
Consumer Awareness and the Use of Payment Media: Evidence from Young Finnish Consumers

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Introduction

- Monetary history is full of examples where new payment media have taken off only slowly -- if at all
 - Most of the major payment innovations have been used over an extensive period of time in chorus with the previously established payment media
 - Recent example: Debit card, which has only recently become important
 - U.S.
 - See, e.g., Borzekowski, Kiser, Ahmed -06, Klee -06
 - Europe (+ elsewhere)
 - See, e.g., Amronin and Chakravorti -07
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This paper

- Why do some consumers use only one payment medium, while others use many?
 - This behaviour reflects, at least in part, the diffusion of new payment media
 - Holding acceptance constant (merchant-side), issuers / policy-makers have two primary instruments to enhance consumer usage of modern payment media
 - Pricing
 - Information provision
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- Pricing:
 - "apparently very elastic", "strong consumer response"
 - Humphrey, Kim and Vale -01: Semi-annual time-series data from Norway (two banking groups)
 - Borzekowski, Kiser, and Ahmed -06: Special module of the Michigan Surveys of Consumers
 - Amromin, Jankowski and Porter -05: Asymmetric pricing / toll payments
 - Zinman -06: 2001 Survey of Consumer Finances (debit vs. credit)
 - see also:
 - Bolt, Humphrey and Uittenbogaard -06: Aggregate time-series data from Norway and Netherlands
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- Information
 - IO: Information provision fosters the diffusion of new products
 - Finance: Awareness important for stock market participation
 - E.g., Guiso and Japelli -05
 - But: How important is information (awareness) for consumer participation in the market for payment media?
 - No systematic evidence
 - Informed conjectures:
 - Awareness and education => acceptance of stored value cards (Chakravorti -04)
 - Visa's massive advertisement campaigns => rise of debit cards in the U.S. (Evans and Scmalensee -05)
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Other related literature (point-of-sale paying)

- Rate of adoption / choice of payment media
 - varies with consumer demographics, income and wealth (heterogeneity)
 - Carow and Staten -99, Stavins -01, Mester -03
 - depends on merchant acceptance
 - Rysman -07: localized feedback loops between consumers and merchants matter
 - is affected by the characteristics of retail transactions
 - Klee -06 (time), Hayashi and Klee -03
 - See also:
 - Borzekowski and Kiser -06 (discrete choice), Fusaro -07
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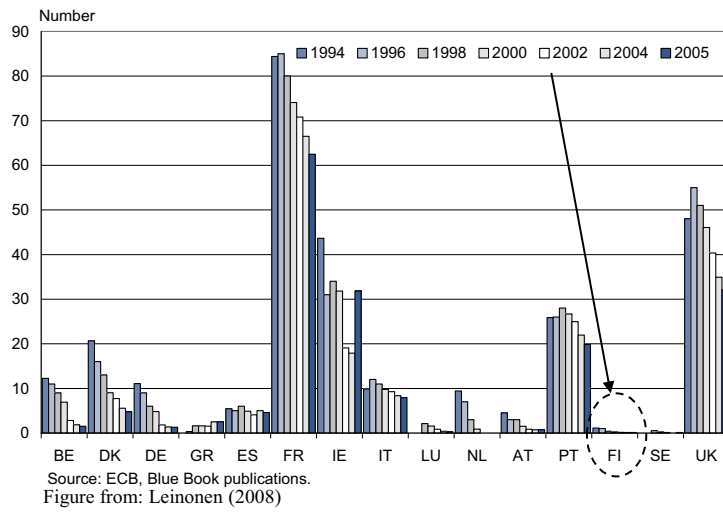
European vs. Finnish vs. US payment system 1/2

- The Finnish market for payment media is (used to be?) relatively advanced
 - Checks disappeared (from consumer usage) already by the early 1990s
 - Use of cash has been decreasing for some time
 - The ratio of cash in circulation to GDP has for long been among the lowest in the world
 - In 1996: about 2.1%
 - In 2002: about 1.8% (our survey year)
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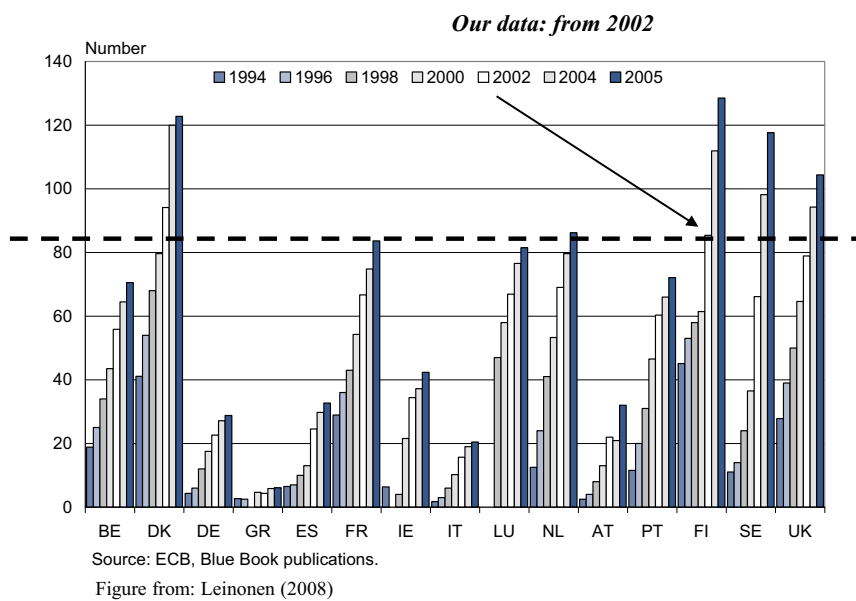
European vs. Finnish vs. US payment system 2/2

- The shift towards wider use of debit cards occurred early
 - Started in the 1980s,
 - In 1991, ~30 transactions per capita
 - By 2002, they accounted for 2/3 of the value of all card payments
 - Rate of merchant-participation high (both for debit and credit cards)
 - Signature and PIN
 - See also Figures a)-c)
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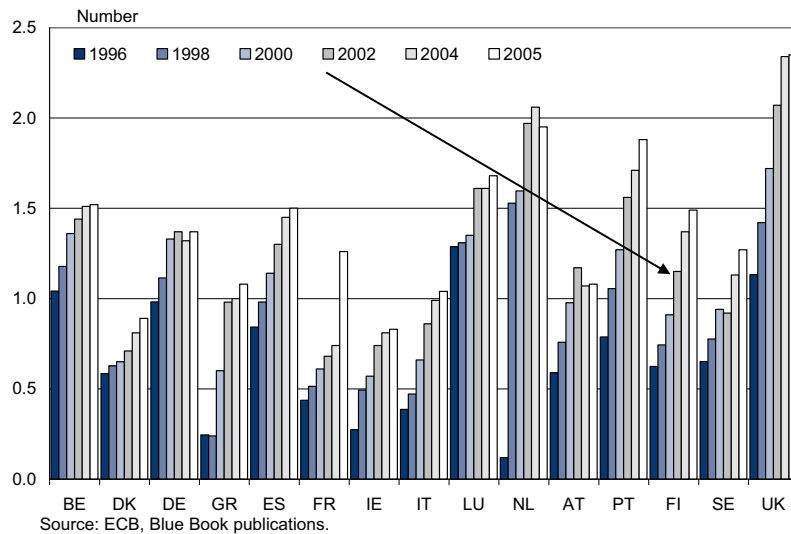
a) Number of cheques per inhabitant



b) Number of card payments per inhabitant



c) Number of payment cards per inhabitant



Data – Overview of survey

- Data based on a survey
 - conducted regularly by the Finnish Bankers' Association
 - primary aim:
 - Collect data on the consumption/payment habits of the Finnish young + their views about banking services
 - Date of survey (available to us):
 - February-March, 2002
 - Based on a random sample
 - 1004 young adults ($\approx 1/900$ of total population)
 - aged between 15-28
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Data - Two specific observations

- Credit cards
 - used rarely for borrowing (by the Finnish young)
 - 37% of the young have an outstanding credit balance
 - only 5% due to credit card borrowing
 - used mostly for point-of-sale transactions abroad
 - card balance is typically paid in full by the due date
 - almost no rewards for using credit cards
 - Pricing of payment media
 - Concentrated banking sector, issuers = main deposit banks
 - Banking service packages are free for the young (until 26)
 - Include ATM card or debit card
 - Surcharge (price discrimination) allowed, but very rarely used
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Data - Measuring payment media use

- Three detailed questions on payment media use:

Q1: *What is the most typical way you pay for your purchases or consumption of services? i) cash, ii) debit card, iii) combined debit-credit card, iv) credit card, v) debit or credit card issued by a retailer, vi) Visa Electron, vii) stored value card, viii) GSM or WAP phone, ix) by other means, how? (specify);*

Q2: *What about the second most typical way? Is it i) cash, ii) debit card, iii) combined debit-credit card, iv) credit card, v) debit or credit card issued by a retailer, vi) Visa Electron, vii) stored value card, viii) GSM or WAP phone, ix) by other means, how? (specify), x) there is no second way;*

Q3: *Is there yet another way you pay for your purchases or consumption of services? If yes, is it i) cash, ii) debit card, iii) combined debit-credit card, iv) credit card, v) debit or credit card issued by a retailer, vi) Visa Electron, vii) stored value card, viii) GSM or WAP phone, ix) by other means, how? (specify), x) there are no additional ways.*

Data – Main dependent variables

- Count variable
 - n_i = the number of different payment media consumer i uses, based on Q1-Q3
 - Mean of n_i = 1.6
 - Min = 1
 - Max = 3
 - Note: One answer recoded from 4 to 3.
 - Dummy variable
 - $USEMANY_i = 1$ if $n_i > 1$ and $= 0$ if $n_i = 1$
 - Mean of $USEMANY_i = 0.53$
-

Data – Measuring consumer awareness

- Not clear how to measure consumer awareness
 - Proxy: Series of questions that reflect how much consumer i has been offered information about payment media => awareness indicator (a_i)
 - Definition of a_i
 - = 1 if consumer i answered that she had either received or had been offered *a lot of* information about (a) debit or credit cards, (b) ways of paying bills, (c) use of transaction accounts, or (d) borrowing through credit cards
 - = 0 otherwise
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Data – Main independent variable

- Awareness indicator
 - Rationale:
 - Awareness of the existence and characteristics of payment media is directly related to the amount of information a consumer has been offered about them
 - Proxy related to systematic and unsystematic forms of information provision by the various issuers of payment media
 - Mean of $a_i = 0.70$
 - Imperfect measure:
 - Use an alternative proxy
 - If awareness measured imperfectly => measurement error
 - Results robust to using instrumental variables -methods
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Data – Other independent variables (controls)

- Two sets of control variables:
 - Demographics + income/wealth
 - Gender, age, age², employment status, level of education, household type, type of family, residential area (city or not), geographic region of residence, income, income², type of wealth owned (real, financial, liquid)
 - Bank relationship
 - Identity of a consumer's main bank, use of other banks, choice of the main bank, duration of the relationship with the main bank, membership in the main bank's youth club, recent switch of main bank
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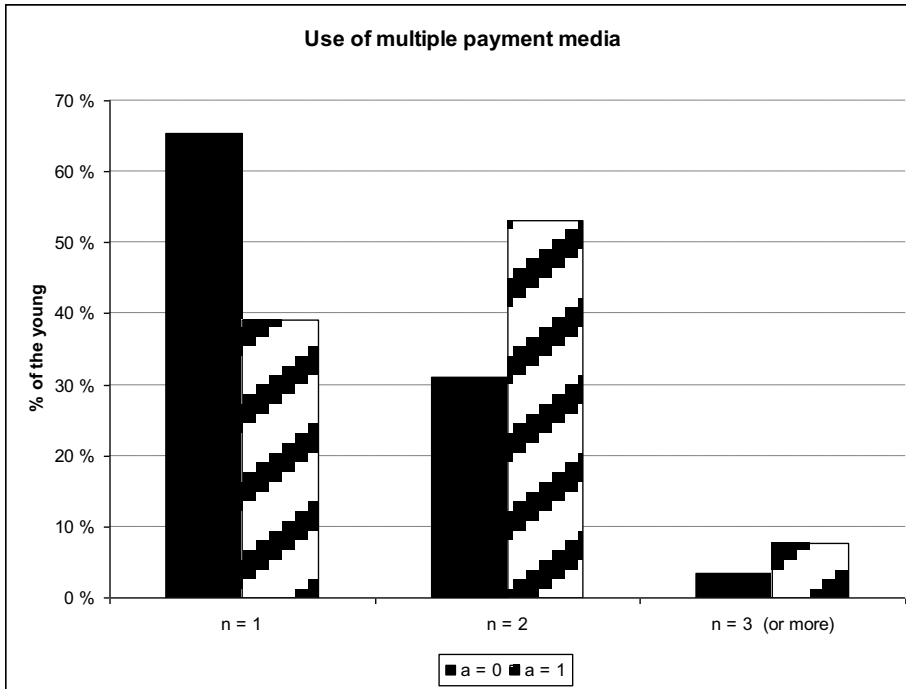
Data – Descriptive statistics 1/2

	Obs	Mean	Std. Dev.	Min	Max
<i>n</i>	946	1.59	0.61	1	3
<i>USEMANY</i>	946	0.53	0.50	0	1
<i>a</i>	946	0.70	0.46	0	1
<i>INCOME</i>	946	8.14	9.64	0	37.80
<i>AGE</i>	946	21.22	3.99	15	28
<i>SEX</i>	946	0.51	0.50	0	1
<i>LIVCITY</i>	946	0.48	0.50	0	1
<i>WEST</i>	946	0.38	0.48	0	1
<i>EAST</i>	946	0.12	0.33	0	1
<i>NORTH</i>	946	0.13	0.34	0	1
<i>EMP</i>	946	0.32	0.47	0	1
<i>UNEMP</i>	946	0.07	0.25	0	1
<i>HIGH</i>	946	0.28	0.45	0	1
<i>MEDIUM</i>	946	0.62	0.49	0	1
<i>NOHOUSEH</i>	946	0.44	0.50	0	1

Data – Descriptive statistics 2/2

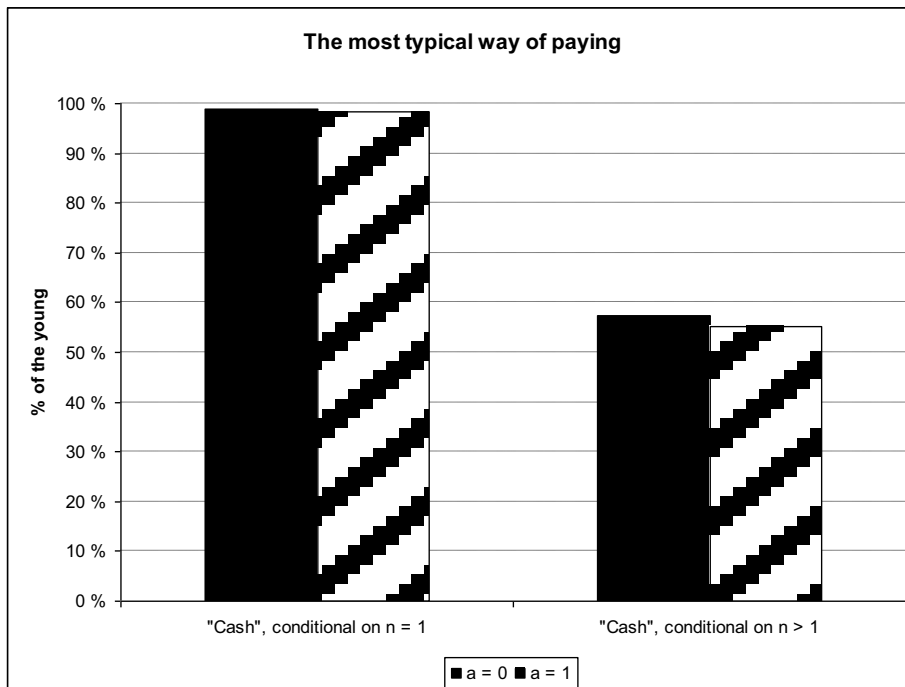
	Obs	Mean	Std. Dev.	Min	Max
<i>CHILDREN</i>	946	0.09	0.28	0	1
<i>RWEALTH</i>	946	0.14	0.35	0	1
<i>FWEALTH</i>	946	0.27	0.44	0	1
<i>LWEALTH</i>	946	0.25	0.44	0	1
<i>MBANK_1</i>	946	0.33	0.47	0	1
<i>MBANK_2</i>	946	0.39	0.49	0	1
<i>MBANK_3</i>	946	0.06	0.23	0	1
<i>MBANK_4</i>	946	0.15	0.36	0	1
<i>MBANK_5</i>	946	0.02	0.14	0	1
<i>MBANK_6</i>	946	0.03	0.17	0	1
<i>NOSBANK</i>	946	0.74	0.44	0	1
<i>BCHOICE</i>	931	0.36	0.48	0	1
<i>BLENGTH</i>	849	0.64	0.48	0	1
<i>BCLUB</i>	937	0.57	0.50	0	1
<i>SWBANK</i>	934	0.03	0.16	0	1

Univariate analysis – Figure 1



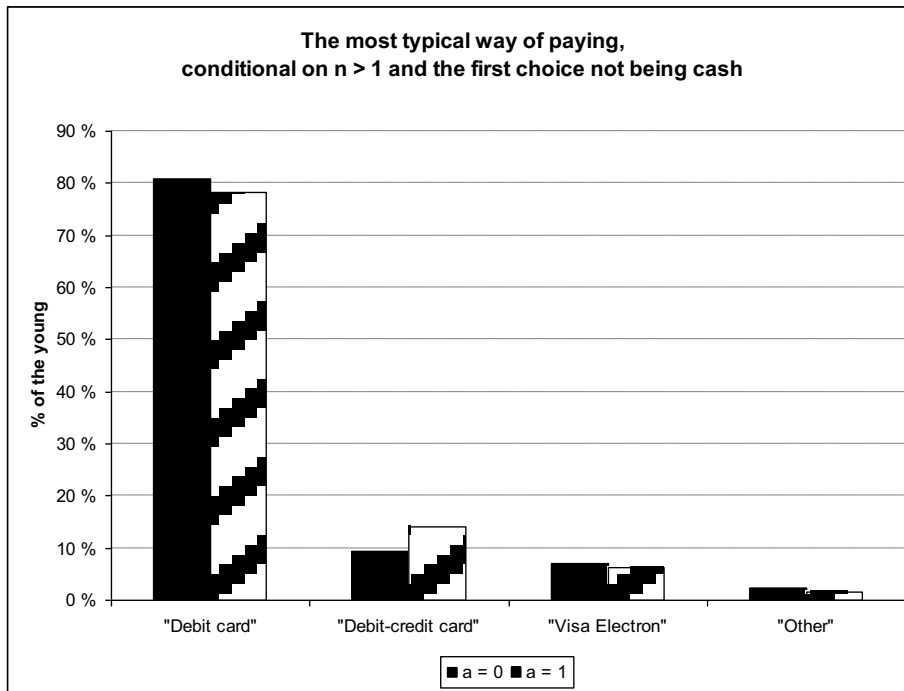
Pearson's χ^2 -test for independence = 55.75 (d.f. = 2) => The null hypothesis of independence rejected at the 1% level

Univariate analysis – Figure 2



Pearson's χ^2 -test for independence => The null hypothesis of independence **not** rejected

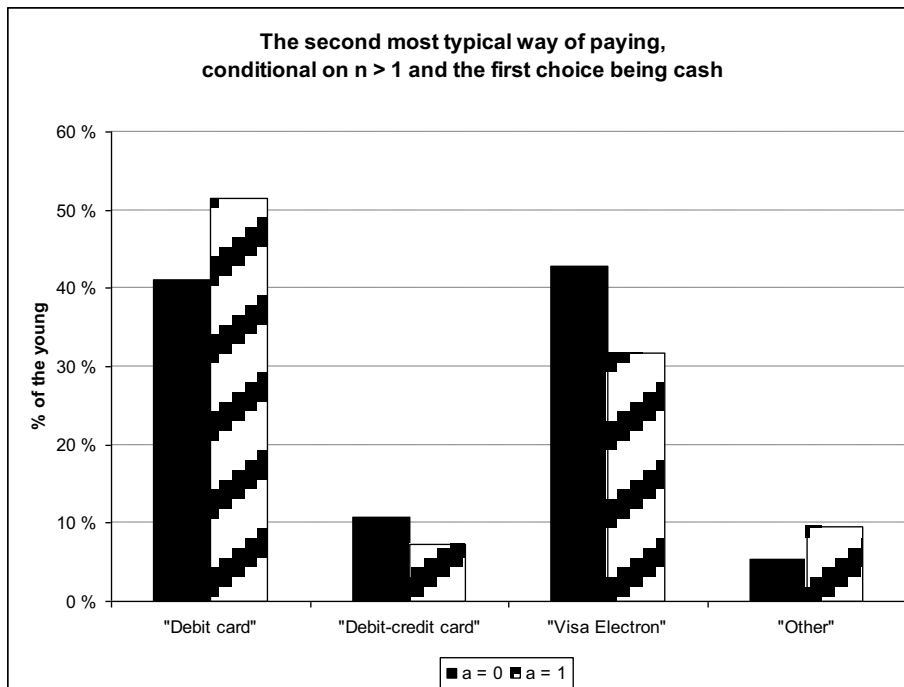
Univariate analysis – Figure 3A



Pearson's χ^2 -test for independence \Rightarrow
The null hypothesis of independence **not** rejected

Note: In domestic point-of-sale paying, Visa electron very similar to a debit card

Univariate analysis – Figure 3B



Pearson's χ^2 -test for independence \Rightarrow
The null hypothesis of independence **not** rejected

Univariate analysis - summary

- Use of multiple payment media is closely related to the decision to use debit card in addition to cash
 - *A priori*, this was not known
 - Awareness is associated with the use of multiple payment media
 - No straightforward link from awareness to debit use:
 - Those with $n_i = 1$ use cash irrespective of their awareness
 - Awareness induces a shift towards $n_i > 1$
 - but the shift means that some begin to use debit as their *primary* method of paying, whereas the others begin to use it as their *secondary* method.
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Regression (exogenous a_i) - Methods

- Quantitative impact:
 - How much does awareness increase the probability that a young consumer uses multiple payment media?
 - How much does awareness increase the use of "plastic"
 - Use three methods (assuming a_i is exogenous):
 - For $Y = n$
 - Quasi-maximum likelihood Poisson
 - Ordered Probit
 - For $Y = \text{USEMANY}$
 - Probit
-

Regression (exogenous a_i) – Results (Panel A)

PANEL A	$Y = n$		$Y = n$		$Y = USEMANY$	
	Ordered Probit		Poisson		Probit	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
a	0.37	0.10 ***	0.09	0.02 ***	0.42	0.10 ***
<i>INCOME</i>	0.04	0.01 ***	0.01	3.9E-03 ***	0.04	0.02 ***
<i>INCOMESQ</i>	-8.0E-04	4.7E-04 *	-2.2E-04	1.2E-04 *	-1.1E-03	5.2E-04 **
<i>AGE</i>	0.38	0.18 **	0.11	0.04 **	0.18	0.20
<i>AGESQ</i>	-0.01	3.8E-03 *	-1.8E-03	9.5E-04 *	-1.7E-03	4.4E-03
<i>SEX</i>	0.24	0.09 ***	0.06	0.02 ***	0.30	0.10 ***
<i>LIVCITY</i>	0.11	0.09	0.03	0.02	0.24	0.10 **
<i>WEST</i>	-0.11	0.10	-0.03	0.03	-0.02	0.11
<i>EAST</i>	0.07	0.14	0.02	0.04	0.20	0.16
<i>NORTH</i>	0.03	0.13	0.01	0.03	0.15	0.15
<i>EMP</i>	0.03	0.14	5.7E-03	0.04	0.11	0.16
<i>UNEMP</i>	-0.07	0.17	-0.02	0.05	0.06	0.20
<i>HIGH</i>	0.77	0.25 ***	0.17	0.06 ***	0.86	0.27 ***
<i>MEDIUM</i>	0.50	0.22 **	0.10	0.05 **	0.53	0.22 **
<i>NOHOUSEH</i>	-0.05	0.13	-0.01	0.03	-0.01	0.13
<i>CHILDREN</i>	0.08	0.15	0.02	0.04	0.04	0.19
<i>RWEALTH</i>	0.21	0.13 *	0.06	0.03 *	0.32	0.16 **
<i>FWEALTH</i>	0.30	0.10 ***	0.08	0.02 ***	0.28	0.11 **
<i>LWEALTH</i>	0.15	0.10	0.04	0.02	0.06	0.11
Observations	946		946		946	
Log pseudo-likelihood	-670.75		-1185.76		-489.08	
Pseudo R ²	0.20		0.03		0.25	

Prob[USEMANY = 1 / $a = 1$] –
 Prob[USEMANY = 1 / $a = 0$]
 ≈ 56.6%-44.0%
 i.e. 12.6 percentage points
 Recall: Mean of USEMANY =
 0.53

Note 1: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level
 Note 2: Standard errors based on the robust Huber-White covariance matrix

Regression (exogenous a_i) – Results (Panel B)

PANEL B	$Y = n$		$Y = n$		$Y = USEMANY$	
	Ordered-Probit		Poisson		Probit	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
a	0.33	0.10 ***	0.08	0.03 ***	0.36	0.11 ***
<i>INCOME</i>	0.04	0.02 ***	0.01	4.1E-03 ***	0.05	0.02 *
<i>INCOMESQ</i>	0.00	0.00 **	-2.8E-04	1.3E-04 **	-1.3E-03	5.8E-04 *
<i>AGE</i>	0.16	0.19	0.05	0.05	-0.06	0.21
<i>AGESQ</i>	0.00	0.00	-6.8E-04	1.0E-03	0.00	0.00
<i>SEX</i>	0.20	0.09 **	0.05	0.02 **	0.23	0.11 *
<i>LIVCITY</i>	0.16	0.10 *	0.04	0.02 *	0.32	0.11 ***
<i>WEST</i>	-0.08	0.10	-0.02	0.03	-0.01	0.12
<i>EAST</i>	0.00	0.14	1.8E-03	0.04	0.10	0.17
<i>NORTH</i>	0.04	0.15	0.01	0.04	0.16	0.17
<i>EMP</i>	0.05	0.15	9.8E-03	0.04	0.13	0.17
<i>UNEMP</i>	-0.03	0.19	-0.01	0.05	0.12	0.22
<i>HIGH</i>	0.87	0.27 ***	0.20	0.06 ***	0.99	0.29 ***
<i>MEDIUM</i>	0.57	0.23 **	0.13	0.05 **	0.65	0.24 ***
<i>NOHOUSEH</i>	-0.07	0.14	-0.02	0.04	-0.01	0.14
<i>CHILDREN</i>	0.13	0.17	0.03	0.04	0.16	0.21
<i>RWEALTH</i>	0.26	0.13 **	0.07	0.03 **	0.39	0.16 *
<i>FWEALTH</i>	0.21	0.10 **	0.05	0.03 **	0.20	0.12 *
<i>LWEALTH</i>	0.13	0.10	0.03	0.03	0.02	0.12

Regression (exogenous a_i) – Results (Panel B)

<i>MBANK_1</i>	0.64	0.47	0.14	0.12	0.53	0.54
<i>MBANK_2</i>	0.77	0.47	0.18	0.12	0.73	0.54
<i>MBANK_3</i>	1.05	0.50 **	0.25	0.12 **	1.10	0.57 *
<i>MBANK_4</i>	0.66	0.48	0.15	0.12	0.49	0.55
<i>MBANK_5</i>	1.05	0.56 *	0.25	0.14 *	0.60	0.59
<i>MBANK_6</i>	0.83	0.54	0.19	0.13	0.88	0.62
<i>NOSBANK</i>	-0.12	0.10	-0.03	0.03	-0.06	0.12
<i>BCHOICE</i>	0.25	0.11 **	0.07	0.03 **	0.29	0.13 *
<i>BLENGTH</i>	0.00	0.11	3.6E-03	0.03	0.11	0.13
<i>BCLUB</i>	0.24	0.09 ***	0.06	0.02 ***	0.29	0.10 ***
<i>SWBANK</i>	-0.24	0.21	-0.06	0.05	0.14	0.29
Observations	840		840		840	
Log pseudo-likelihood	-599.23		-1059.55		-430.73	
Pseudo R ²	0.20		0.03		0.25	

Note 1: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level
Note 2: Standard errors based on the robust Huber-White covariance matrix

Regression (exogenous a_i) - Robustness

- Rob. test #1: Add new controls
 - Has currently outstanding debt; Uses Internet frequently; 7 dummies for planned consumption (proxy for consumption habits)
 - Rob. test #2: Pricing
 - Banking services cease to be free at age of 26 (=> special dummy for this)
 - Rob. test #3: Alternative proxy for a_i
 - "No need for further information"
 - Rob. test #4: $\text{Log}(n_i) + \text{OLS}$
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Regression (endogenous a_i) – Endogeneity?

- Two main sources of endogeneity:
 - Endogeneity due to marketing strategies of issuers
 - E.g. Some consumers more likely to be a target of (informative) advertising campaigns
 - May be related to the unobserved (to us) propensity to use multiple payment media
 - Endogeneity due to awareness being a consumer's choice variable ("self-selection")
 - E.g. Willingness to learn about payment media may be related to one's propensity to use many of them
 - Signing the direction of the bias difficult a priori
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Regression (endogenous a_i) – Methods

- Use two methods:
 1. Count regression with an endogenous treatment effect
 - Mullahy -97, Windmeijer and Santos Silva -97
 - $Y = n_i$ (count-variable)
 - Method of estimation: GMM
 2. Recursive bivariate Probit
 - See, e.g., Greene -08
 - Two equation model:
 - Equation 1: $Y = a_i$
 - Equation 2: $Y = USEMANY$
 - with a_i as an endog. regressor
 - Residual correlation allowed
 - Method of estimation: Maximum likelihood
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Regression (endogenous a_i) – Two sets of IVs

- The first IV set: Two indicators that capture whether a respondent had received or had been offered a lot of information about banking products *other than* those related to payment media:
 - INFO_F = 1 if the information was about housing loans, student loans, term deposits, or investing in stocks, mutual funds, etc., and = 0 otherwise.
 - INFO_M = 1 if the information was about using banking services via the Internet or via mobile phone, and = 0 otherwise.
 - Instrument validity:
 - Relevant: determine consumer awareness (joint provision of information)
 - Exogenous: no *direct* effect on a consumer's propensity to use multiple payment media
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- The second IV set:
 - FIN_FO = 1, if consumer i follows regularly banking and financial news in media and = 0 otherwise
 - FIN_IM = 1, if consumer i finds it important to be literate in banking and financial issues and = 0 otherwise
 - FIN_IN = 1, if consumer i is interested to learn more about banking and banking services, and = 0 otherwise
 - Instrument validity:
 - Relevant: if overall interest in banking determines a consumer's awareness about payment media
 - Exogenous: if the overall interest has no *direct* impact on use multiple payment media (conditional on controls)
 - Tests
 - F-test statistic for “weak instruments” (Steiger and Stock 1997)
 - Over-identification test
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Regression (endogenous a_i) – Results

	Y = n		Y = USEMANY	
	GMM-Poisson		Bivariate-probit	
	Coef.	Std. Err.	Coef.	Std. Err.
a	0,18	0,05 ***	0,77	0,22 ***
INCOME	0,01	3,9E-03 **	0,04	0,02 *
INCOMESQ	-2,0E-04	1,0E-04 *	-1,0E-03	5,3E-04 *
AGE	0,07	0,05	0,10	0,20
AGESQ	-1,0E-03	1,0E-03	-1,4E-04	4,5E-03
SEX	0,07	0,02 ***	0,30	0,10 ***
LIVCITY	0,04	0,02 *	0,24	0,10 *
WEST	-0,02	0,03	-0,01	0,11
EAST	0,02	0,04	0,17	0,16
NORTH	0,02	0,03	0,18	0,15
EMP	0,02	0,04	0,11	0,16
UNEMP	-0,02	0,05	0,02	0,20
HIGH	0,18	0,06 ***	0,83	0,27 ***
MEDIUM	0,09	0,05 **	0,53	0,22 *
NOHOUSEH	-0,01	0,04	0,01	0,13
CHILDREN	0,02	0,04	0,02	0,19
RWEALTH	0,06	0,03 *	0,31	0,15 *
FWEALTH	0,08	0,03 ***	0,26	0,11 *
LWEALTH	0,03	0,03	0,05	0,11
Instruments:	INFO_F, INFO_M		INFO_F, INFO_M	
Observations	942		942	
Log pseudo-likelihood			-920,99	
Over-identification test (p-value)	0,88			

- Here: Instruments INFO_F ja INFO_M
- Consumer awareness significant and positive
- Sargan's overidentification test does not reject the null hypothesis of instrument exogeneity
- F-test for weak instruments > 10

Regression (endogenous a_i) – Results

	Y = n		Y = USEMANY	
	GMM-Poisson		Bivariate-probit	
	Coef.	Std. Err.	Coef.	Std. Err.
a	0,19	0,05 ***	0,77	0,22 ***
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INCOMESQ	-2,0E-04	1,0E-04	-1,0E-03	5,3E-04 *
AGE	0,07	0,05	0,10	0,20
AGESQ	-1,0E-03	1,0E-03	-1,4E-04	4,5E-03
SEX	0,07	0,02 ***	0,30	0,10 ***
LIVCITY	0,04	0,02 *	0,24	0,10 *
WEST	-0,01	0,03	-0,01	0,11
EAST	0,02	0,04	0,17	0,16
NORTH	0,02	0,03	0,18	0,15
EMP	0,01	0,04	0,11	0,16
UNEMP	-0,02	0,05	0,02	0,20
HIGH	0,17	0,06 ***	0,83	0,27 ***
MEDIUM	0,09	0,05 **	0,53	0,22 *
NOHOUSEH	-0,01	0,04	0,01	0,13
CHILDREN	0,02	0,04	0,02	0,19
RWEALTH	0,06	0,03 *	0,31	0,15 *
FWEALTH	0,08	0,02 ***	0,26	0,11 *
LWEALTH	0,03	0,03	0,05	0,11
Instruments:	INFO_F, INFO_M, FIN_FO, FIN_IM, FIN_IN		INFO_F, INFO_M, FIN_FO, FIN_IM, FIN_IN	
Observations	942		942	
Log pseudo-likelihood			-916,49	
Over-identification test (p-value)	0,12			

- Here: Full list of instruments
- Results nearly identical
- Instrument validity
- $\text{Prob}[\text{USEMANY} = 1 / a = 1] \text{ minus } \text{Prob}[\text{USEMANY} = 1 / a = 0]$
= 23.9 percentage points (a clear increase)

Regression (endogenous a_i) – Robustness

- Rob. test #1:
 - Alternative proxy for a_i
 - Rob. test #2:
 - Longer vector of control variables
 - Rob. test #3:
 - Use as IVs only {INFO_FO, INFO_IM, INFO_IN}
 - Rob. test #4:
 - $\log(n_i)$ and 2SLS
-

Conclusions 1/3

- Awareness is associated with the use of multiple payment media
 - Use of multiple payment media is closely related to the decision to use debit card in addition to cash
 - But: No straightforward link from awareness to debit use:
 - Those with $n_i = 1$ use cash irrespective of their awareness
 - Awareness induces a shift towards $n_i > 1$, but the shift means that some begin to use debit as their *primary* method of paying, whereas the others begin to use it as their *secondary* method
-

Conclusions 2/3

- The effect of awareness on the probability of using multiple payment media is quantitatively large
 - $\text{Prob}[\text{USEMANY} = 1 / a = 1] \text{ minus } \text{Prob}[\text{USEMANY} = 1 / a = 0]$
 - 12.6 percentage points (assuming exogenous a_i)
 - 23.9 percentage points (allowing for endogenous a_i)
 - Recall: Mean of USEMANY = 0.53
-

Conclusions 3/3

- Limited market participation in the market for modern payment media
 - Increasing consumer awareness is a means to enhance participation, i.e. the use of modern payment media
 - Quite like elsewhere in the financial system (?)
 - Compare to: Awareness and limited market participation in stock markets (Guiso and Japelli -05)
 - Implications for
 - models which predict that multihoming is important?
 - how to increase multihoming?
 - diffusion of electronic money and mobile payments?
 - Next on research agenda?
 - persuasive vs. informative advertising (Ackerberg -01)?
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