Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations

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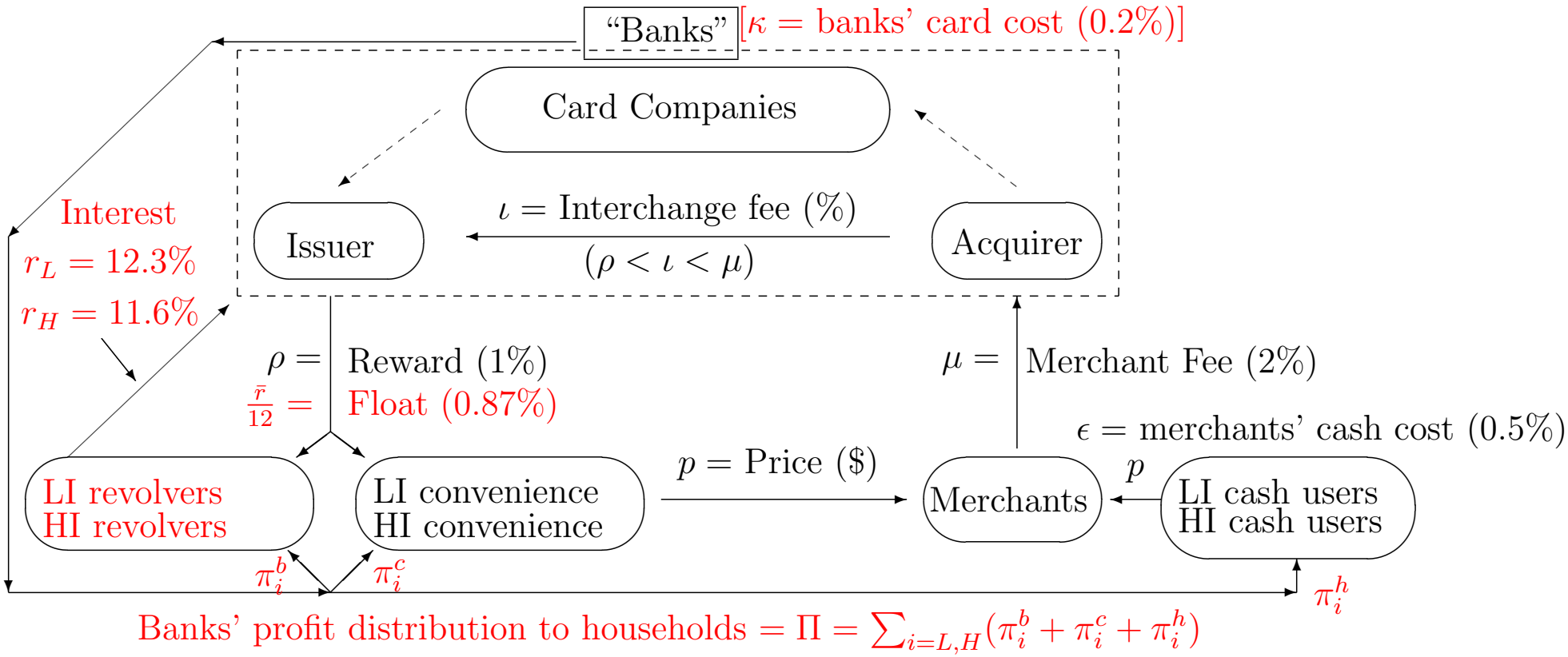
Introduction: Simplified overview of U.S. payment market



Two types of transfers among buyers:

1. From cash to card users
   a. From cash and revolving card users to card convenience card users
2. From low-income to high-income households

Introduction

Summary of the presentation

- Literature summary
- Basic facts about consumer credit cards
- Transfer accounting
- Qualifications and extensions
- Policy discussion
- Model of consumer payment choice (tentative)

Introduction

Literature on payment transfers

- The idea in which cash users subsidize card payers is first mentioned in Carlton & Frankel (*Antitrust Law Journal*, 1995)
- Frankel (1998) was the first to connect it to transfer between low- to high-income buyers, see also Berkowich (2009).
- We support these 2 ideas with actual numbers !
- McAndrews & Wang (FRB-KC, 2008) demonstrate the possibility of a subsidy in the opposite direction (from card to cash users) in cases where merchants' cost of handling cash exceeds merchants' card fees. *Note*: They consider all cards (debit and credit), whereas we focus on credit cards only.

Introduction

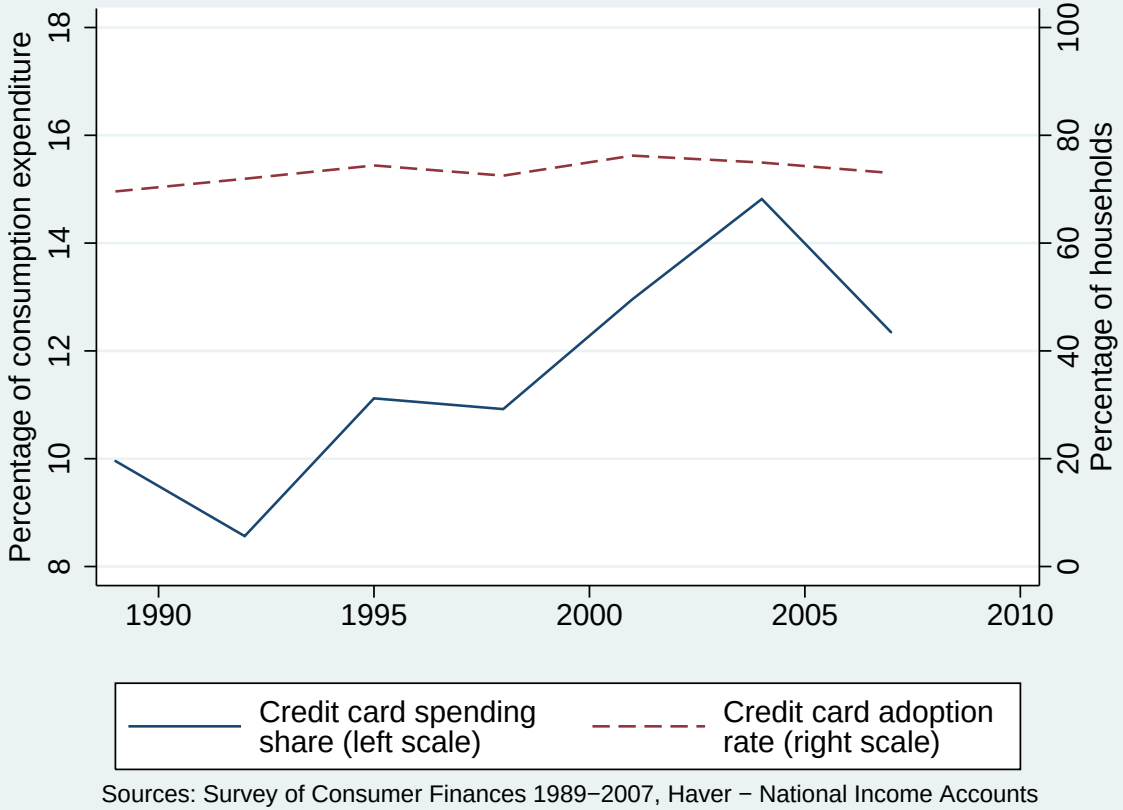
Sample Literature (Mostly Surveys) on Card Networks, Interchange Fees, and Two-Sided Markets

Chakravorti & Shah (*AB* 2003); Gans & King (2003); Rochet (*RNE* 2003); Wright (*EER* 2003); Roson (*RNE* 2005); Armstrong (*Rand* 2006); Schwartz & Vincent (*RNE* 2006); Rochet & Tirole (*Rand* 2006); Bolt & Chakravorti (*EP* 2008); Hayashi (*Fed-KC* 2008); Prager, Manuszak, Kiser, and Borzekowski (*FRB* 2009); Rysman (*JEP* 2009); Shy & Wang (*AER* 2011); Verdier (*JES* 2011).

- Our research (hopefully) opens a new direction of research focusing on aspects of income distribution among buyers (associated with the use of credit cards).
- The analysis is "compatible" with any merchant fee and buyer reward
- Hence, we don't explicitly focus on interchange fees.
- Computations are based on a 2% merchant fee and a 1% reward.

Some Basic Facts

1 Credit card use is increasing



Sources: Survey of Consumer Finances 1989–2007, Haver – National Income Accounts

Adoption

Steady (over two decades) at 70–75% of households who have credit cards

CC spending as % of expenditure

Roughly doubled

Note: Merchant fee revenue is also rising because it is proportional to credit card spending (Shy and Wang, *AER*, 2011).

Some Basic Facts

2 Card use and rewards are increasing with income

Households' credit card adoption rates and

new monthly charges by annual household income

Annual income	Have a credit card (%)	Credit card spending: Average monthly ($)		Credit card spending: Share of spending (%)	
		Revolvers	Convenience	Revolvers	Convenience
Under $\$20,000$	42	461	343	6.2	3.8
$\$20,000$–$49,999$	67	380	650	6.0	6.0
$\$50,000$–$79,999$	87	521	1,170	8.0	8.5
$\$80,000$–$99,999$	91	773	1,647	9.8	10.3
$\$100,000$–$119,999$	93	1,012	1,854	11.4	11.4
$\$120,000$–$149,999$	97	1,370	2,084	11.5	15.3
Over $\$150,000$	97	3297	5,771	9.2	26.2
Low ($< \$100,000$)	68	490	847	7.3	7.1
High ($\geq \$100,000$)	96	1,927	4,146	9.9	21.9
Whole sample	73	779	1,874	8.4	13.3

Source: 2007 Survey of Consumer Finances

Some Basic Facts

2 Card use and rewards are increasing with income

Percent of Card Holders Receiving Rewards

Income	Any Reward	Cash Back	Air. Miles	Discounts	Other
Under $20,000	48	27	17	13	8
$20,000–49,999	50	28	17	11	10
$50,000–79,999	62	35	26	13	12
$80,000–99,999	68	38	36	15	11
$100,000–119,999	71	37	33	16	15
$120,000–149,999	82	44	39	19	25
Over $150,000	75	33	48	15	19
Low ($< \$100,000$)	57	32	23	12	10
High ($> \$100,000$)	77	37	40	16	19
Whole sample	61	33	27	13	12

Source: 2008 Consumer Finance Monthly, Ohio State University

Some Basic Facts

3 Credit card borrowing (revolving) is not strongly correlated with income

Revolving credit activity by household income group

	Low-income	High-income
Revolving debt (reported incidence)	32.9%	30.7%
Revolving debt (actual incidence)	43.2%	47.5%
Revolving debt (revolvers)	$6,252	$11,709
Percent of income (revolvers)	16.37%	8.06%
Interest rate (card holders/revolvers)	12.35%/12.31%	12.60%/11.65%
Annual interest payment	$759	$1303
Percent of income (revolvers)	1.93%	0.87%
Aggregate interest revenue	$30.9 billion	$13.4 billion
Annual rewards	$2.7 billion	$5.8 billion

Source: 2008 Survey of Consumer Payment Choice

Agents and Data

Distributions of Households and Spending

	Distribution of Households					
	Total (millions)			Shares (%)		
	I_L	I_H	Total	I_L	I_H	Average
Total	94	22	116	81	19	100
Cash users	81	15	96	70	13	83
All credit card users	13	7	20	12	6	17
Convenience users	7	5	11	6	4	10
Revolvers	7	2	9	6	2	8

	Distribution of Spending					
	Total ($ trillions)			Shares (%)		
	I_L	I_H	Total	I_L	I_H	Average
Total	3.3	2.4	5.7	58	42	100
Cash users	2.8	1.6	4.5	50	29	79
All credit card users	0.5	0.7	1.2	8	13	21
Convenience users	0.2	0.5	0.7	4	9	13
Revolvers	0.2	0.2	0.5	4	4	8

- \$100,000 income cut-off generates: 81% low-income households
- Cash is used more frequently than cards.
- High-income buyers perform proportionally more transactions than low-income

Agents and Data

Merchants

- Supply one representative good (product or a service), 2 locations
- λ_L, λ_H share of low- and high-income households shopping at location one
- Benchmark values: $\lambda_L = 0.3$ and $\lambda_H = 0.7$
- S_i^h, S_i^c, S_i^b spending by cash, card-convenience, and card-borrowing households belonging to income group $i = H, L$
- μ (say, 2%) merchant card fee, ϵ (say, 0.5%) cash handling cost
- M_1, M_2 cost per one dollar of sales of handling a payment for merchants $1, 2$

$$M_1 \overset{\text{def}}{=} \left[\frac{\sum_i \lambda_i (S_i^c + S_i^b)}{S}\right] \mu + \left[\frac{\sum_i \lambda_i S_i^h}{S}\right] \epsilon \approx 0.87\%$$

$$M_2 \overset{\text{def}}{=} \left[\frac{\sum_i (1-\lambda_i)(S_i^c + S_i^b)}{S}\right] \mu + \left[\frac{\sum_i (1-\lambda_i) S_i^h}{S}\right] \epsilon \approx 0.77\%$$

Agents and Data

Banks

- Focus only on credit card activities
- ρ_L, ρ_H reward rates on credit card purchase.
- κ card resource cost
- r_L^b, r_H^b interest on revolving, $\bar{r}$ banks' benchmark rate
- Aggregate banking industry profit:

$$\Pi \stackrel{\text{def}}{=} \sum_{i=H,L} \left\{ \underbrace{(\mu - \kappa - \rho_i)(S_i^b + S_i^c)}_{\text{(Net of rewards) merchant fee profit}} + \underbrace{(r_i^b - \bar{r})S_i^b}_{\text{Interest profit}} - \underbrace{\frac{\bar{r}}{12} S_i^c}_{\text{Float cost}} \right\}.$$

Π is divided (via stock ownership) among the three types of households, so that $\Pi = \sum_{i=H,L} \left(\pi_i^b + \pi_i^c + \pi_i^h\right)$.

Transfer Accounting

Transfer Definitions: Cash and convenience card users

Transfer received (paid if negative) by cash users of income group $i = H, L$

$$X_i^h \stackrel{\text{def}}{=} \underbrace{\pi_i^h}_{\text{Banks' dividends}} + \underbrace{\epsilon S_i^h}_{\text{Resource cost of cash payments}} - \underbrace{\left[\lambda_i S_i^h M_1 + (1-\lambda_i) S_i^h M_2\right]}_{\text{Actually pay}}$$

Transfer received (paid if negative) by convenience card users

$$X_i^c \stackrel{\text{def}}{=} \underbrace{\pi_i^c}_{\text{Banks' dividends}} + \underbrace{\kappa S_i^c}_{\text{Resource cost of card payments}} + \underbrace{\rho_i S_i^c}_{\text{Card rewards}} + \underbrace{\frac{\bar{r}}{12} S_i^c}_{\text{Float value}} - \underbrace{\left[\lambda_i S_i^c M_1 + (1-\lambda_i) S_i^c M_2\right]}_{\text{Merchants' costs of cards and cash}} .$$

Transfer Accounting

Transfer Definitions: Revolvers and between income groups

Transfer received (paid if negative) by card borrowers (revolvers) of income group $i = H, L$

$$X_i^b \stackrel{\text{def}}{=} \underbrace{\pi_i^b}_{\text{Banks' dividends}} + \underbrace{\kappa S_i^b}_{\text{Resource cost of card payments}} + \underbrace{\rho S_i^b}_{\text{Card rewards}} - \left\{ \underbrace{\left[\lambda_i S_i^b M_1 + (1-\lambda_i) S_i^b M_2\right]}_{\text{Merchant's card and cash costs}} + \underbrace{(r_i^b - \bar{r}) S_i^b}_{\text{Banks' interest profit}} \right\}.$$

Transfer received (paid if negative) by income group $i = H, L$

$$X_i = X_i^h + X_i^c + X_i^b$$

Transfer Accounting

Results

	Total ($ Billions)			Per household ($)		
	I_L	I_H	Total	I_L	I_H	Average
Total	-7.8	7.8	0	-83	361	0
Cash users	-5.6	0.8	-4.8	-69	52	-50
All credit card users	-2.2	7.0	4.8	-162	1058	240
Convenience users	2.2	7.2	9.4	331	1567	833
Revolvers	-4.4	-0.1	-4.5	-647	-63	-511
Cash users & Revolvers	-10	0.6	-9.4	-114	38	-89

- Cash households subsidize card households
- Card revolvers subsidize card convenience users
- Low-income households subsidize high-income households
- Further research is needed to understand the relationship among income, debt, and credit card use

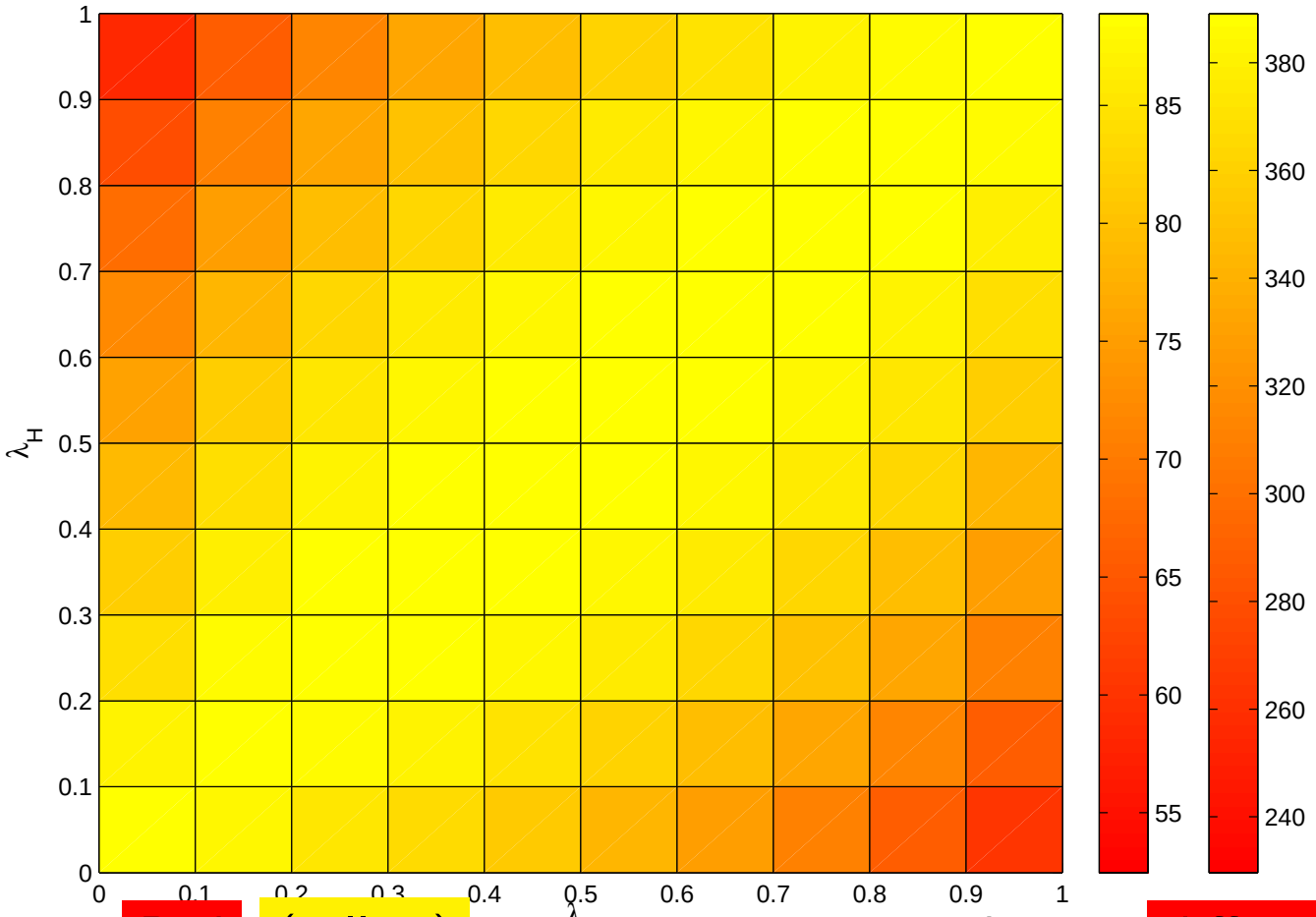
Transfer Accounting

Transfer breakdown by income group

Income range	Transfers received	
	Total ($ Billions)	Per household ($)
Under $\$20,000$	-1.5	-63
$\$20,000$–$\$49,999$	-3.4	-89
$\$50,000$–$\$79,999$	-2.2	-96
$\$80,000$–$\$99,999$	-0.5	-56
$\$100,000$–$\$119,999$	-0.6	-89
$\$120,000$–$\$149,999$	0.1	10
Over $\$150,000$	8.2	823
Low-income ($< 100,000$)	-7.7	-81
High-income ($\geq 100,000$)	7.7	355

Sensitivity Analysis

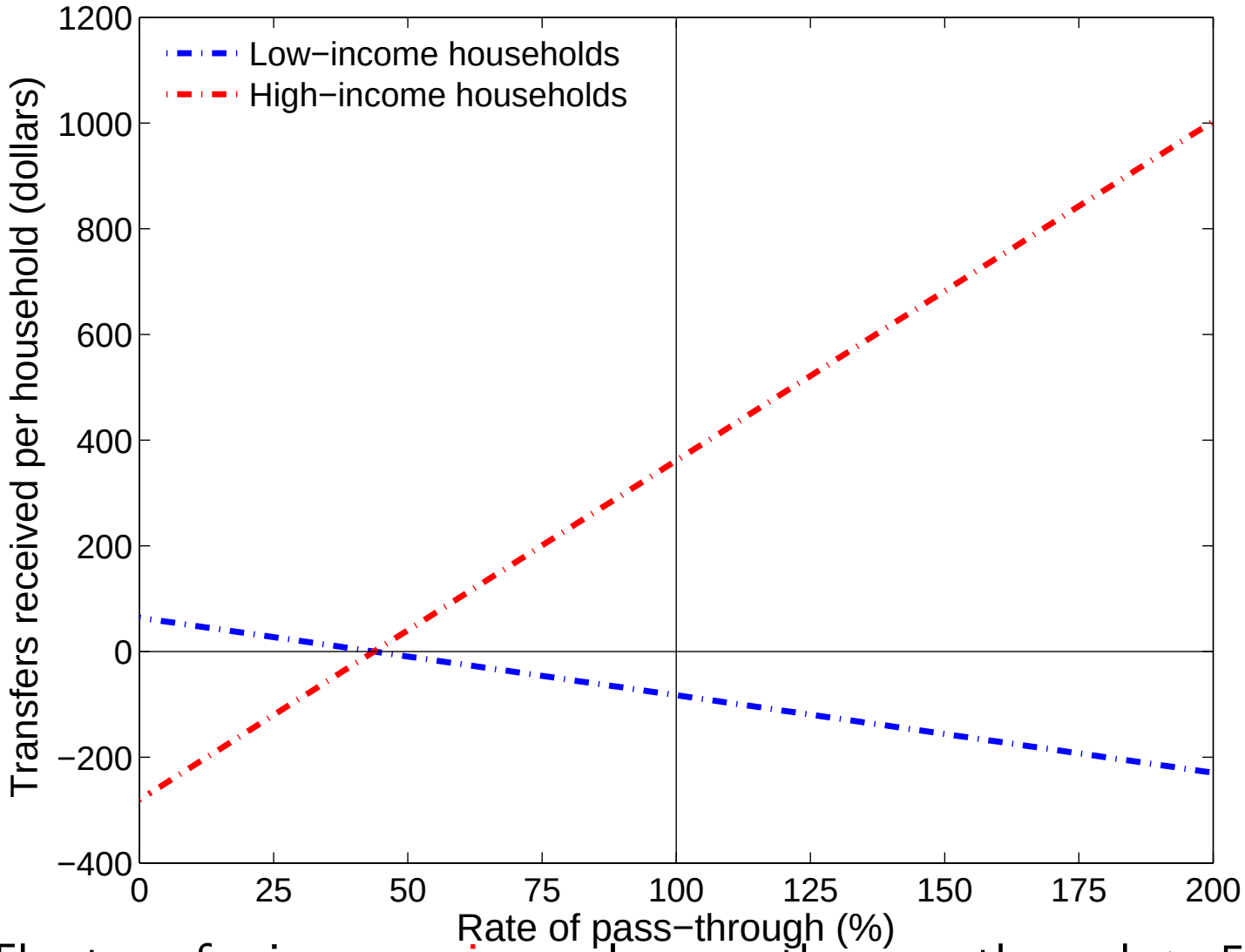
Household shopping patterns



- Red (yellow) areas income groups shop at different (same) places
- Left column: Transfer from low- to high-income households \$55 – \$85
- Right column: High income households received \$240 – \$380 in 2007

Sensitivity Analysis

Pass-through

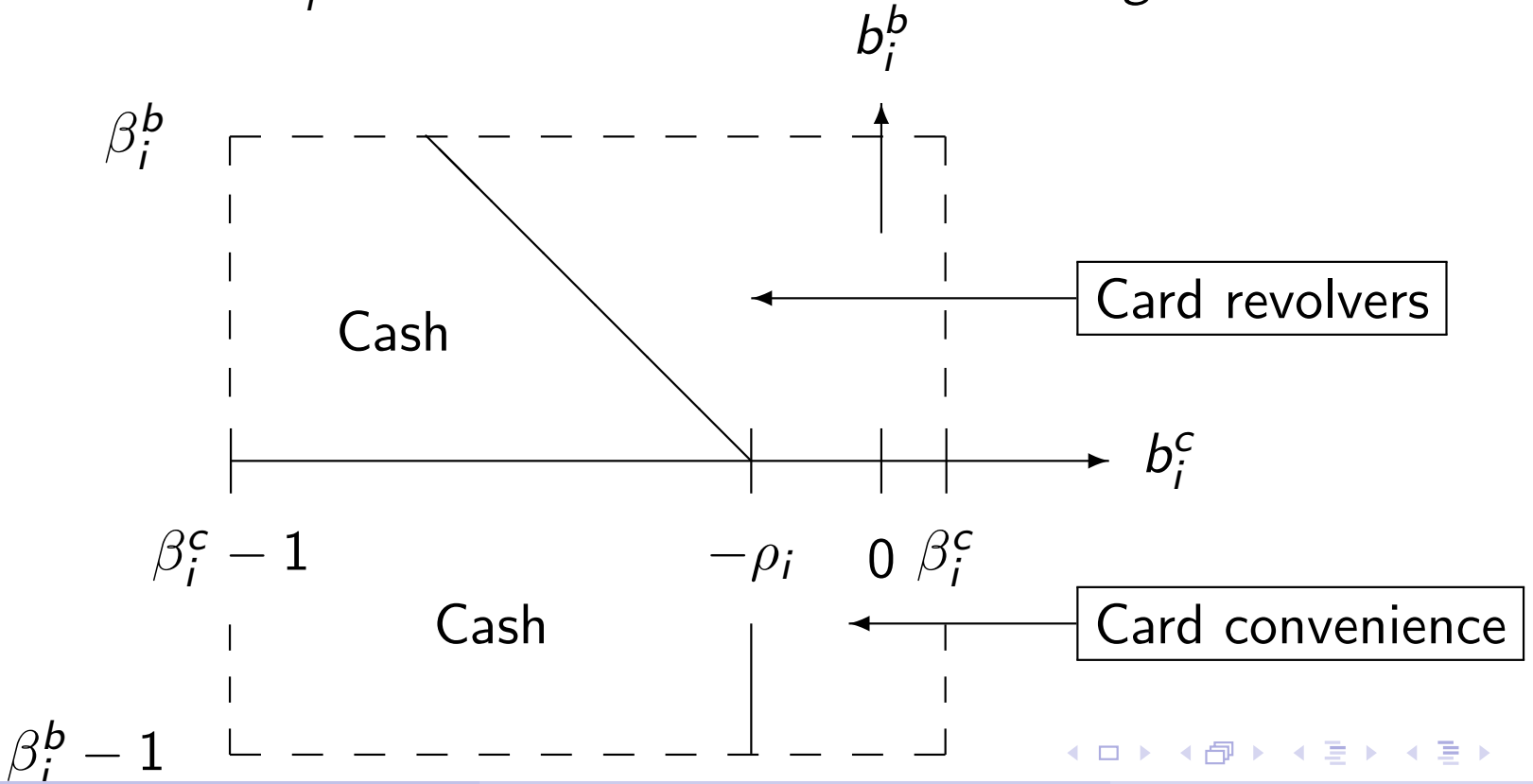


The transfer is regressive as long as the pass-through $> 50\%$

A Model of Consumer Payment Choice

Buyer heterogeneity

- N_L low-income and N_H high-income buyers, income levels I_L and I_H
- Each income group, $i = H, L$ is composed of a continuum of buyers indexed on the unit square by $(b_i^c, b_i^b) \in [\beta_i^c - 1, \beta_i^c] \times [\beta_i^b - 1, \beta_i^b]$.
- The index b_i^c measures benefits from *convenience* use of credit cards
- The index b_i^b measures benefits from *borrowing* on credit cards



A Model of Consumer Payment Choice

Exact formulation of buyers' preferences

$$p^{\text{buyer}} = \begin{cases} p(1-\rho_i) & \text{paying with a card} \\ p & \text{paying cash} \end{cases}$$

- Assuming that buyers spend their entire budget, low-income buyers perform I_L/p^{buyer} transactions, whereas high-income buyers perform I_H/p^{buyer} transactions
- Let $0 < \alpha \leq 1$. We define the utility function of an income group i buyer who is indexed by (b_i^c, b_i^b) by

$$U_{(b_i^c, b_i^b)} = \begin{cases} \left(\dfrac{I_i}{p}\right)^{\alpha} & \text{paying cash,} \\ \left[(1+b_i^c)\dfrac{I_i}{p(1-\rho_i)}\right]^{\alpha} & \text{paying with a card (convenience)} \\ \left[(1+b_i^c+b_i^b)\dfrac{I_i}{p(1-\rho_i)}\right]^{\alpha} & \text{paying with a card (borrow)} \end{cases}$$