Explaining adoption and use of payment instruments by US consumers

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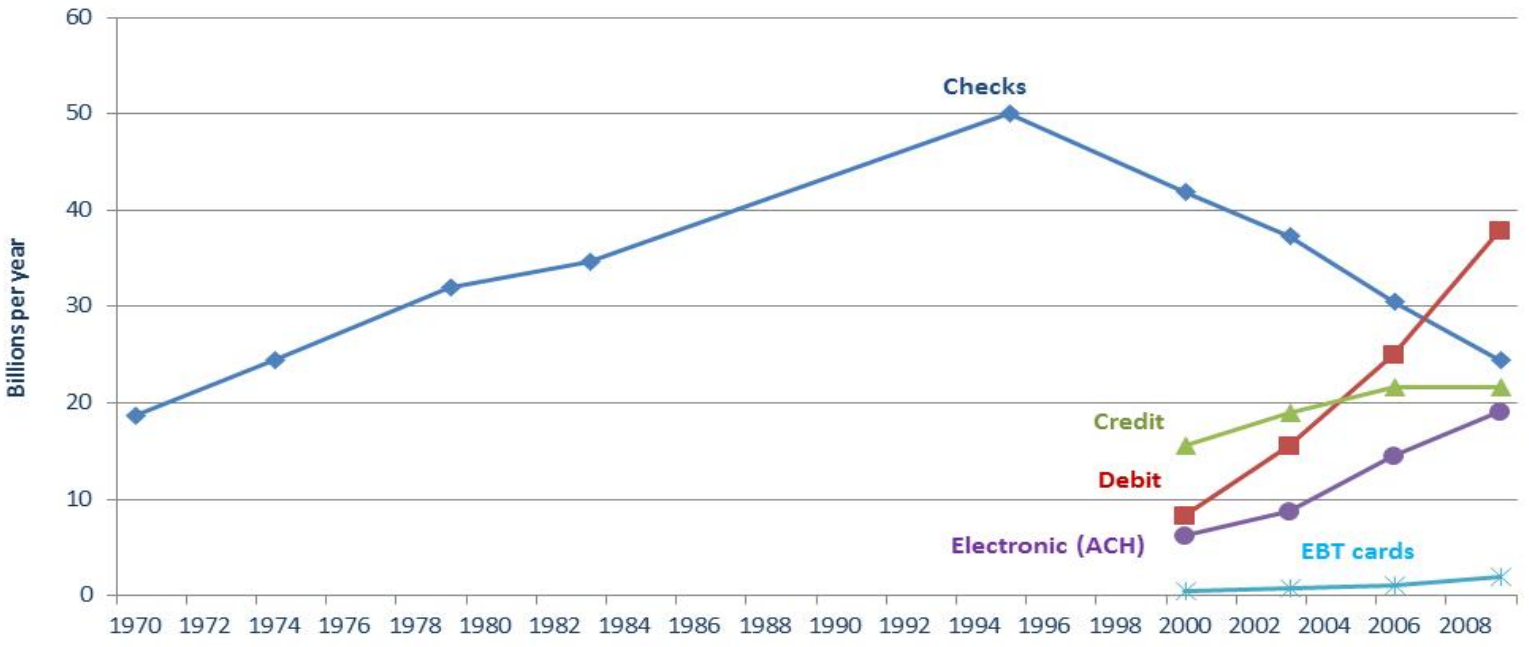
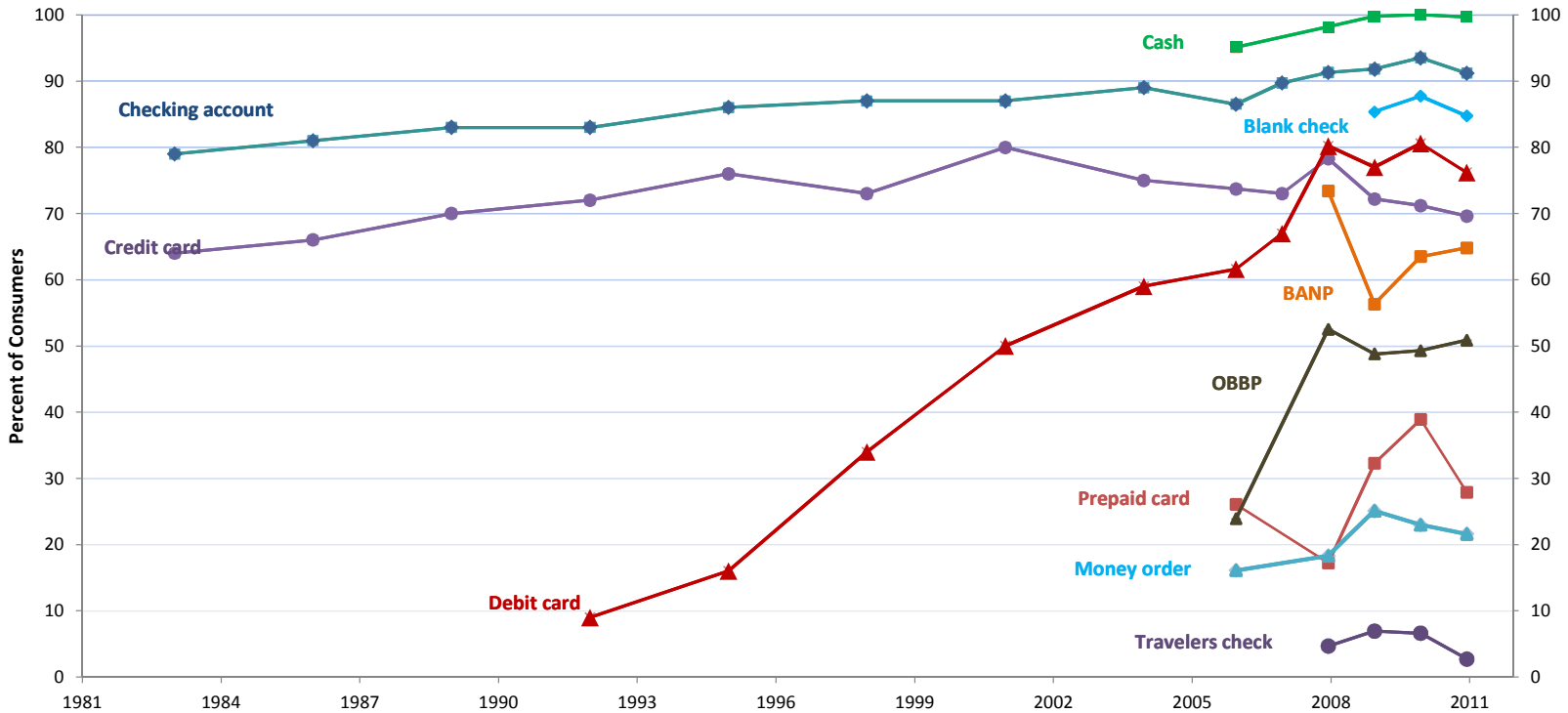
Payments Tranformation I

Total *Use* of Non-Cash Payment Instruments (FRPS)



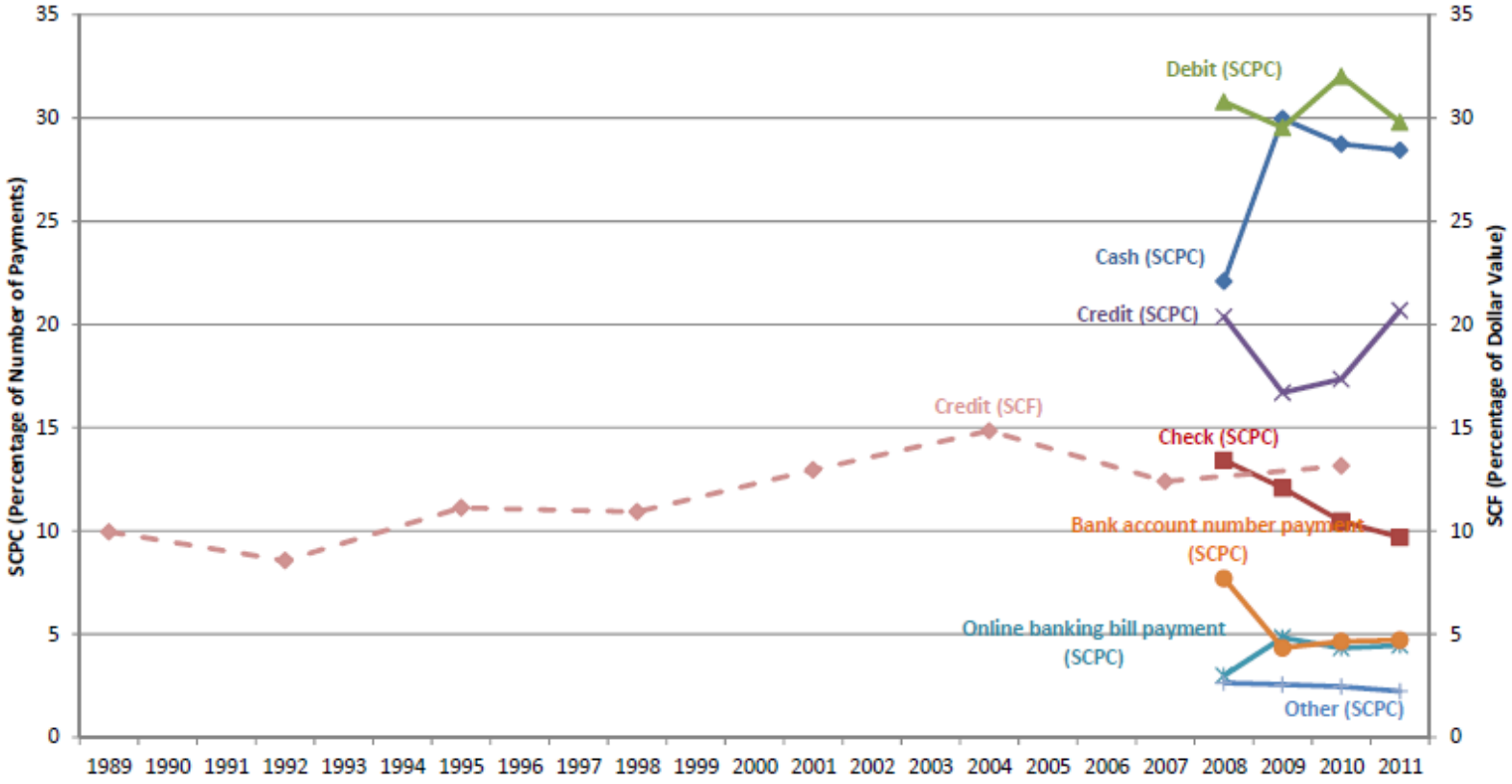
Payments Tranformation II

Consumer *Adoption* of Payment Instruments (SCPC)



Payments Tranformation III

Consumer *Use* of Payment Instruments (SCPC)



Motivation I

Interchange Fee Regulation

- Recently, a number of countries regulated interchange fees for payment instruments
  - Credit cards in Europe and Australia
  - Debit cards in the US (Regulation II)
- Banks may respond by changing usage fees (rewards, monthly or per-transaction fees) or adoption fees (annual or account-opening fees)
  - Ex: B of A proposed $5 per month for debit usage
- How will consumers respond?

Motivation II

Freedoms to Steer Payment Choice

- Other countries have allowed discounting or surcharging of payment instruments by retailers the past decade
  - Australia, UK
- New U.S. developments allow more steering of payments
  - 1970s law allowed cash discounts
  - 2010 Durbin Amendment/2011 Regulation II allows discounting of card classes
  - 2011 DOJ settlement with Visa/MC allows discounting of card products, disclosure of merchant discount fee
  - 2012 DOJ proposed settlement with Merchants/Visa-MC would allow surcharging

Motivation III

Evaluation of Bank and Public Policies

- To evaluate policies, we must know how consumers substitute between payment instruments.
- Substitution patterns may differ based on whether regulations affect usage or adoption costs.
- Consumers' choices may differ from preferences of the social planner
  - Consumers face few explicit costs for payment choice
  - Social planner recognizes costs that consumers may not.
    - Ex 1: SP may prefer digital payments to cash or check.
    - Ex 2: SP may believe credit cards lead to consumer problems.

Our contribution

- We build and estimate a static, structural model of household adoption and use of common payment instruments in various contexts
  - ex: cash, check, credit, debit, online banking bill payment
  - ex: retail, on-line, bill-pay
- We distinguish between adoption and usage decisions.
- We evaluate substitution patterns across payment instruments and highlight how patterns differ:
  - In response to changes in adoption versus usage costs.
  - Across income levels.
  - Between retail (point-of-sale) and bill-pay
- Basic question: If the cost of debit or credit cards goes up, what will consumers switch to?

Selected literature

- Discrete-continuous models.
  - Heckman (1979), Dubin & McFadden (1984), Hendel (1999) and others.
- Bundled choices.
  - Gentzkow (2007), Crawford and Yurukoglu (2009).
- Payment choices.
  - Schuh and Stavins (2010), Arango, Huyhn and Sabetti (2011), Borzekowski and Kaiser (2008), Borzekowski, Kaiser and Ahmed (2008).

Data

Survey of Consumer Payment Choice (SCPC)

- Boston Fed and RAND Corporation panel
- Consumer (18-years and older) fills out detailed survey:
  - Which payment *instruments* do they have?
  - How often do they use instruments in various *contexts*?
- Attitudes towards instruments – rate them on various dimensions (ease of use, set-up cost, security, etc.)
- Use first year of data: 2008
- Focus on consumers with checking accounts (92% of sample).
- 997 consumers.

Payment Instruments

- Paper
  - Cash
  - Check
- Cards
  - Debit
  - Credit
  - Prepaid
- Electronic
  - Online banking bill payment
  - Bank account (number) deduction
  - Direct income deduction

Instruments and Contexts

	Bill Pay			Retail			
	Automatic	Online	Mail/In person	Online	Essential	Non-essential	Other
cash			1.1		6.2	3.1	3.8
check			4.0	1.6	1.0	0.7	2.8
debit card	1.6	1.6	1.3	2.1	7.5	3.6	3.3
credit card	1.4	1.1	1.2	1.6	4.2	2.2	2.8
prepaid card				0.1	0.2	0.1	0.1
online banking		2.1					
bank acct. deduct	2.3	1.7		1.3			
income deduction	0.8						
total	6.0	6.5	7.6	6.8	19.1	9.8	12.8
std. dev.	11.2	10.5	12.8	11.4	23.5	15.7	15.0

Notes: 997 Observations.

Attitudes

	security	setup	accept	cost	control	records	speed	ease
cash	2.6	4.3	4.6	4.3	3.9	2.5	4.3	4.1
check	2.9	3.7	3.6	3.7	3.2	4.1	2.9	3.4
debit card	2.9	3.9	4.3	3.8	3.6	4.0	4.0	4.2
credit card	3.0	3.7	4.5	2.7	3.5	4.2	4.0	4.3
prepaid card	2.7	3.4	3.8	3.3	3.3	2.9	3.7	3.7
bank acct. deduct	3.3	3.4	3.2	3.7	3.6	3.9	3.8	3.6

997 observations. On-line banking bill payment and automatic back account deduction of the same ratings.

Top adoption bundles

Population	cash	check	debit	credit	prepaid	online banking	bank accnt deduction	income deduction	total instruments
23%	1	1	1	1	0	1	1	0	6
12%	1	1	1	1	0	0	1	0	5
8%	1	1	1	1	0	1	1	1	7
6%	1	1	0	0	0	0	0	0	2
5%	1	1	1	1	1	1	1	0	7
4%	1	1	1	1	0	1	0	0	5
4%	1	1	1	1	0	0	0	0	4
3%	1	1	1	0	0	0	1	0	4
3%	1	1	1	1	1	0	1	0	6
3%	1	1	1	1	0	0	1	1	6
3%	1	1	0	1	0	0	0	0	3
3%	1	1	0	1	0	0	1	0	4
2%	1	1	1	0	0	1	1	0	5
2%	1	1	1	0	0	1	0	0	4
2%	1	1	1	0	0	0	0	0	3

A "1" indicates population holds that instrument.

Model (brief overview)

- Two-stage, simultaneous model of adoption and use of 8 payment instruments
  1. Consumer i picks bundle of instruments $b_i \in B$ with $2^6 = 64$ elements (all have cash, check)
  2. For each opportunity l at context c, consumer i chooses usage of instrument j in b_i to maximize expected utility:

$$u_{ijcl} = \delta_{ijc} + \varepsilon^{u}_{ijcl}$$

  - Value of i adopting bundle b:

$$V_{ib} = \overline{V}_{ib} + \varepsilon^{a}_{ib} = \sum_{j \in b} \lambda_{ij} + \alpha v_i(b) + \varepsilon^{a}_{ib}.$$

  - λ_{ij} is adoption cost; $\epsilon^{a}_{ib} \sim EV$; no interaction in λ_{ij}
  - Consumer picks b such that:

$$V_{ib} = \max_{k \in B} V_{ik}$$

Model review

Model advantages:

- Simultaneous determination of adoption and use
- Handles rich correlation in unobserved terms across contexts, instruments, stages
- Adoption of one instrument affects value of other instruments through usage (but not adoption).
- # of transactions can depend on instrument portfolio
  - e.g. Adopting credit card leads to more transactions
- Context choice depends on instrument portfolio
  - e.g. Adopting card leads to more online purchases

Model limitations:

- Static adoption/use decision; no discarding, re-adoption
- No consumer switching of bank accounts
- Partial equilibrium — bank decisions are exogenous

Identification

- Structural model identification of the effect of use on adoption is achieved by:
  - Consumer knows more than econometrician about use at time of adoption
  - Requiring excluded variables in adoption and use equations
  - Restricting bundle value to be additively separable in adoption costs
  - Limits payments substitution to occur through use only
  - Rich patterns of correlation across use and adoption equations

Estimation

- Parameterize δ_{ijc} and λ_{ij}

$$\delta_{ijc} = \mathbf{x}_{ijc}\beta_\delta + \nu_{ijc}$$

$$\lambda_{ij} = \mathbf{z}_{ij}\beta_\lambda + \omega_{ij}$$

- ν_{ijc} and ω_{ij} unobserved; $\{\nu_\mathbf{i}, \omega_\mathbf{i}\} \sim \mathbb{N}(0, \Sigma)$
- $\theta = \{\beta_\delta, \beta_\lambda, \alpha, \Sigma\}$ to be estimated
- Simulated maximum likelihood method (Pakes & Pollard 1989, Gourieroux & Montfort 1996)
- Standard errors corrected for simulation error (Pakes & Pollard 1989, Train 2003)
- Individual shocks at context-instrument level (form of clustering as in Moulton 1990)
- Lots of demographic controls (see paper)

Mean values in usage equation

	Bill Pay			Retail			
	Automatic	Online	Mail/In person	Online	Essential	Non-essential	Other
cash			-6.87		-4.45	-5.55	-4.89
			(0.11)		(0.11)	(0.11)	(0.11)
check			-4.81	-6.04	-6.27	-6.86	-5.20
			(0.12)	(0.12)	(0.12)	(0.13)	(0.12)
debit card	-6.10	-6.25	-6.48	-5.82	-4.31	-5.27	-4.99
	(0.13)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)
credit card	-6.45	-6.74	-6.68	-6.01	-4.82	-5.54	-5.17
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
prepaid card			-8.66	-8.07	-6.74	-7.69	-7.60
			(0.49)	(0.40)	(0.41)	(0.47)	(0.46)
online banking		-4.95					
		(0.08)					
bank acct. deduct	-5.14	-5.51		-5.82			
	(0.09)	(0.09)		(0.09)			
income deduction	-5.06						
	(0.07)						

Notes: Standard errors are in parenthesis. 997 observations.

Instrument ratings in usage equation

	use		full	
security	-0.01	(0.003)	0.04	(0.003)
acceptance	0.01	(0.005)	0.02	(0.005)
cost of use	0.10	(0.004)	0.08	(0.005)
control of pay time	0.03	(0.004)	0.08	(0.004)
record keeping	0.08	(0.005)	0.00	(0.005)
speed	0.01	(0.005)	0.04	(0.005)
ease of use	0.12	(0.006)	0.10	(0.006)

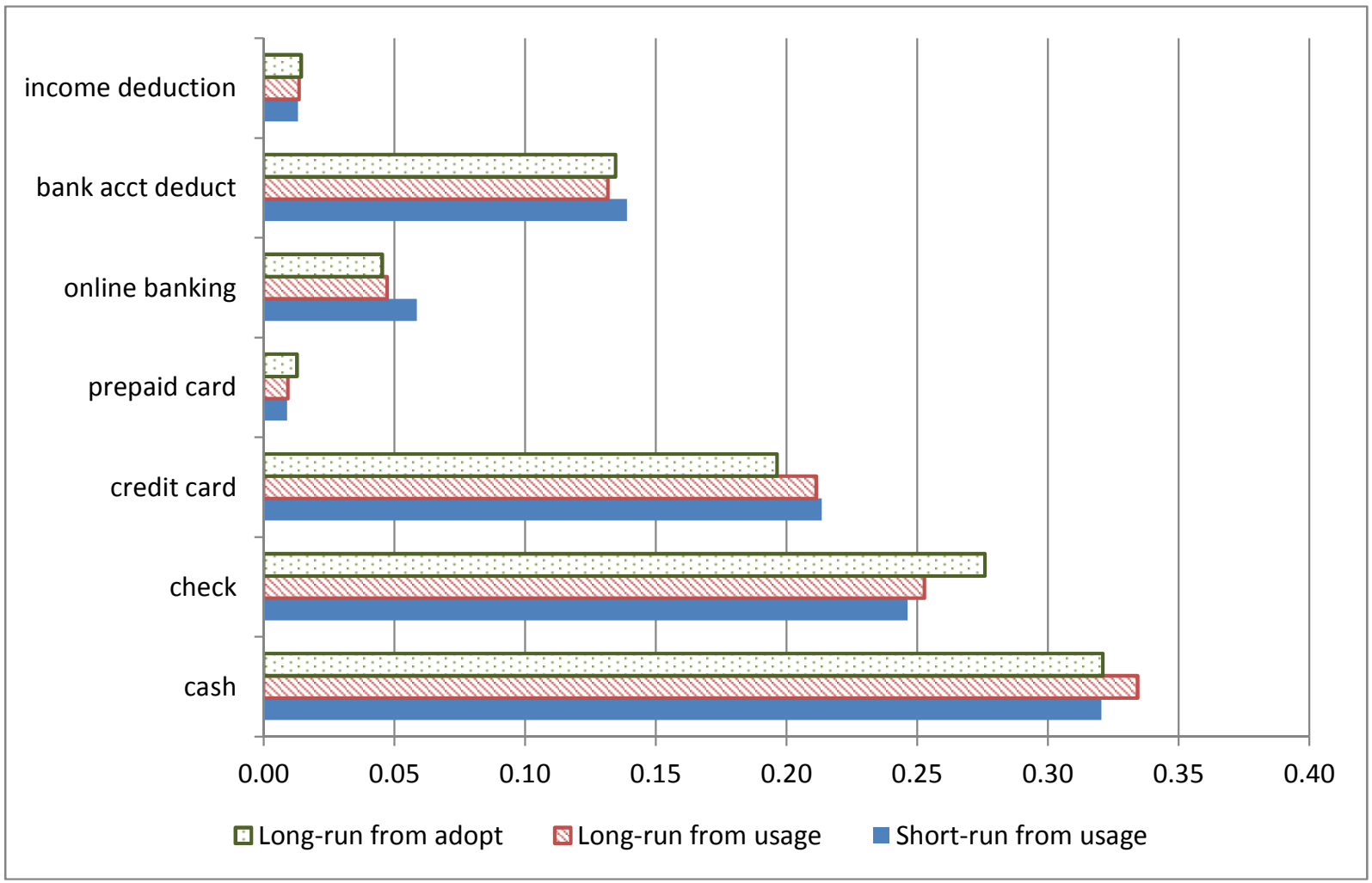
Instrument mean utilities in adoption equation

	Coef	std. dev.
debit card	-1.42	(0.61)
credit card	-1.77	(0.70)
online banking bill pay	0.05	(0.31)
electronic bank account deduction	-1.08	(0.31)
store value card	1.49	(0.82)
direct deduction from income	1.61	(0.26)

Notes: 997 observations

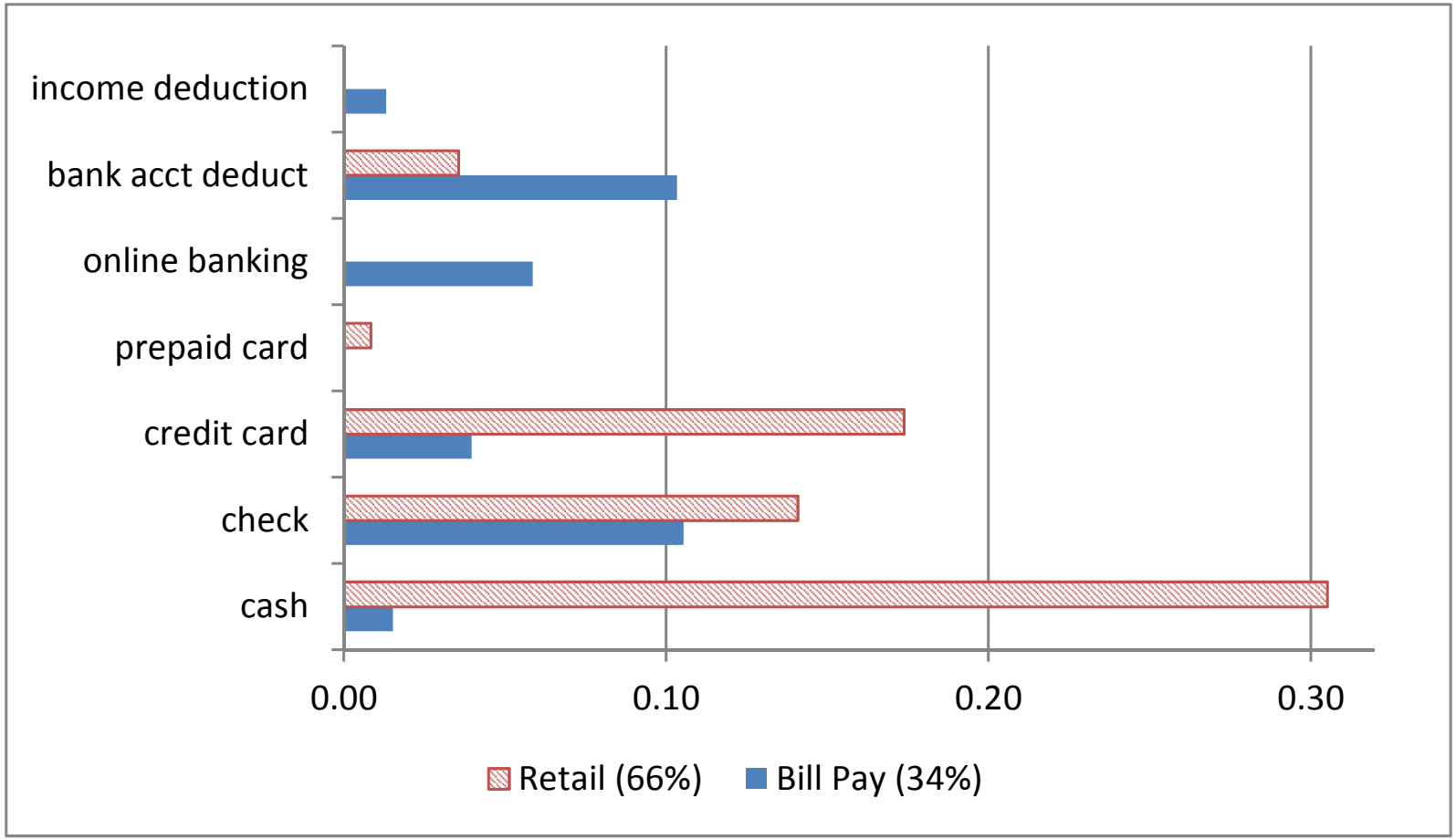
Elasticities to higher cost of debit

What if banks charge a monthly debit card fee or cut debit rewards?



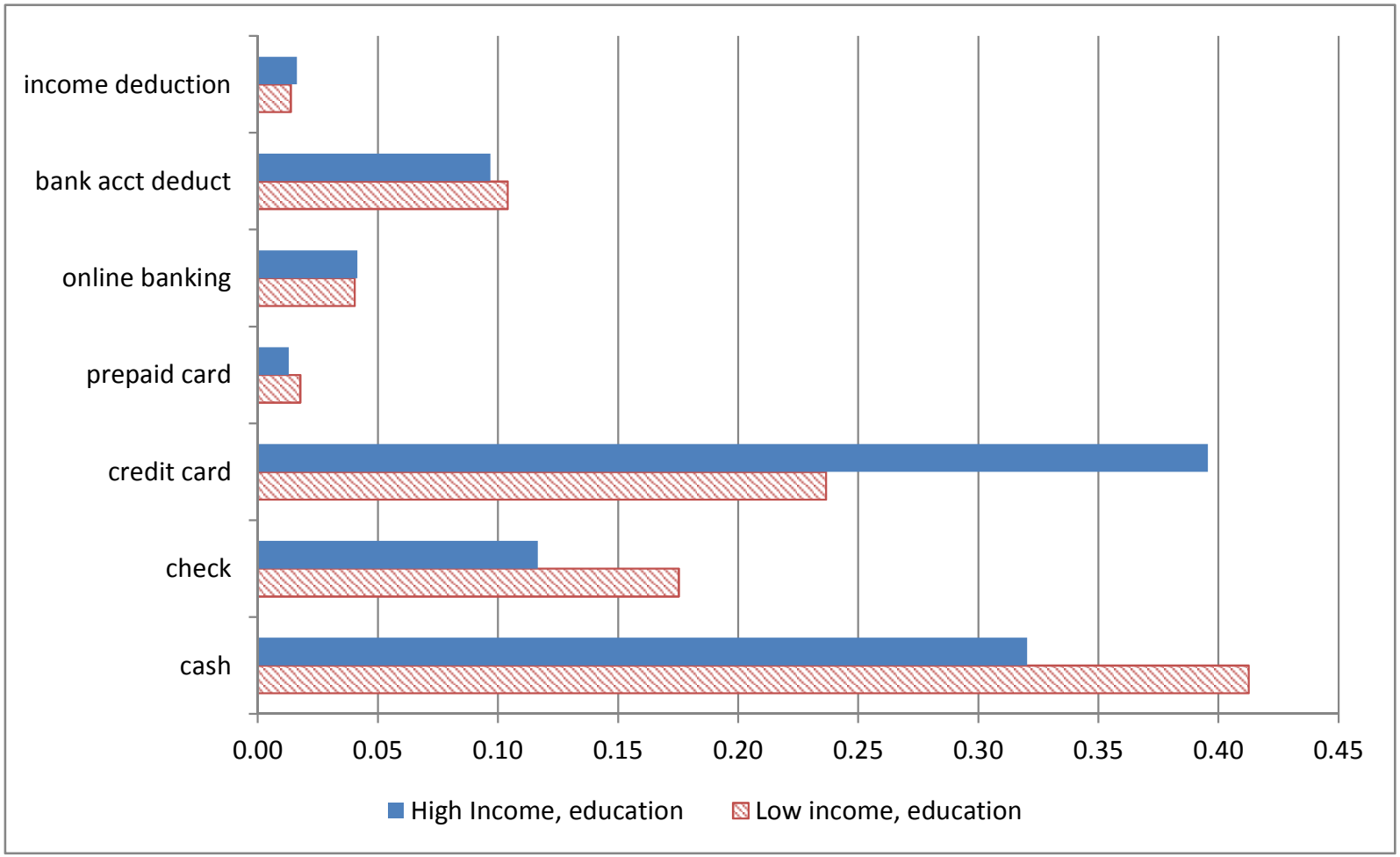
Elasticities to higher usage cost in debit

By effect on retail vs. bill pay



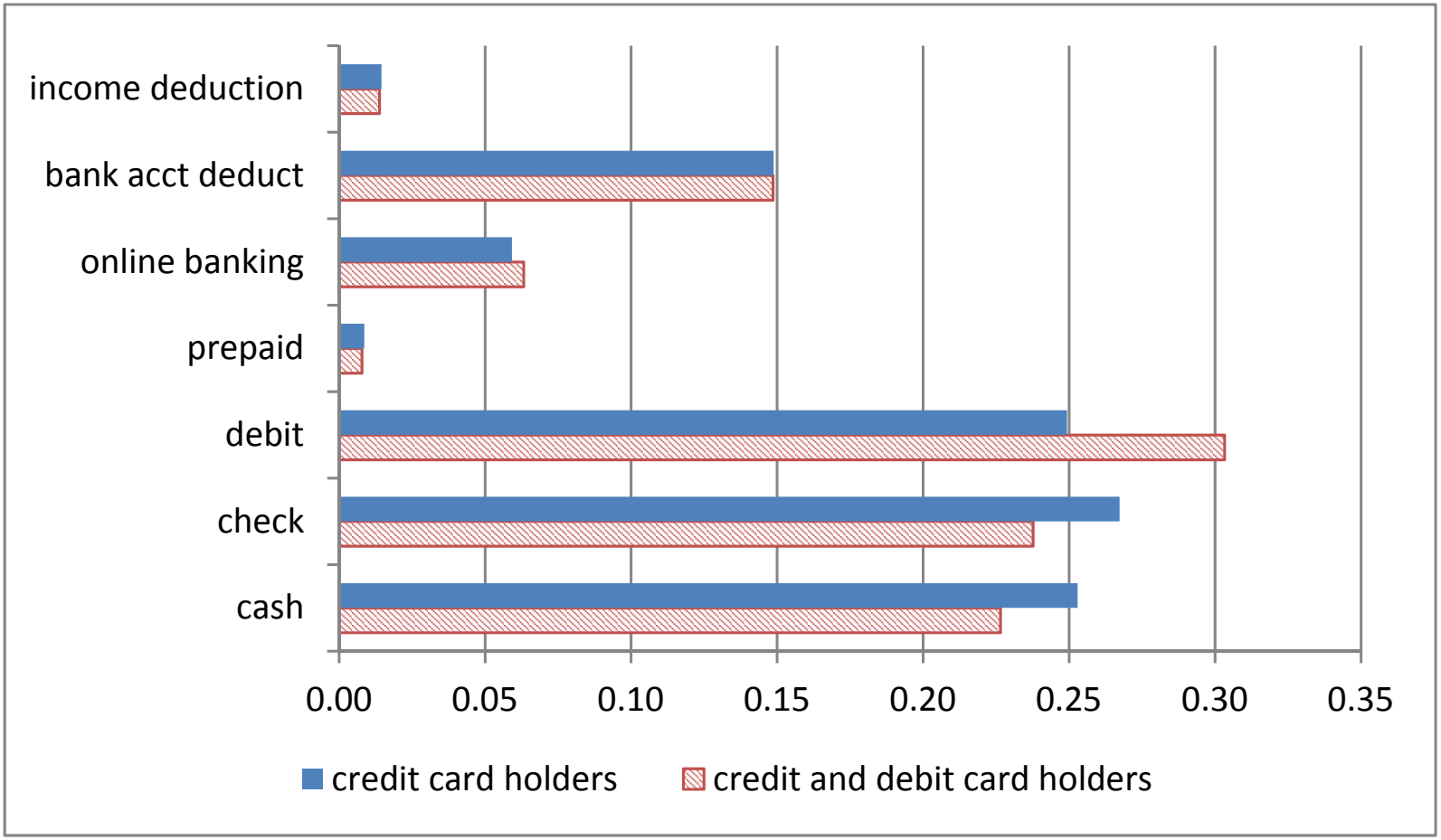
Elasticities by income/education

Consumers assumed to hold all instruments

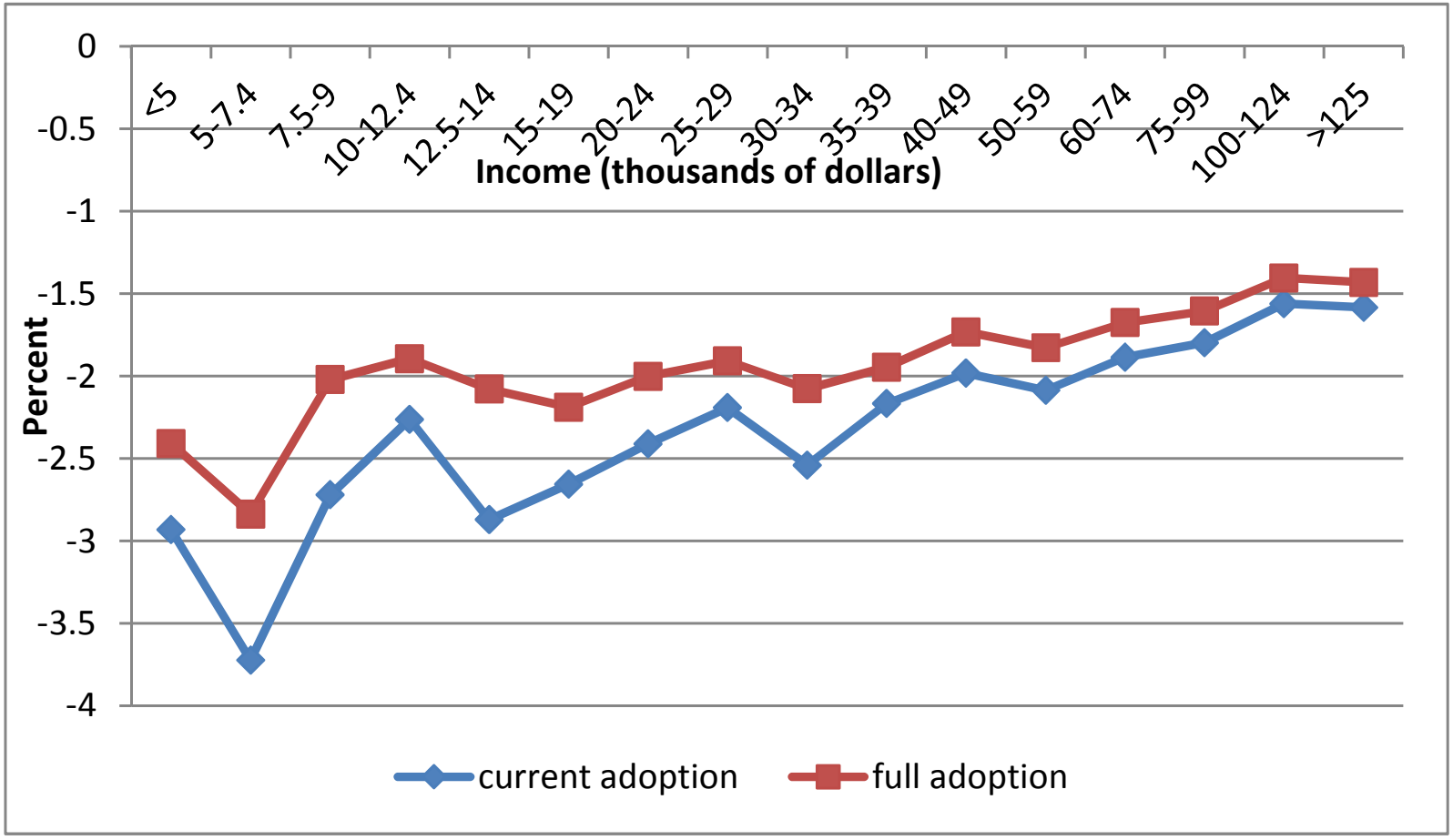


Elasticities to higher usage cost of credit card

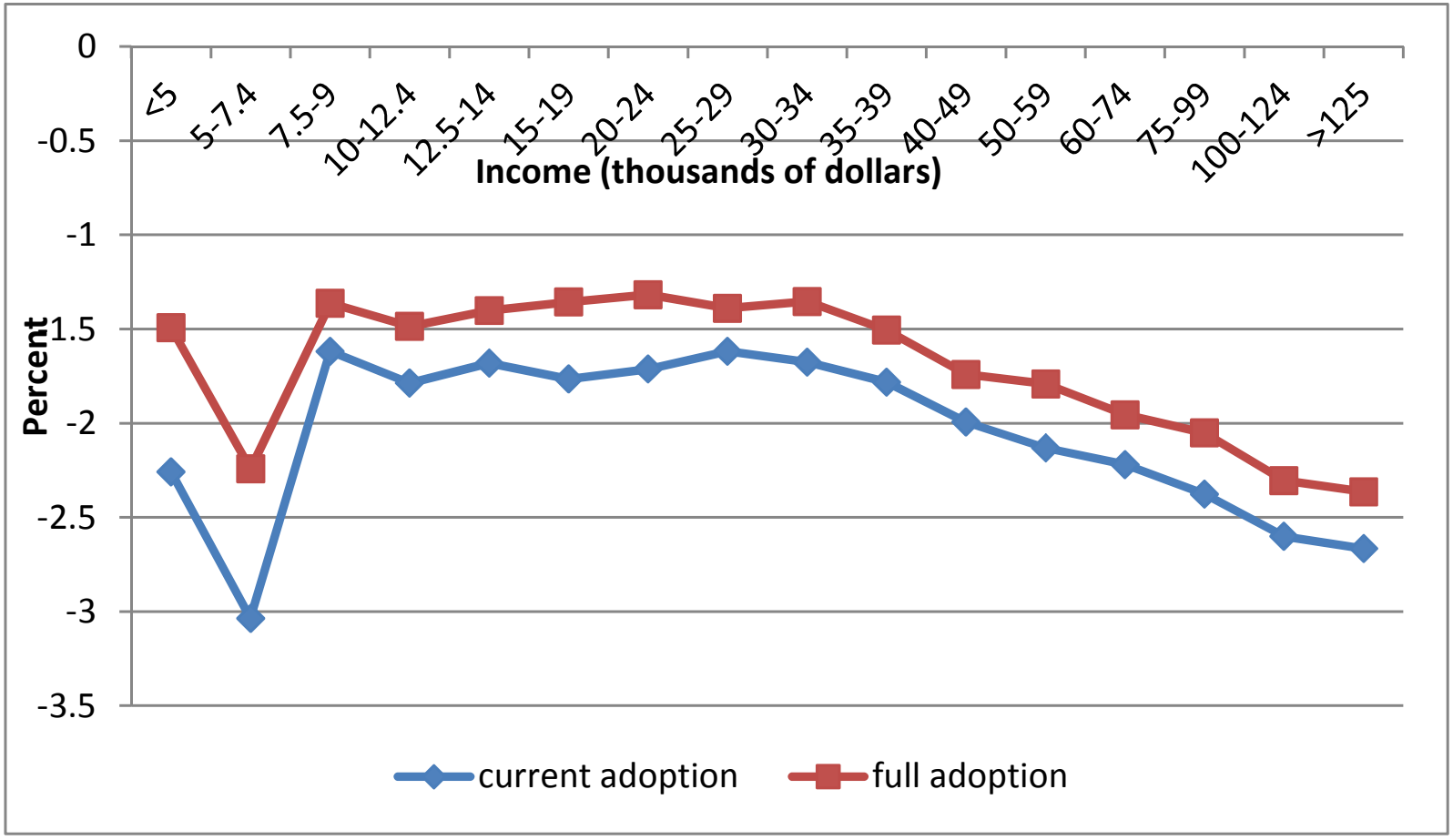
What if 2012 DOJ settlement allows credit card surcharges?



Welfare change from higher cost of debit



Welfare change from higher cost of credit



Key Conclusions

- New two-stage model of adoption and usage of payment instruments fits new data on consumer payment choice reasonably well
- Higher debit, credit costs likely to induce substitution among instruments
- No "one size fits all" payment choice:
  - Mostly substitution to paper (cash, check) but not exclusively (credit cards)
  - Substitution to paper occurs especially for low income/education and bills
  - Substitution to credit occurs for high income/education
  - Demographic characteristics are important but heterogeneous
- Banks, policy makers need to think about consequences of these substitutions