# Multihoming in the Market for Payment Media: Evidence from Young Finnish Consumers

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FRB of Boston, 25.7.2006

## Main result:

- Increasing consumer awareness speeds up adoption/use of new payment media

## So what?

# Why multihoming?

- New payment media typically used simultaneously with established media (≈ consumers multihome)

$\Rightarrow$ Adoption & use of new payment media

- What determines multihoming $\Rightarrow$ what determines adoption and use of new payment media

# Why adoption/use?

- Substantial heterogeneity in the use of payment media
  - Many use only cash
- Limited use of new payment media has implications for individual welfare, competition among issuers and merchants, monetary policy, economic efficiency etc.

# Why awareness?

- By definition, one cannot adopt if one does not know $\Rightarrow$ awareness and adoption will correlate
- Can we tackle causality?
  - Use increases knowledge about *characteristics*
  - existence $\neq$ characteristics

- How relevant is consumer awareness *quantitatively*?
- It is a major determinant of
  - financial market participation (Guiso&Japelli-05)
  - social program participation (Heckman&Smith-05)
- Is payment media market participation different?

  $\Rightarrow$ policy implications

# Previous and simultaneous research

- Why people use *different* media?
  - Theory: e.g. Tarkka & Shy-02
  - Empirics: e.g. Klee-06, Fusaro-05, Zinman-05
- Effects of pricing on adoption
  - Humprey et al.-00, Snellman et al. -01, Bolt et al.-05
- Uses the US data or (cross-country) aggregate data

# What we do?

- Focus on
  - the *number* of payment media used in point-of-sale transactions ≈ *multihoming*
    - Theory: e.g. Rochet&Tirole-03, 05
    - Empirics: Rysman-06
  - the effect of consumer awareness on multihoming

- Derive a semi-structural model of multihoming and test it against our data

- Microlevel (survey) data on young Finnish consumers
  - *young* $\Rightarrow$ a window to the future
  - *Finland* $\Rightarrow$ fits for the study of multihoming

# Finnish payment media market

- electronic money is widely used
- debit cards popular
- credit cards used for paying, not accessing to credit
- the use of cash is preceded by the use of ATM network
- the market is concentrated
- the pricing of payment media is simple

# Rest of the Presentation

1) Theory

2) Econometric model

3) Data (briefly)

4) Estimation methods & results

5) Policy implications

# 1. Theory

- Acceptability of a payment media is among its key properties
  - Theory of two sided markets (multihoming)
  - Search theory of payment media
    - e.g. Kioytaki & Wright-93
  - Baumol-Tobin type of models
    - e.g. Santonomero & Seater-96

$\Rightarrow$ consumers use different payment media to economize their costs of transacting

# 2. Econometric model

- A variant of the Baumol-Tobin model
- Using more payment media facilitates "shopping"
- Payment media are imperfect substitutes
- $\boldsymbol{n_i}$ = the number of payment media adopted by consumer $\boldsymbol{i}$
- Derive an estimable theory of $\boldsymbol{n_i}$

- Consumer $i$ chooses $n_i$ to

$$\min \tau_i \omega + n_i \psi_i$$

  - $\omega$ = time cost of transactions
  - $\psi_i$ = cost of adopting a new payment medium
  - Transaction technology:

$$\tau_i = A T_i^{\gamma_1} \left( \frac{T_i}{n_i} \right)^{\gamma_2}$$

  - $T_i$ = amount of transactions

f.o.c.:

$$\ln n_i = \frac{1}{1+\gamma_2}\left[(\gamma_1+\gamma_2)\ln T_i + \ln \omega A \gamma_2 - \ln \psi_i\right]$$

Assumption 1)

$$T_i = \exp\left(\theta_1 INC_i + \theta_2 INC_i^2 + \sum_{j=3} \theta_j x_{ij}\right)$$

- one-to-one mapping from a consumer's income to her amount of transactions

Assumption 2):

- $\omega$ does not vary conditional on $x_i$

$\Rightarrow$ ln $\omega A \gamma_2$ is constant

Assumption 3)

$$\ln \psi_i = x'_i \delta - \alpha a_i + \upsilon_i$$

- $a_i$ = awareness
- $x'_i$ = vector of other observables
- $\upsilon_i$ = unobservable consumer heterogeneity

- Impose Assumptions 1-3 on the f.o.c.:

$$\ln n_i = \pi_0 a_i + \pi_1 INC_i + \pi_2 INC_i^2 + \sum_{j=3} \pi_j x_{ij} + \varepsilon_i$$

where

$$\varepsilon_i \equiv -\frac{\upsilon_i}{1+\gamma_2},\ \pi_0 \equiv \frac{\alpha}{1+\gamma_2}, \pi_{j\neq 0} \equiv \frac{(\gamma_1+\gamma_2)\theta_j - \delta_j}{1+\gamma_2}$$

- note: cannot distinguish between $\alpha$ and $\gamma_2$

# 3. Data & variables

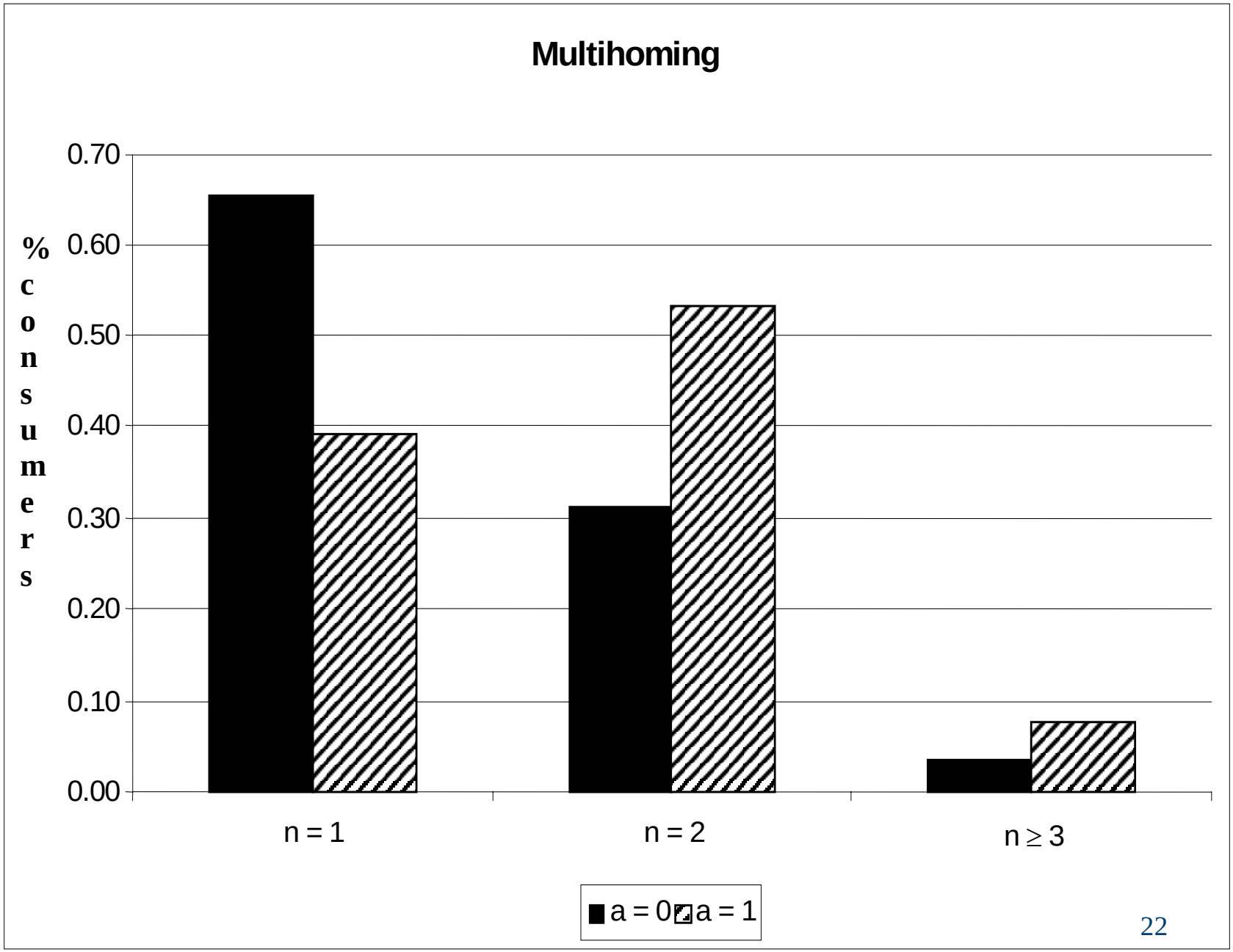
- A survey by the Finnish Bankers' Association 2002
- 1004 individuals around Finland, between ages 15-28
- Questions:
  - demographic background
  - socio-economic background

- In particular, questions concerning
  - payment habits
  - use of various payment media
  - received information on payment media
  - general financial awareness

- $\boldsymbol{n_i}$ = the number of payment media a responded actually ***uses*** in her point-of-sale transactions

  $\neq$ bill-paying or holding of payment media

- $\boldsymbol{a_i}$ = 1, if a respondent had received a *lot* of information about
  - debit or credit cards
  - borrowing through credit cards
  - ways of paying bills
  - use of transaction accounts


Multihoming
% consumers
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
n = 1
n = 2
n ≥ 3
a = 0
a = 1

# 4. Basic estimation & results

- Control for demographic, socio-economic characteristics & banking relationship

- OLS, Log-OLS, Poisson quasi-likelihood method

- Many robustness tests
  - in particular the construction of $\boldsymbol{n_i}$ & $\boldsymbol{a_i}$

| PANEL A | Dependent variable: n | | | | | |
|---|---|---|---|---|---|---|
| | OLS | | Log-OLS | | Poisson | |
| | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| a | 0,14 | 0,04 | 0,09 | 0,02 | 0,09 | 0,02 |
| INCOME | 0,02 | 6,2E-03 | 0,01 | 3,8E-03 | 0,01 | 3,9E-03 |
| INCOMESQ | -3,5E-04 | 1,8E-04 | -2,4E-04 | 1,1E-04 | -2,2E-04 | 1,2E-04 |
| AGE | 0,11 | 0,07 | 0,07 | 0,04 | 0,11 | 0,04 |
| AGESQ | -1,5E-03 | 1,6E-03 | -9,2E-04 | 9,8E-04 | -1,8E-03 | 9,5E-04 |
| SEX | 0,10 | 0,04 | 0,06 | 0,02 | 0,06 | 0,02 |
| LIVCITY | 0,05 | 0,04 | 0,04 | 0,02 | 0,03 | 0,02 |
| WEST | -0,05 | 0,04 | -0,02 | 0,02 | -0,03 | 0,03 |
| EAST | 0,02 | 0,06 | 0,03 | 0,04 | 0,02 | 0,04 |
| NORTH | 0,02 | 0,06 | 0,02 | 0,03 | 0,01 | 0,03 |
| EMP | 0,01 | 0,06 | 0,01 | 0,04 | 5,7E-03 | 0,04 |
| UNEMP | -0,03 | 0,08 | -7,9E-03 | 0,05 | -0,02 | 0,05 |
| HIGH | 0,26 | 0,09 | 0,17 | 0,06 | 0,17 | 0,06 |
| MEDIUM | 0,12 | 0,07 | 0,08 | 0,05 | 0,10 | 0,05 |
| NOHOUSEH | -0,02 | 0,05 | -0,01 | 0,03 | -0,01 | 0,03 |
| CHILDREN | 0,04 | 0,07 | 0,02 | 0,04 | 0,02 | 0,04 |
| RWEALTH | 0,11 | 0,06 | 0,07 | 0,03 | 0,06 | 0,03 |
| FWEALTH | 0,13 | 0,04 | 0,08 | 0,02 | 0,08 | 0,02 |
| LWEALTH | 0,06 | 0,04 | 0,03 | 0,02 | 0,04 | 0,02 |

| PANEL B | Dependent variable: n | | | | | |
|---|---|---|---|---|---|---|
| | OLS | | Log-OLS | | Poisson | |
| | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| a | 0,12 | 0,04 | 0,08 | 0,03 | 0,08 | 0,03 |
| INCOME | 0,02 | 6,7E-03 | 0,01 | 4,1E-03 | 0,01 | 4,1E-03 |
| INCOMESQ | -4,5E-04 | 2,0E-04 | -2,9E-04 | 1,2E-04 | -2,8E-04 | 1,3E-04 |
| AGE | 0,02 | 0,08 | 0,01 | 0,05 | 0,05 | 0,05 |
| AGESQ | 1,9E-04 | 1,7E-03 | 2,2E-04 | 1,1E-03 | -6,8E-04 | 1,0E-03 |
| SEX | 0,08 | 0,04 | 0,05 | 0,02 | 0,05 | 0,02 |
| LIVCITY | 0,07 | 0,04 | 0,06 | 0,03 | 0,04 | 0,02 |
| WEST | -0,03 | 0,04 | -0,01 | 0,03 | -0,02 | 0,03 |
| EAST | -2,7E-05 | 0,06 | 9,2E-03 | 0,04 | 1,8E-03 | 0,04 |
| NORTH | 0,02 | 0,06 | 0,03 | 0,04 | 0,01 | 0,04 |
| EMP | 0,02 | 0,06 | 0,02 | 0,04 | 9,8E-03 | 0,04 |
| UNEMP | -0,02 | 0,08 | 4,0E-03 | 0,05 | -0,01 | 0,05 |
| HIGH | 0,31 | 0,10 | 0,20 | 0,06 | 0,20 | 0,06 |
| MEDIUM | 0,17 | 0,08 | 0,11 | 0,05 | 0,13 | 0,05 |
| NOHOUSEH | -0,03 | 0,06 | -0,02 | 0,04 | -0,02 | 0,04 |
| CHILDREN | 0,06 | 0,07 | 0,03 | 0,05 | 0,03 | 0,04 |
| RWEALTH | 0,13 | 0,06 | 0,08 | 0,04 | 0,07 | 0,03 |
| FWEALTH | 0,09 | 0,04 | 0,05 | 0,03 | 0,05 | 0,03 |
| LWEALTH | 0,05 | 0,04 | 0,02 | 0,03 | 0,03 | 0,03 |
| MBANK_1 | 0,21 | 0,20 | 0,12 | 0,13 | 0,14 | 0,12 |
| MBANK_2 | 0,26 | 0,20 | 0,16 | 0,13 | 0,18 | 0,12 |
| MBANK_3 | 0,38 | 0,21 | 0,23 | 0,13 | 0,25 | 0,12 |
| MBANK_4 | 0,22 | 0,20 | 0,12 | 0,13 | 0,15 | 0,12 |
| MBANK_5 | 0,39 | 0,23 | 0,20 | 0,15 | 0,25 | 0,14 |
| MBANK_6 | 0,28 | 0,23 | 0,18 | 0,14 | 0,19 | 0,13 |
| NOSBANK | -0,05 | 0,04 | -0,03 | 0,03 | -0,03 | 0,03 |
| BCHOICE | 0,11 | 0,05 | 0,07 | 0,03 | 0,07 | 0,03 |
| BLENGTH | 7,1E-03 | 0,05 | 0,01 | 0,03 | 3,6E-03 | 0,03 |
| BCLUB | 0,09 | 0,04 | 0,06 | 0,02 | 0,06 | 0,02 |
| SWBANK | -0,09 | 0,12 | -0,04 | 0,07 | -0,06 | 0,05 |

# Comments

- Determinants of multihoming:
  - Gender
  - Education
  - Income
  - Awareness ($a_i$)
    - a bank's kids club membership ≈ initial level of awareness

- A significant, robust, positive effect of $a_i$
- The effect is smallish
  - Yet, $a_i$ is the most important determinant of multihoming
  - The same as if annual income would more than double

- A problem: $a_i$ may be endogenous

  - self-selection: one wants to adopt a new payment medium and acquires info about it

  - some consumers more likely to be targets of the marketing campaigns

$\Rightarrow$ need to use instrumental variables method

i.e., we need to find variables that are only related to $n_i$ trough $a_i$.

# Instrument variables estimations

- The first set of instruments measure:
  - whether a respondent had received or had been offered a lot of information about some other banking products
- The second set of instruments measure:
  - a respondent's overall interest in banking and financial affairs
- 2SLS, Log-2SLS, GMM-Poisson

| PANEL A | Dependent variable: n | | | | | |
|---|---|---|---|---|---|---|
| | 2SLS | | Log-2SLS | | GMM-Poisso | |
| | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| a | 0,29 | 0,09 | 0,18 | 0,06 | 0,18 | 0,05 |
| INCOME | 0,02 | 6,2E-03 | 0,01 | 3,9E-03 | 0,01 | 0,00 |
| INCOMESQ | -3,2E-04 | 1,8E-04 | -2,2E-04 | 1,1E-04 | -2,0E-04 | 0,00 |
| AGE | 7,7E-02 | 0,07 | 4,9E-02 | 0,05 | 0,07 | 0,05 |
| AGESQ | -9,3E-04 | 1,6E-03 | -5,6E-04 | 1,0E-04 | -1,0E-03 | 0,00 |
| SEX | 0,10 | 0,04 | 0,06 | 0,02 | 0,07 | 0,02 |
| LIVCITY | 0,05 | 0,04 | 0,04 | 0,02 | 0,04 | 0,02 |
| WEST | -0,04 | 0,04 | -0,02 | 0,03 | -0,02 | 0,03 |
| EAST | 0,01 | 0,06 | 1,9E-02 | 0,04 | 0,02 | 0,04 |
| NORTH | 0,03 | 0,06 | 0,03 | 0,04 | 0,02 | 0,03 |
| EMP | 0,03 | 0,06 | 0,02 | 0,07 | 0,02 | 0,04 |
| UNEMP | 0,02 | 0,08 | -1,8E-02 | 0,05 | -0,02 | 0,05 |
| HIGH | 0,25 | 0,09 | 0,16 | 0,06 | 0,18 | 0,06 |
| MEDIUM | 0,12 | 0,07 | 0,08 | 0,05 | 0,09 | 0,05 |
| NOHOUSEH | -0,02 | 0,05 | -0,01 | 0,03 | -0,01 | 0,04 |
| CHILDREN | 0,04 | 0,07 | 0,02 | 0,04 | 0,02 | 0,04 |
| RWEALTH | 0,10 | 0,06 | 0,07 | 0,03 | 0,06 | 0,03 |
| FWEALTH | 0,12 | 0,04 | 0,07 | 0,02 | 0,08 | 0,03 |
| LWEALTH | 0,06 | 0,04 | 0,03 | 0,02 | 0,03 | 0,03 |

| PANEL B | Dependent variable: n | | | | | |
|---|---|---|---|---|---|---|
| | 2SLS | | Log-2SL | | GMM-Poiss | |
| | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| a | 0,30 | 0,09 | 0,19 | 0,05 | 0,19 | 0,05 |
| INCOME | 0,02 | 6,2E-03 | 0,01 | 3,9E-03 | 0,01 | 3,9E-03 |
| INCOMESQ | -3,1E-04 | 1,8E-04 | -2,0E-04 | 1,0E-04 | -2,0E-04 | 1,0E-04 |
| AGE | 7,6E-02 | 0,07 | 4,7E-02 | 0,05 | 0,07 | 0,05 |
| AGESQ | -9,0E-03 | 1,6E-03 | -5,0E-04 | 1,0E-03 | -1,0E-03 | 1,0E-03 |
| SEX | 0,10 | 0,04 | 0,07 | 0,02 | 0,07 | 0,02 |
| LIVCITY | 0,0529 | 0,04 | 0,04 | 0,02 | 0,04 | 0,02 |
| WEST | -0,42 | 0,04 | -0,02 | 0,03 | -0,01 | 0,03 |
| EAST | 0,01 | 0,06 | 1,9E-02 | 0,04 | 0,02 | 0,04 |
| NORTH | 0,03 | 0,06 | 0,03 | 0,04 | 0,02 | 0,03 |
| EMP | 0,02 | 0,06 | 0,02 | 0,04 | 0,01 | 0,04 |
| UNEMP | -0,05 | 0,08 | -1,8E-02 | 0,05 | -0,02 | 0,05 |
| HIGH | 0,25 | 0,09 | 0,16 | 0,06 | 0,17 | 0,06 |
| MEDIUM | 0,01 | 0,07 | 0,08 | 0,05 | 0,09 | 0,05 |
| NOHOUSEH | -0,02 | 0,05 | -0,01 | 0,03 | -0,01 | 0,04 |
| CHILDREN | 0,04 | 0,07 | 0,02 | 0,04 | 0,02 | 0,04 |
| RWEALTH | 0,01 | 0,06 | 0,07 | 0,03 | 0,06 | 0,03 |
| FWEALTH | 0,01 | 0,04 | 0,07 | 0,02 | 0,08 | 0,02 |
| LWEALTH | 0,06 | 0,04 | 0,02 | 0,03 | 0,03 | 0,03 |

# Comments

- A significant, robust, positive effect of $a_i$
- The effect is more than twice as large as previously!

  $\Rightarrow$ Not controlling for endogeneity biases estimates downwards

- The result is even more robust than previously

# 6. Policy implications

- Increasing awareness will increase consumer multihoming
  - increases adoption and use of new payment media
  - intensifies issuer competition over merchants

# Future work

- How to increase awareness?
  - Informative vs persuasive advertising?
  - “Channel factors”
- Whom to target?
  - Are poor in a disadvantageous position?