked to Survey) |
|---|---|---|
| 2003 | 424 (Bos Fed employees) | --- |
| 2004 | 2,400 (All Fed employees) | --- |
| 2005 | --- | --- |
| 2006 | 1,000 (w/AARP) | --- |
| 2007 | --- | --- |
| 2008 | 1,010 | --- |
| 2009 | 2,169 | --- |
| 2010 | 2,102 | 353 (94% linked) |
| 2011 | 2,151 | 375 (96% linked) |
| 2012 | 3,176 | 2,547 (95% linked) |
| 2013 | 2,000 (expected) | TBD |

# Introduction

*Our experience derives primarily from our particular methodology*

- Survey methodology
  - RAND American Life Panel (ALP)
  - Representative of U.S. consumers
    - Derived from respondent sources (<=2011)
    - Re-sampled within ALP (2012+)
  - Longitudinal subpanel of respondents (2008-2012)
  - Questionnaires:
    - SCPC: Internet only (30 minutes/year)
    - DCPC: Memory aids + internet survey (20 mins/day)

# Theory

*We need to think hard and ask questions about money and payments to understand how they yield utility for consumers*

- What is consumer payment choice?
  - Who is a consumer?
  - What is a payment?
    - Money versus payments
    - Payments versus goods & services
  - What choice(s) do consumers have?
    - Why do they make payments (and for what)?
    - Where do they make payments?
    - How do they make payments?
    - What do they know about payments?
    - Etc….
- Consumer choice is very diverse, hard to understand
- The economics literature is sparse on this topic!

# Theory

*Money and payment instruments are NOT the same things!*

**Table**
**Definitions of Money and Consumer Payment Instruments**

| Asset or Liability | Basic Money or Debt | Instrument (derivative media) | Instrument Definition | Physical trait |
|---|---|---|---|---|
| Money (M1) | Currency in circulation | Currency | Coins and paper bills or notes created by the U.S. Treasury and issued by the Federal Reserve. | Paper / metal |
| | Travelers check | Travelers check | A draft piece of paper issued by a bank or company and directing the issuer to pay a specific amount of money in cash as instructed to a person or business. It is similar to a check but works like cash and is protected against forgery, loss or theft. | |
| | Demand Deposit Accounts & Other Checkable Deposits | Check | A draft piece of paper directing a bank or other financial institution to pay a specific amount of money from a demand deposit account as instructed to a person or business. | |
| | | Money order | A draft piece of paper issued by a bank, post office, or telegraph office authorizing payment of a specified amount of cash from the issuing institution to the individual named on the order. | |
| | | Online banking bill pay (OBBP) | A bill payment made directly from a bank account and initiated by a consumer using the bank's online banking bill payment function on the bank's website via the Internet or a mobile banking application. This payment is made *without* using a paper check or payment card, and can be automatic or processed as needed. | Electronic |
| | | Bank account number payment (BANP) | An electronic payment made directly from a bank account and initiated by a consumer who provides a bank account number and bank routing number to a non-bank third party via the Internet, verbally, or in writing. This payment is made *without* using a paper check or payment card, and can be automatic or processed as needed. Examples include: automatic bill payment, bill payment made online at a company's web site (but not using online banking bill payment), other online payment, or payment made directly from income. | |
| | | Debit card | Also called a **check card**. A type of card that allows the cardholder to make a payment that is deducted directly from a bank account at the time of purchase or bill payment. Often these cards have a Visa or MasterCard logo, but they are not a credit card. A debit card also works as an ATM card. | Card |
| | | Prepaid card | Also called a **stored value card** or **gift card**. A type of card that can be used for payments up to the amount of money stored (or loaded) on the card. Often these cards will have a Visa or MasterCard logo, but they are not a credit card or debit card. Examples include: general purpose, specific purpose (retailers, telephone, public transportation, etc.), payroll cards, or electronic benefits transfer (EBT). | |
| Credit | Revolving credit | Credit card | Also called a **charge card**. A type of card that authorizes the cardholder to make a purchase by granting a line of credit that will be paid back to the credit or charge card company at a later date, possibly in installments. Examples include: Visa, MasterCard, Discover, American Express, and gasoline or retailer cards. | |

# Theory

*Models of money demand usually don't consider payment instruments and many elements of emerging non-bank payment services*

- Money demand determinants (long history)
  - Real income, price, and velocity (interest)
- Complications in applied work
  - Types of money (M1) have different factors
    - Currency, demand deposits, and travelers checks
  - Little consideration of payment instruments
    - Small # of exceptions (checks, debit)
  - Shadow banking?
    - Prepaid cards, PayPal, mobile texts, e-cash

# Theory

*Models of adoption and use of payment instruments usually don't incorporate foundations of monetary economics*

- Models of demand for payment instruments
  - Depends on demographics, characteristics
  - Two-step approach:
    1. Adoption of the instrument (yes or no)
    2. Use of the instrument
       - Normally the intensity of use (# or $ value per period)….
       - ….but incidence of use (extensive margin) is important too
- Slippage from monetary theory
  - Cash is viewed as something to adopt
  - Sometimes adoption and use are not separable
    - Cash, ATM/debit cards
  - Credit card are used for payment but are not money

# Measurement

*Survey content and design should reflect research objectives and plans; wherever possible, write down the regression first!*

- SCPC questionnaire outline
  - Preliminaries (easy warm ups)
  - Consumer assessments (characteristics)
  - What do you have? (adoption)
  - What do you use? (use)
  - Miscellaneous questions (related to above)
  - Demographics

# Measurement

*Optimal reporting unit depends on the measurement objective(s) and is constrained by budgetary resources*

## Consumer

- Cheaper and easier
- Knows own behavior
  - Miss other HH members
  - Better for cash (indiv. pay)
  - Miss ownership (accounts)
- Sample weights easier

## Household

- Expensive and harder
- Head of HH knows own
  - Guess/get other HH members
  - Better for bills (HH pay)
  - Gets ownership (maybe)
- Sampling more complicated

# Measurement

*"Do you have?" is not as simple or clear as you might think…*

- Ownership
  - Having a card may not reflect ownership
- Accessibility
  - Having a card doesn't mean carrying it daily
- Permanence
  - Have or not today may change tomorrow (cash)
- Historical dependence
  - "Have you ever had" may have affected "have"

# Measurement

*Inclusion of new technologies requires careful cost-benefit analysis*

- Potential costs
  - Adding new questions/longer survey
  - Consumer unfamiliarity may reduce precision
  - Technology failure reduces data value
- Potential benefits
  - Early indication of emerging behavior & trends
  - Valuable information about individual behavior
    - Adoption decisions/determinants
    - Substitution patterns

# Measurement

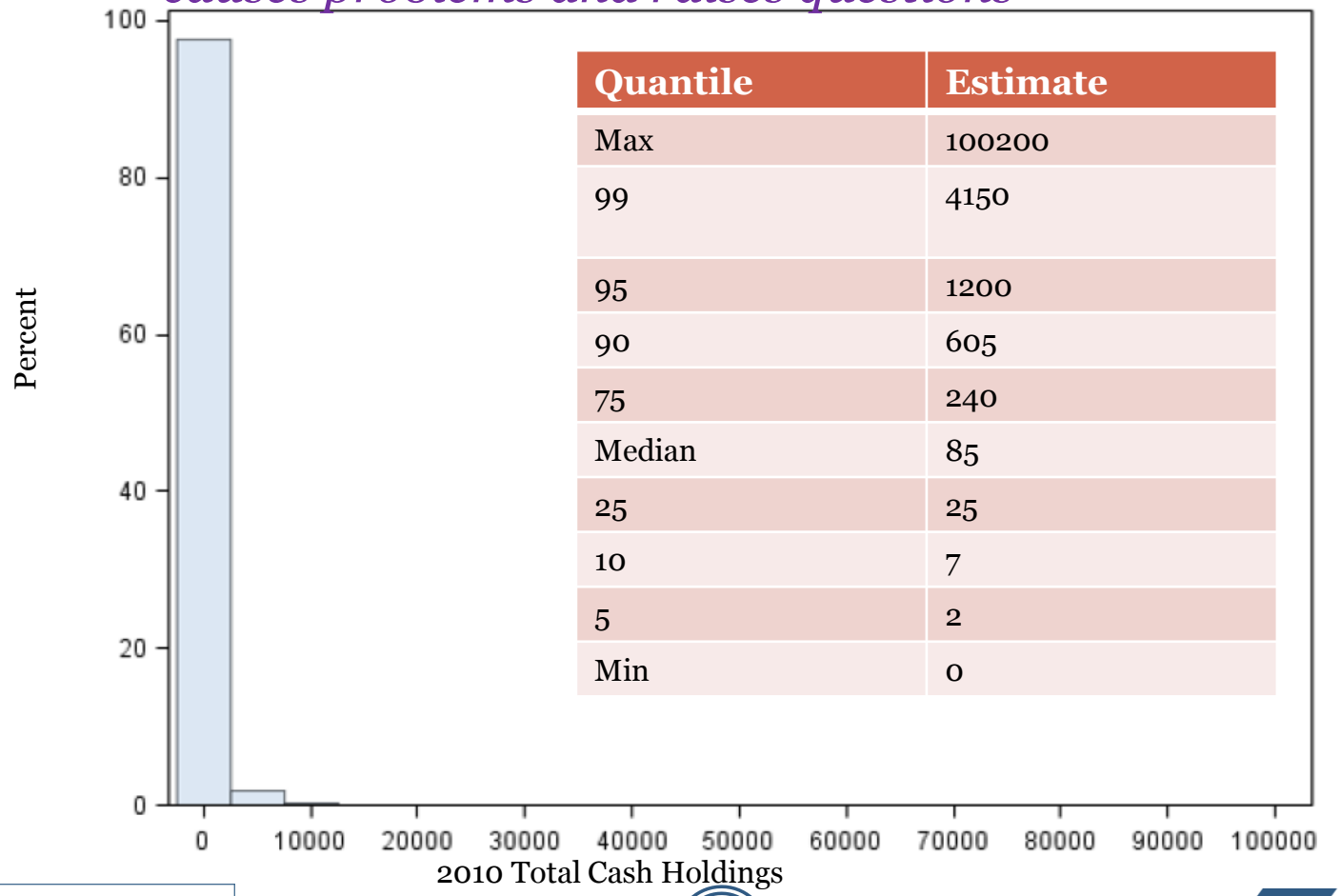
*Consumer financial (il)literacy causes extreme difficulties for measuring initiation (demand) versus clearing/settlement (supply) of payments*

- Payment cards
  - ATM card may or may not have debit feature
  - Prepaid may or may not be loadable, open-loop

- Electronic payments
  - Consumers know:
    - OBBP and BANP
  - Electronic payment suppliers (ACH/EPN) know:
    - Web entry ("must" be consumer BANP thus ACH)
    - OBBP could be ACH or paper check from bank

# Measurement

*Cash holding is sparse at the high end and this causes problems and raises questions*



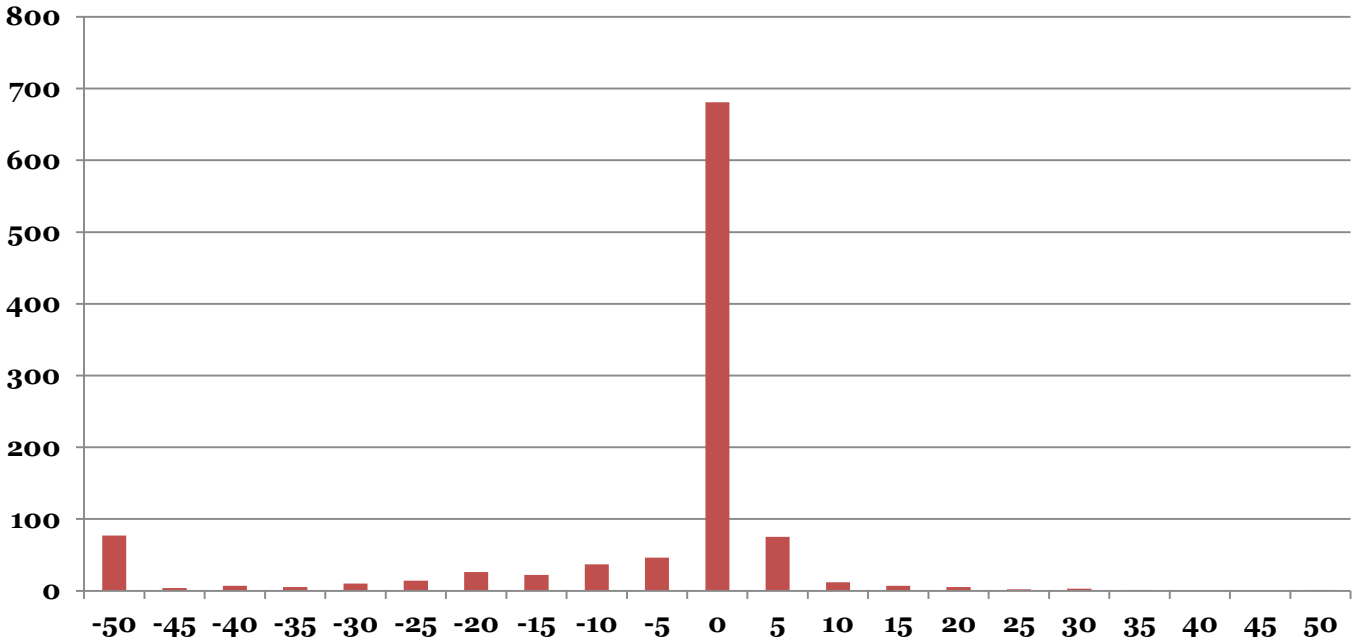

| Quantile | Estimate |
|---|---|
| Max | 100200 |
| 99 | 4150 |
| 95 | 1200 |
| 90 | 605 |
| 75 | 240 |
| Median | 85 |
| 25 | 25 |
| 10 | 7 |
| 5 | 2 |
| Min | 0 |

# Measurement

*Cash identities are very detailed and complex, so they are difficult to measure accurately even with a diary (probably similar for bank accounts?)*

$$C_{end} = C_{start} + C_{get} - C_{spend} - C_{other}$$

**Cash identity error distribution**




**Source:** DCPC 2010

# Measurement

## *Unfamiliar and unclear concepts significantly influence the results (prepaid)*

**Comparison of Prepaid Card Randomization Experiment**

| | Version 1 | Version 2 |
|---|---|---|
| **Sample size** | **1063** | **1088** |
| **Current adoption** | | |
| **Prepaid card** | 27.9 | 50.6 |
| Government issued | 4.7 | 9.4 |
| Direct Express | na | 2.1 |
| EBT | na | 8.7 |
| Employer issued | 4.8 | 8.8 |
| Benefit card | na | 8.2 |
| Payroll card | na | 1.0 |
| Incentive card | na | 0.6 |
| General purpose | 12.8 | 11.2 |
| General purpose with Visa, MasterCard, Discover or American Express | na | 11.0 |
| Remittance card | na | 0.2 |
| Specific purpose | 15.9 | 40.9 |
| Gift card | na | 32.3 |
| Public transportation card | na | 6.3 |
| Phone card | na | 6.2 |
| Merchant rebate card | na | 5.0 |
| Location specific card | na | 1.4 |

# Survey Methodology

*It's easy to write a survey. It's very, very hard to write an excellent survey.*

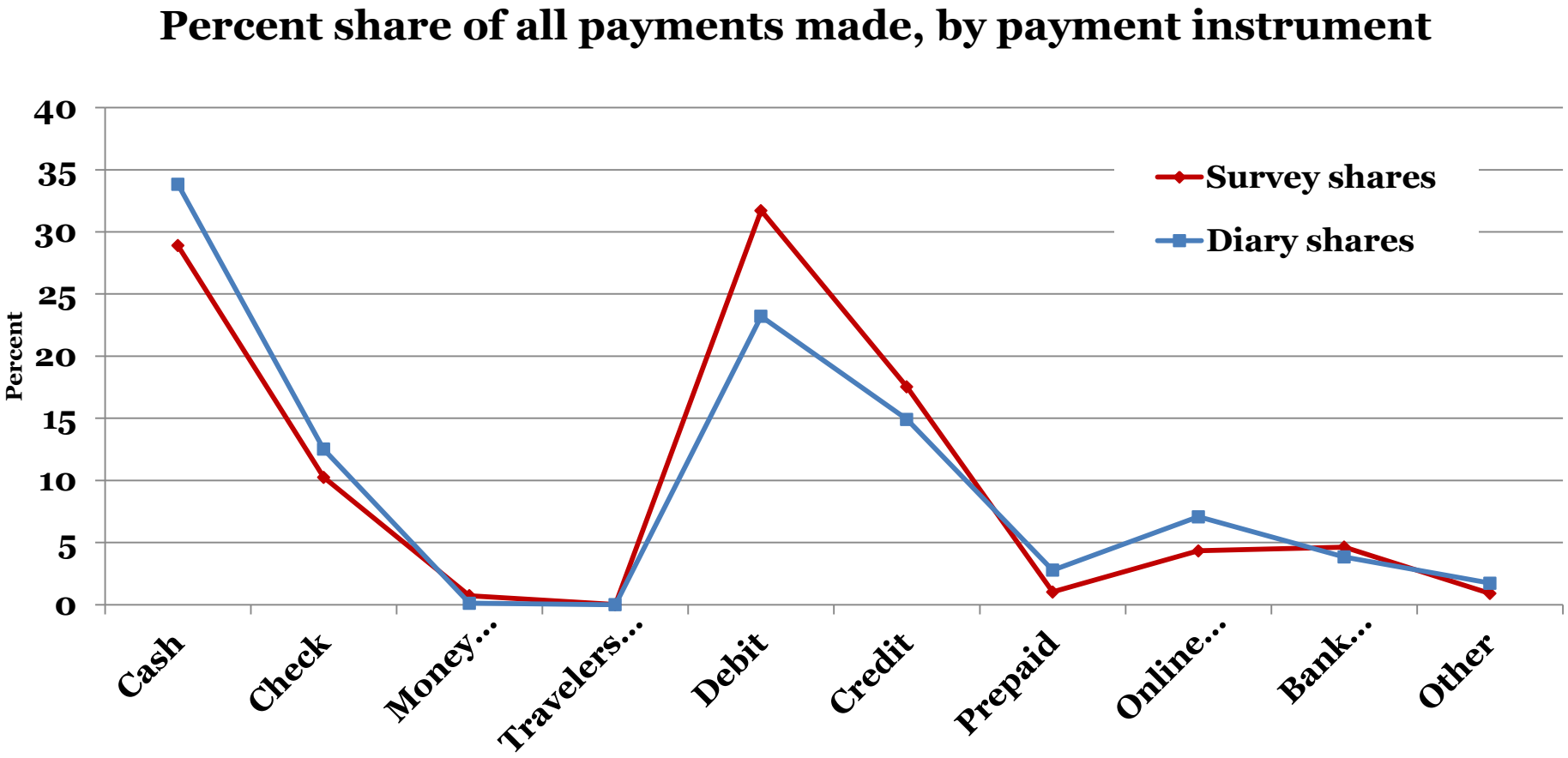
**Table 1:** Number of transactions by response to questions

| | 2010 | | 2011 | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| The merchant... | | | | |
| Q1: Accepted preferred method (left blank) | 1698 | 79.5 | 1994 | 76.2 |
| | | (3.4) | | (3.3) |
| Q1: Did not accept preferred method (non-blank) | 328 | 20.5 | 586 | 23.8 |
| | | (3.4) | | (3.3) |
| *Among non-blank responses, actually used preferred method* | 278 | 61.5 | 517 | 76.0 |
| | | (2.1) | | (1.6) |
| Q1: accepted preferred method (adjusted for inconsistency) | 1976 | 96.7 | 2551 | 96.6 |
| | | (1.5) | | (0.7) |
| Q2: tried to steer | 132 | 6.8 | 145 | 5.9 |
| | | (1.5) | | (1.3) |
| Q3: gave discount | 80 | 4.0 | 75 | 3.3 |
| | | (1.1) | | (0.9) |
| Q3: gave discount (excluding non-steered) | 49 | 2.1 | 50 | 2.2 |
| | | (0.7) | | (0.9) |

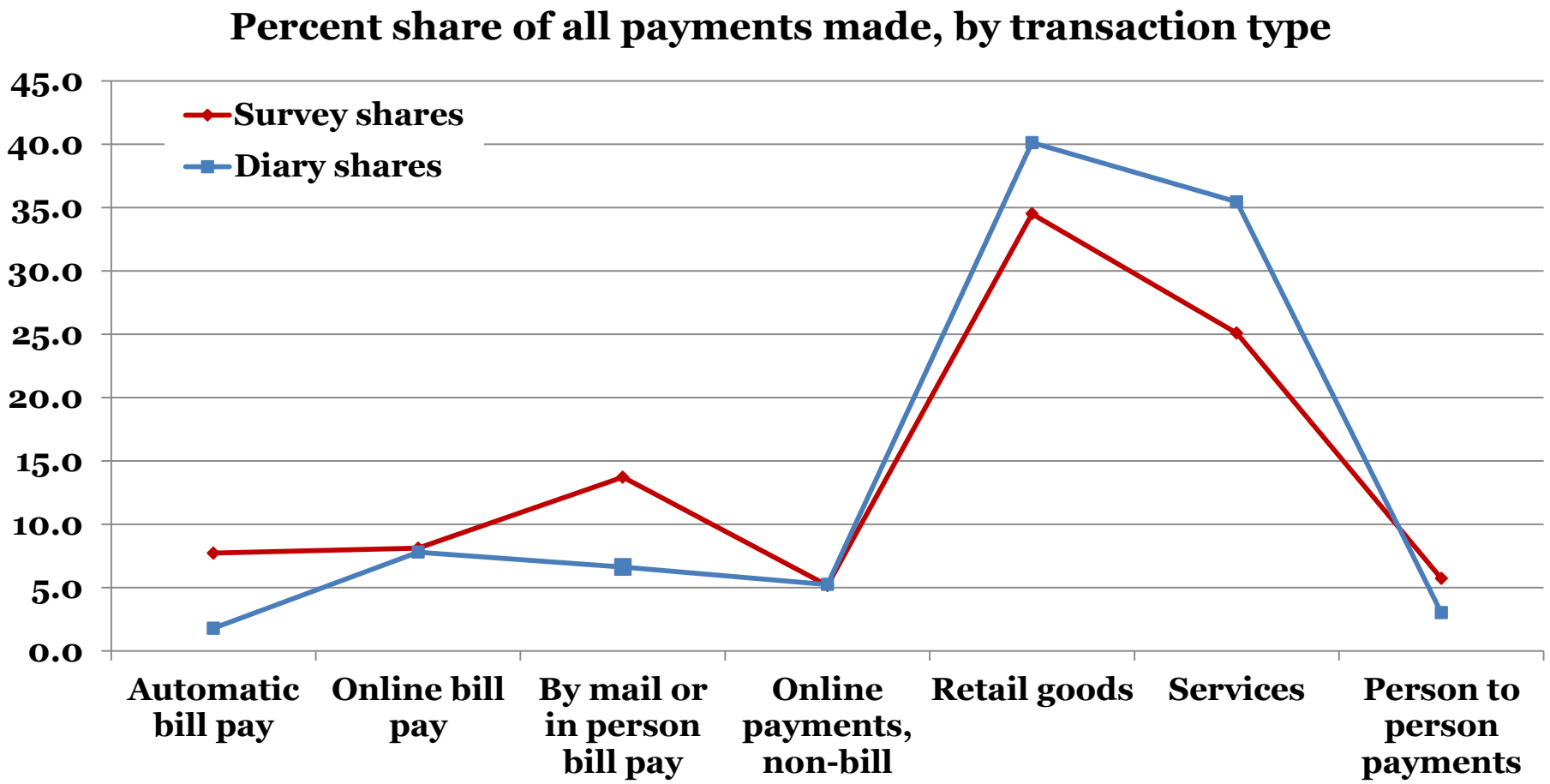
Notes: This table shows the number and weighted percent at the transaction level. Robust standard errors have been reported in parentheses.
In Question 1, respondents who had their preferred payment method accepted were supposed to leave the question blank. If respondents stated that a merchant did not accept their payment method, but also stated that they used their preferred payment method, we corrected those responses and included them with those who left the question blank.
In Question 2, steering was defined as including discounts, while Question 3 asked specifically about discounts. Some respondents said no on the steering question ("No" in Question 2), but yes on the discount question ("Yes" on Question 3). If respondents said "No" on Question 2 (no steering), we assumed there should also be a "No" on Question 3 (no discounts).
Source: 2010 and 2011 Diary of Consumer Payment Choice (DCPC)

# Survey Methodology

*Consumer recall might not be as bad as you might fear as long as you help the respondent remember*



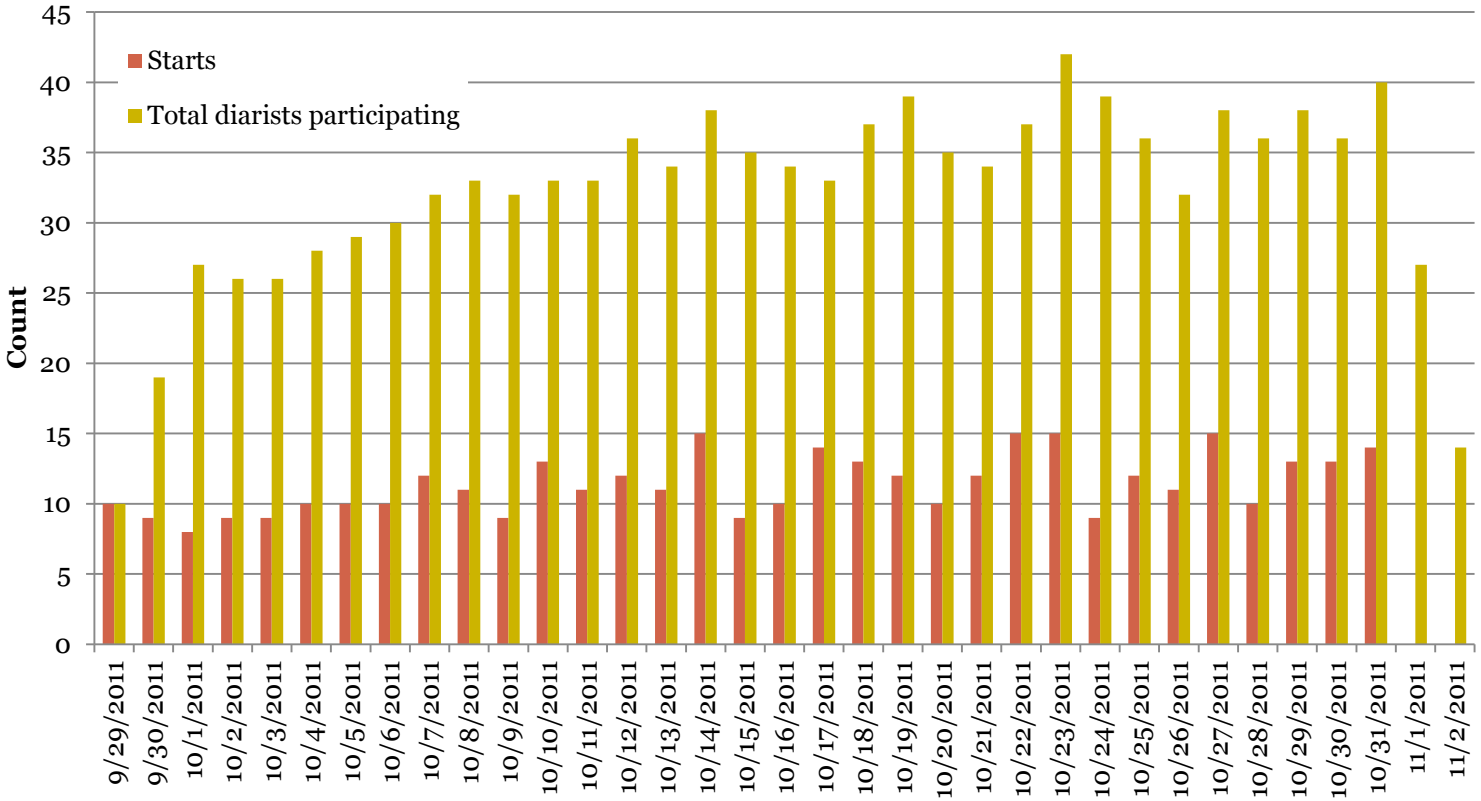
# Survey Methodology



# Survey Methodology

*Optimal diary design involves tradeoffs*

**Number of diarists by day of month, 2011**



# Selected Research Results

*Two-step models provide evidence on the importance of demographics and payment characteristics*

## Adoption

| | Checks | Credit | Debit | BAN | OBBP | Prepaid |
|---|---|---|---|---|---|---|
| **Characteristics** | | | | | | |
| Cost | | | ✓ | ✓ | | |
| Speed | | | ✓ | | | |
| Setup | | | ✓ | ✓ | | |
| Security | | | | ✓ | ✓ | |
| Control | | ✓ | ✓ | | | |
| Records | | ✓ | ✓ | ✓ | ✓ | |
| Acceptance | ✓ | | | | | ✓ |
| Ease | | ✓ | ✓ | | | |
| **Age** | ✓ | | ✓ | ✓ | ✓ | |
| **Education** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Martial Status** | ✓ | ✓ | | ✓ | ✓ | |
| **Race** | ✓ | ✓ | | ✓ | ✓ | ✓ |
| **Gender** | ✓ | | | | | |
| **Income** | ✓ | ✓ | ✓ | ✓ | | |
| **Observations** | 866 | 882 | 901 | 904 | 871 | 891 |

**Source:** Schuh, Scott and Stavins, Joanna "How Consumers Pay: Adoption and Use of Payments"

# Selected Research Results

## Adoption

| | Checks | Credit | Debit | BAN | OBBP | Prepaid |
|---|---|---|---|---|---|---|
| **Net Worth** | ✓ | | ✓ | ✓ | ✓ | ✓ |
| **Employment** | | | | | | |
| **Financial Responsibility** | ✓ | ✓ | ✓ | ✓ | | |
| **Born Aboard** | | | ✓ | | | |
| **Urban** | | ✓ | | | | ✓ |
| **Number of Children** | ✓ | | | | ✓ | ✓ |
| **Access to Internet at Home** | ✓ | | | | ✓ | |
| **Owns Home** | ✓ | | ✓ | | | |
| **Ever Had Bankruptcy** | | ✓ | | | | |
| **Paid Late** | | | ✓ | ✓ | | |
| **Observations** | 866 | 882 | 901 | 904 | 871 | 891 |
| **Pseudo R-square (CHAR)** | 0.42 | 0.43 | 0.31 | 0.17 | 0.12 | 0.11 |
| **Pseudo R-square (No CHAR)** | 0.40 | 0.38 | 0.18 | 0.10 | 0.10 | 0.07 |

**Source:** Schuh, Scott and Stavins, Joanna "How Consumers Pay: Adoption and Use of Payments"

# Selected Research Results

## Use

| | Cash | Checks | Credit | Debit | BAN | OBBP | Prepaid |
|---|---|---|---|---|---|---|---|
| **Characteristics** | | | | | | | |
| Cost | | | ✓ | ✓ | | | |
| Speed | | ✓ | | ✓ | | | ✓ |
| Security | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| Control | ✓ | | | | | | |
| Records | | | ✓ | ✓ | | | ✓ |
| Ease | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| **Age** | ✓ | ✓ | | ✓ | | | ✓ |
| **Education** | | | | ✓ | ✓ | ✓ | |
| **Martial Status** | ✓ | | | | ✓ | | |
| **Race** | ✓ | | ✓ | ✓ | ✓ | | ✓ |
| **Gender** | ✓ | | | ✓ | | ✓ | |
| **Income** | ✓ | | | ✓ | ✓ | ✓ | ✓ |
| **Net Worth** | | | ✓ | ✓ | ✓ | | |
| **Employment** | ✓ | ✓ | | | | ✓ | |
| **Observations** | 915 | 823 | 787 | 740 | 692 | 451 | 186 |



**Source:** Schuh, Scott and Stavins, Joanna "How Consumers Pay: Adoption and Use of Payments"

# Selected Research Results

## Use

| | Cash | Checks | Credit | Debit | BAN | OBBP | Prepaid |
|---|---|---|---|---|---|---|---|
| **Financial Responsibility** | ✓ | ✓ | | | | ✓ | |
| **Born Abroad** | | | | | ✓ | | |
| **Urban** | | | | | | | ✓ |
| **Number of Other Payment Instruments Adopted** | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| **Observations** | 915 | 823 | 787 | 740 | 692 | 451 | 186 |
| **Adjusted R-square (CHAR)** | 0.31 | 0.24 | 0.23 | 0.26 | 0.05 | 0.04 | 0.34 |
| **Adjusted R-square (No CHAR)** | 0.29 | 0.20 | 0.16 | 0.18 | 0.03 | 0.03 | 0.29 |

**Source:** Schuh, Scott and Stavins, Joanna "How Consumers Pay: Adoption and Use of Payments"

# Selected Research Results

*State of the art modeling is far from perfect but can provide valuable insights such as elasticities of substitution across payment instruments by consumers*

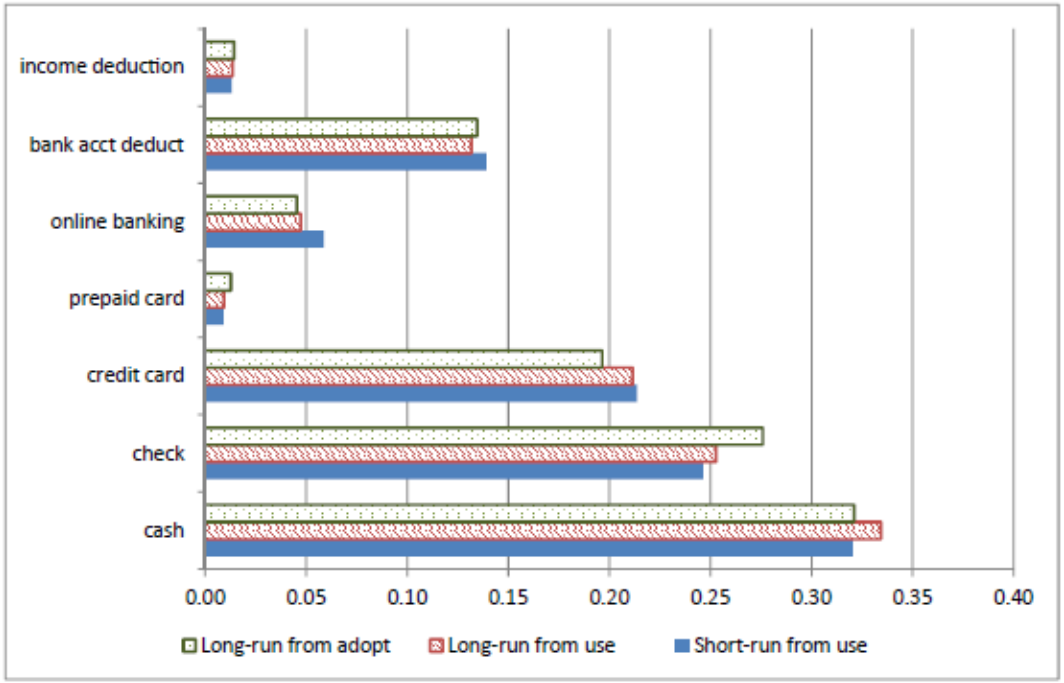



Figure 1: Changes in use of each payment instrument, measured in market share percentage points, in response to an increase in debit card use cost and adoption cost, by adoption adjustment (short-run or long-run).

# Selected Research Results

*Don't forget there is information about merchants in a consumer diary!*

| Type | M1 | M2 | M3 | M4 | M6 | M7 | M8 | M9 | M10 | M11 | M12 | M13 | M14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $nif_m$ | 0.29 | 0.24 | 0.37 | 0.34 | 0.28 | 0.17 | n/a | 0.21 | 0.31 | 0.35 | n/a | 0.27 | 0.41 |
| $oif_m$ | 0.37 | 0.26 | 0.56 | 0.50 | 0.36 | 0.11 | n/a | 0.21 | 0.43 | 0.53 | n/a | 0.33 | 0.66 |
| $\Delta_m$ | −0.08 | −0.02 | −0.19 | −0.16 | −0.08 | 0.06 | n/a | 0.00 | −0.12 | −0.18 | n/a | −0.06 | −0.25 |

*Source*: Author's calculations. *Note*: $\Delta_m > 0$ ($< 0$) indicates increase (decrease) in per-transaction fee.

**Table 7:** A comparison of per-transaction (signature and PIN combined) interchange fee after and before the reform ($).

**Source:** Shy, Oz "Who Gains and Who Loses from the 2011 Debit Card Interchange Fee Reform?"