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Consumer awareness and the use of payment media: evidence from young Finnish consumers

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Abstract

In the market for payment media, some consumers use only one medium when paying for their point-of-sale transactions, while others use many. This pattern reflects the diffusion of new payment media, because a payment method innovation is typically first used simultaneously with the established methods. We study the use of multiple payment media by employing data on young Finnish consumers. We find that the use of multiple payment media is directly related to consumer awareness and that not controlling for the endogeneity of awareness can bias its effect downwards. These results suggest that increasing consumer awareness may have been underlying the rise of debit card use around the world. It could also speed up the adoption of new means of payment, such electronic money and mobile payments. To the extent that antitrust concerns in the market for payment media stem from the lack of information, improving consumer awareness could be a remedy.

Maksutapoja koskeva informaatio ja maksutapojen käyttö Suomessa

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Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Jotkut kuluttajat käyttävät vain yhtä tapaa ostoksiensa maksamiseen, toiset taas useampia. Tällainen käyttäytyminen heijastaa uusien maksutapojen leviämistä, koska yleensä uusia maksutapoja käytetään ensin samanaikaisesti perinteisempien maksutapojen kanssa. Tässä tutkimuksessa tarkastellaan uusien maksutapojen leviämiseen vaikuttavia tekijöitä nuoria suomalaisia koskevan aineiston avulla. Kuluttajien saama informaatio uusista maksutavoista on tutkimuksen mukaan yksi maksutapojen leviämisen keskeinen selittäjä. Tavallisesti maksutapojen käyttöä selittävät esimerkiksi koulutus ja tulotaso, mutta tämän tutkimuksen mukaan ne ovat vähemmän tärkeitä. Naiset käyttävät merkittävästi useampia maksutapoja kuin miehet. Tulokset viittaavat siihen, että kuluttajien tietoisuuden kohentaminen voisi merkittävästi nopeuttaa uusien maksutapojen, kuten sähköisen rahan ja mobiilimaksamisen, leviämistä. Kuluttajien tietoisuuden parantaminen saattaisi myös vähentää kilpailuongelmia maksuvälinemarkkinoilla.

Avainsanat: maksuvälineet, kuluttajien tietoisuus, uuden teknologian käyttöönotto rahoituspalvelusektorilla

JEL-luokittelu: G200, E590

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1 Introduction

The technological breakthroughs and regulatory reforms of the past decades have brought payment media to the forefront of business, social and political interest. Spreading of debit and credit cards has thoroughly changed the way people pay for good and services (see, eg Humphrey, 2004, Klee, 2006a, and Amromin and Chakravorti, 2007). New payment instruments, such as smart cards and those embedded in mobile phones, are entering commercial use and making money more digital and less tangible. The new payment media also hold a promise to enhance the access of the poorest to basic financial services, especially in developing countries. But the development is not free of concerns. As money has become less tangible, consumer protection authorities worry that people spend and borrow too much, whereas central banks worry that the traditional instruments of monetary policy become obsolete. The increased concentration of payment card industry has alarmed competition policy authorities, who have begun to scrutinize card platforms' practices (see, eg Hunt, 2003, and Evans and Schmalensee, 2005, chapter 12).

Whether and how benefits and concerns from digitalization of money materialize depend on the diffusion of new payment media. Monetary history is full of examples where new payment media have taken off only slowly if not at all. It is not well understood what hampers the adoption of these financial innovations, notably because of a lack of systematic evidence.[1] It can be hard to obtain consumer-level data on early adopters of emerging payment media. In this paper we take advantage of a special feature of the payment media market that some consumers only use one medium, while others use simultaneously many. Such payment behavior essentially reflects the diffusion of new payment media, because even the most recent major innovations, coins, checks, paper money, and the payment card, have long been used in chorus with the previously established payment media (Evans and Schmalensee, 2005).[2]

We focus on the role of consumer awareness in the use of multiple payment media. Previous research has shown that the rate of adoption of new payment methods varies with consumer demographic and financial characteristics such as age, education, income and home-ownership status (eg Carow and Staten, 1999, Mantel, 2000, Stavins, 2001, and Mester, 2003) and that localized feedback loops between consumers and merchants matter (Rysman, 2007). Holding consumer

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[1] See Frame and White (2004) for a review of the scant empirical literature on financial innovations and their diffusion.
[2] This is one indication of sluggish diffusion of new payment media innovations. For example, payment cards were introduced in the 1950s, but only over the past two decades they have begun to replace checks and, to lesser extend, cash (see, eg Humphrey, 2004, and Amromin and Chakravorti, 2007). Similarly, while mobile and smart money are (finally) spreading, the slow pace of change has been considered puzzling.

characteristics and merchant acceptance constant, pricing and information provision are the main instruments that policy makers and issuers can adopt to boost consumer use of modern payment media. While there is growing evidence that consumers react strongly to explicit pricing of paying (Humphrey, Kim and Vale, 2001, and Borzekowski, Kiser and Ahmed, 2006), the quantitative importance of consumer awareness in the market for payment media is not known. Nor do we know much about how sensitive consumers' payment behavior is to information provision about payment media.

The available evidence on the importance of consumer awareness in the market for payment media is either indirect or qualitative: Chakravorti (2004) argues that awareness is needed for wide-spread acceptance of stored value cards. Evans and Schmalensee (2005) conjecture that Visa's massive advertisement campaigns to foster consumer awareness of its debit products in the 1990s have contributed to the rise of signature debit in the US. Marketing and industrial economics literature suggests that providing information about any new product should foster its diffusion, especially if the adoption is held back by non-monetary costs, such as the costs arising from imperfect consumer information, and learning and searching costs. But, prior to our study, virtually no quantitative evidence exists on the effects of the information provision on the adoption of new payment media.[3]

There is a link from our study to the literature on multihoming in the market for payment media (see, eg Rochet and Tirole, 2003, 2006). In this literature, a consumer is said to be engaged in multihoming if she carries, say multiple different *brands* of credit cards, whereas we focus on the use of multiple different *methods* of payment. Our paper is also complementary to the emerging literature on the determinants of the use of one payment media versus another at the point of sale in the US (eg Carow and Staten, 1999, Borzekowski and Kiser, 2006, Klee, 2006b, Fusaro, 2007, and Zinman, 2007). This literature has begun to produce important insights on what drives the discrete choice between using 'paper or plastic' and 'debit or credit' by emphasizing the differences across various payment media and documenting how payment choice depends on the characteristics of transactions. In contrast we emphasize what drives the *number* of different payment method used and how this payment behavior depends on consumer awareness. In this respect a close paper to ours is Klee (2006a) who addresses the question of the *family's* use of multiple payment media.

To study how the use of multiple payment media and consumer awareness are related in the market for payment media we exploit some unique features of the survey data on young Finnish consumers available to us.

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[3] An important exception is Hayashi and Klee (2003), who provide related evidence by showing that the adoption of electronic payment media correlates with the adoption of other new technologies.

- The Finnish market for payment media is by international standards advanced and Finns have for long relied on an access to electronic payment networks when paying point-of-sale. Because young consumers typically show a great rate of adoption of new payment media (Carow and Staten, 1999, Mantel, 2000, Humphrey et al, 2001, Stavins, 2001, Stix, 2003), we can study how the behaviour of the most likely early adopters of new payment media is affected by information provision.
- The data contains direct measures of the point-of-sale paying habits of individual consumers. The measures allow us to generate a dependent variable at the level of individual consumers that distinguishes the point-of-sale paying from settling bills and the actual use of the payment media from having a passive access to them.
- As Guiso and Jappelli (2005) point out, consumer awareness in financial markets can take many guises and be an elusive concept. It can be both about the existence and characteristics of payment media. Our data include a series of questions capturing the consumers' exposure to the provision of information about financial services and payment media. The data also yield instruments, which allow us to control for the potential endogeneity of consumer awareness.
- Our consumer-level data contains extensive demographic and socio-economic information, and an unusual degree of detail on consumers' banking relationship. This provides a wide-ranging list of consumer characteristics that in some respects goes beyond the standard control variables used in the literature.

We find that more than half of the young Finnish customers in our sample use more than one payment media when paying at the point-of-sale and that this use of multiple payment media is closely related to the decision to use debit card in addition to cash. However, while an informed consumer is more likely to use multiple payment media, the link from awareness to debit use is subtle. It turns out that those who use only one payment method use cash irrespective of their awareness and that while awareness induces a shift towards using many payment methods, 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. The effect of awareness on the probability of using multiple payment media is quantitatively large, especially if the potential endogeneity of consumer awareness is controlled for. We also show that the effect of consumer awareness on use of multiple payment media survives a number of robustness checks, including using an alternative measure of consumer awareness and methods of estimation.

    In the next section, we describe the institutional environment and some special characteristics of the Finnish market of payment media that make Finland a neat case for our study. In section 3 we describe our data and the construction of

variables. We go trough the basic estimations, their results, and robustness tests in section 4. In section 5 we address the potential endogeneity of consumer awareness. The concluding section includes a discussion of the implications of our findings for the adoption of new payment media.

2 Institutional environment[4]

The Finnish market for payment media has some distinctive features that simplify our study and some profound differences with the much-studied US market of payment media (see, eg Ausubel, 1991 and Humphrey, Pulley and Vesala, 2000, Klee, 2006a,b, and Fusaro, 2007 for a description of the US market).

The Finnish market for payment media is relatively advanced, for Finns have for some time now relied on accessing electronic payment networks at the point-of-sale (see, eg Amromin and Chakravorti, 2007, for a cross-country comparison). Checks disappeared from consumer trade in the 1980s, and debit cards became subsequently popular: In 2002, they accounted for 2/3 of the value of all card payments.[5] In other words, the shift away from checks towards increasing use of debit cards occurred in Finland much earlier than in the US and many other countries.

The use of cash is decreasing rapidly. Between 1999 and 2003, the use of cash as a way of paying for daily consumer goods and services decreased by 18% (13 percentage points, to 58%). Although it still is relatively common in point-of-sale transactions, the ratio of currency in circulation to GDP, about 1.8% in 2002, is in Finland among the lowest in the world. Moreover, a special feature of the Finnish market is that the use of cash is almost invariantly preceded by the use of an ATM: The entire currency in circulation (2,4 billion euros) goes through the ATMs seven times a year, and getting 'cash back' when paying by a card (say, at a retail store) is rare. The use of cash without first accessing one's bank account via an ATM is a habit that is restricted to the senior citizens that have never learned to use ATMs. For the rest, using ATMs is easy, since virtually everyone has a banking account where incomes are credited directly and an ATM

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[4] Most of the industry details come from the various publications of the Finnish Bankers' Association and the Bank of Finland.
[5] Various surveys show that between 1999 and 2003, the use of debit cards as the most common way of paying for daily consumer goods and services increased from 17% to 30%.

(compatible) card. The coverage of the ATM networks is rather extensive, and the networks of different banks allow for roaming.[6]

In Finland, credit and debit cards appear to be closer substitutes than in the US. This means that studying the discrete choice between 'debit versus credit', which has been one of the research focuses in the US (see, eg Fusaro, 2007, and Zinman, 2007), is less of interest to us. Besides the four margins (acceptance, security, portability and time costs) in which credit and debit cards are close substitutes also in the US, there are additional reasons for their substitutability in the Finnish market: First, Finns in general and young Finns in particular use their credit cards primarily for paying and *not for borrowing*: Our data (described more closely in section 4) tells us that in 2002, 37% of the young had an outstanding credit balance, but only for 5% it originated from payment card borrowing (for 4% from credit cards).[7] Instead of borrowing, the young have other, convenience related motivations to use a credit card, such as a Visa or a MasterCard. One of them is the desire to use it abroad in the point-of-sale transactions. Further, there are very few 'revolvers' in Finland who do not pay their credit card balance in full by the payment due date. Second, the benefit of float (ie, interest-free loan) that a typical Finnish consumer (who pays the balance in full) foregoes if she uses debit instead of credit, appears to be small at least in the euro era (from the start of 1999).[8] Third, at the time when our data was collected, there were little, if any, rewards such as rebates or airline miles available for a debit or a credit card user.

The Finnish market for payment media is concentrated, because the few main deposit banks that dominate the banking sector are the main issuers of payment media. Because the issuers of payment media are relatively homogenous the payment media, their pricing, and the ways of providing them with customers tend to be similar across the issuers, at least after controlling for the banking relationships of consumers.

The pricing of the payment media is also quite simple (see Koskinen, 2001). At least one ATM or payment card is often automatically attached to a banking account as a part of a banking service package. The packages can include various payment media, whose pricing hence depends on the pricing of the banking service packages. Their pricing in turn is tied to the age of a consumer. It is

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[6] The reason for the extensive ATM networks is that the Finnish banking sector was heavily regulated until the late 1980s. Because both deposit and loan interest rates were regulated, the banking groups competed by the scope of their service network. The last phase of the service competition was the introduction of ATMs. The deregulation and the subsequent banking crisis of the early 1990s actually first intensified the competition through ATM networks, because the banks replaced their branches by a set of ATMs to cut down costs.

[7] For the rest, the loan was either a mortgage or a student loan. Borrowing via payment cards is directly related to age even within the young.

[8] We do not have exact figures. Zinman (2007) computes the foregone float to be about 3$ for a 'typical' US customer.

typical that the basic packages are free of charge until the age of 26, which applies to most individuals in our data.

3 Data and definition of variables

3.1 Data

The data for our analysis come from a survey conducted by the Finnish Bankers' Association between the 21st February and 5th March, 2002. The primary aim of the survey was to collect data on the consumption habits of young Finns and their views about banking and financial products and services. The survey was based on a random sample of 1004 young adults aged between 15 and 28. We use the entire sample, which represents approximately 1/900 of the total population in the age group.

The data are rich in detail concerning the young adults' demographic and socio-economic characteristics, financial affairs, banking relationships, and information about banking products and financial affairs, including payment media. The data also include information about the use of various payment media in retail transactions.

3.2 Definition of variables

Use of payment media

The survey contains the following three questions, Q1–Q3, about how the young pay for their purchases and consumption of services:[9]

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;

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[9] Translation from Finnish by the authors.

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.

These questions allow measuring the number of different payment media a young consumer uses and characterizing which media she uses when paying for her purchases or consumption of services. Note that questions Q1–Q3 identify virtually all the payment media consumers could use when paying for consumption or services at the point-of-sale in Finland. Even if a payment medium were not properly identified, the respondents had three possibilities to identify such a medium by themselves. But no one did. Moreover, questions Q1–Q3 concern actually using a payment medium, not having an access to it (ie carrying it passively in one's wallet). We therefore need not to worry about card owners who never use their cards.[10]

We let n_i denote the number of different payment media consumer i uses. We also define dummy variable USEMANY$_i$ to equal zero if $n_i = 1$ and one if $n_i > 1$.

Consumer awareness

The previous literature unfortunately provides little help in choosing a proxy for consumer awareness, a_i.[11] We measure it based on a series of questions included the survey that concern the provision of information about payment media. The questions were introduced as follows:

Q4: I will next list a number of different banking services or products. Please indicate for each item whether you have either received or been offered (i) a lot of information, (ii) some information, or (iii) no information.

We code an indicator variable that equals 1, if the responded chose (i) to items *{'Debit and credit cards', 'Other loans, such as consumer credit and borrowing using cards', 'Transaction accounts, ie those designed for frequent, daily usage', 'Ways of paying bills'}*. The value of the indicator is zero otherwise, ie, only 'a lot of information' is counted as awareness.

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[10] Yet another useful feature of the survey is that just before the questions of the use of payment media in retail transactions were presented, the respondents had been asked about their habits of paying for their bills. The questions should thus capture the young adults' payment habits in point-of-sale-transactions instead of their bill-paying habits.

[11] On measuring consumer awareness in financial markets, see Guiso and Jappelli (2005). Lusardi and Mitchell (2007) provide an overview of a related literature on financial literacy and investor sophistication.

The rationale for our definition of a_i is that a consumer's awareness of the existence and characteristics of payment media is likely to be directly related to the amount of information the consumer has been offered about them. The amount should, in turn, be directly related to the systematic and unsystematic forms of information provision by the various issuers of payment media. For now, we maintain the assumption of exogenous awareness.

Although our measure of consumer awareness is certainly imperfect, we can show that our results hold in instrumental variable estimations that allow for a measurement error in a_i. We also establish the robustness of our results with respect to an alternative proxy for awareness.

Control variables

We construct two sets of variables. The first set consists of demographic and socio-economic characteristics: sex ($SEX_i = 1$ if the respondent is female), age in years (AGE_i), age squared ($AGESQ_i$), employment status ($EMP_i =$ if employed; $UNEMP_i =$ if unemployed, the omitted category is for students), level of completed or on-going education ($HIGH_i = 1$, if university, $MEDIUM_i = 1$ if high school or equivalent, the omitted category is for those with elementary school education), household type ($NOHOUSEH_i = 1$, if lives with parents), type of family ($CHILDREN_i = 1$, if has at least one child), residential area ($CITY_i = 1$ if lives in a city with more than 30 000 inhabitants), geographic region of residence ($WEST_i = 1$, $EAST_i = 1$, $NORTH_i = 1$, if lives in these parts of Finland, the omitted category represents the respondents living in south), income ($INCOME_i$, in thousands of EUR), income squared ($INCOMESQ_i$), the type of real wealth ($RWEALTH_i = 1$ if owns a real estate, a house or a condominium), financial wealth ($FWEALTH_i = 1$, if has savings in deposit or savings accounts, if owns stocks, shares of mutual funds, bonds, private pension insurance, or if has made other financial investments), and liquid wealth ($LWEALTH_i = 1$, if has savings in transaction accounts).

The previous literature suggests that demographic and education variables should be included to control for heterogeneity in adoption costs and consumption behavior (eg Carow and Staten, 1999, Mantel, 2000, Stavins, 2001, and Mester, 2003). Similarly, the literature suggests that we should control for income and the type of wealth, because they affect consumption patterns and measure how relevant fixed monetary adoption costs are. Dummies for the residential area and region aim at acknowledging the two-sided nature of payment media market and capturing related adoption determinants considered by Attanasio, Luigi and Japelli (2002), Stix (2003) and Rysman (2007), such as the number of ATM points in the area of residence and regional variation in the acceptance of payment media by retailers. They also capture other regional variation affecting use of payment

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media. For example, the determinants of consumer awareness uncovered by Guiso and Jappelli (2005) include geographical variations in the intensity of social networks and learning as well as in the costs of spreading information about payment media.

The second set of control variables is more unusual and comes from the variables depicting consumers' relationship to their deposit banks: Identity of a consumer's main bank (MBANK_h_i = 1, if principally uses the services of bank h, h = 1, 2, …, 6, the omitted category is for those who principally use the services of bank 7), use of other banks (NOSBANK$_i$ = 1, if uses the services of other banks in addition to the main bank), choice of the main bank (BCHOICE$_i$ = 1, if the main bank has been chosen by the respondent herself and not, eg, by her parents or spouse), duration of the relationship with the main bank (BLENGHT$_i$ = 1 if has been a customer of the current main bank since her birth), membership in the main bank's youth club (BCLUB$_i$ = 1 if a member), and recent switch of main bank (SWBANK$_i$ = 1 if has changed the main bank over the past 12 months).

Controlling for the banking relationships is quite natural because of the prominent role of the deposit banks in the Finnish market for payment media (see section 2). We trust that these regressors reflect heterogeneity in adoption costs: The MBANK_h_i-dummies and NOSBANK$_i$ should capture, for example, differences in the pricing of various cards and marketing strategies across the banks. We can moreover conjecture that BCLUB$_i$ proxies the initial level of consumer awareness about payment media, as a former member of a bank's youth club should be relatively well informed about banking products and services.

We introduce the two sets of controls sequentially into the model to ensure that our results are not driven by potential (unmodelled) endogeneity of some of the control variables in the second set of regressors. Variable SWBANK$_i$ is for example potentially endogenous, because consumers could self-select, ie, switch their main bank on the basis of anticipated demand for multiple payment media.[12]

4 Analysis

4.1 Descriptive statistics

The summary statistics are presented in Table 4.1. They show that the respondents are on average 21 years old and have annual income of about 8100 EUR. A bit more than half of them are female, some 60% of them are students and around

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[12] Besides the control variables described here we have tried several other groupings and sets. Our results are robust to such alternative specifications as also the robustness tests of the next section indicate.

28% have a university degree or are studying for one. The average of a_i, which is our indicator for consumer awareness, is 0.7.

The table also indicates that consumers use multiple payment media but their number is rather restricted. The mean of the dummy variable $USEMANY_i$ is 53%, which indicates that a bit more than half of the young Finns use more than one payment medium in their point-of-sale transactions. The count variable, n_i, varies from 1 to 3 and has a mean of 1.6.[13]

Table 4.1   **Descriptive statistics**

	Obs	Mean	Std. Dev.	Min	Max
n	946	1.59	0.61	1	3
USEMANY	946	0.53	0.50	0	1
a	946	0.70	0.46	0	1
INCOME	946	8.14	9.64	0	37.80
AGE	946	21.22	3.99	15	28
SEX	946	0.51	0.50	0	1
LIVCITY	946	0.48	0.50	0	1
WEST	946	0.38	0.48	0	1
EAST	946	0.12	0.33	0	1
NORTH	946	0.13	0.34	0	1
EMP	946	0.32	0.47	0	1
UNEMP	946	0.07	0.25	0	1
HIGH	946	0.28	0.45	0	1
MEDIUM	946	0.62	0.49	0	1
NOHOUSEH	946	0.44	0.50	0	1
CHILDREN	946	0.09	0.28	0	1
RWEALTH	946	0.14	0.35	0	1
FWEALTH	946	0.27	0.44	0	1
LWEALTH	946	0.25	0.44	0	1
MBANK_1	946	0.33	0.47	0	1
MBANK_2	946	0.39	0.49	0	1
MBANK_3	946	0.06	0.23	0	1
MBANK_4	946	0.15	0.36	0	1
MBANK_5	946	0.02	0.14	0	1
MBANK_6	946	0.03	0.17	0	1
NOSBANK	946	0.74	0.44	0	1
BCHOICE	931	0.36	0.48	0	1
BLENGTH	849	0.64	0.48	0	1
BCLUB	937	0.57	0.50	0	1
SWBANK	934	0.03	0.16	0	1

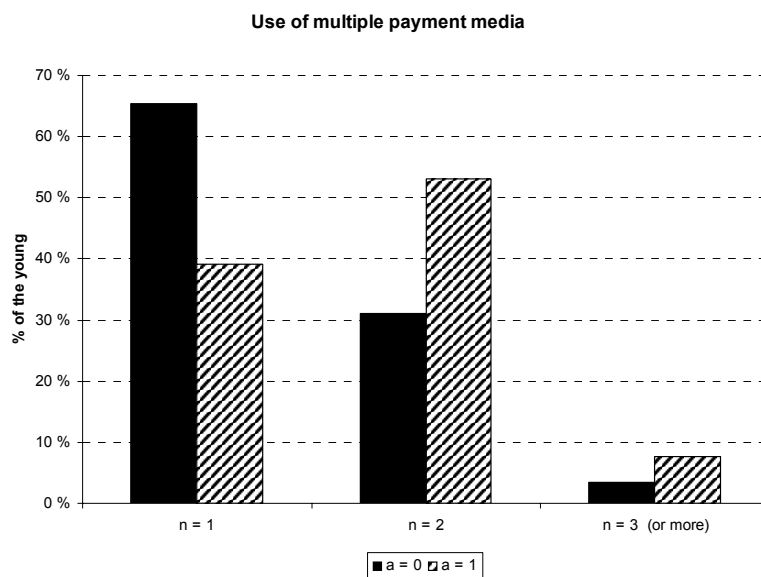Note: Data source is 'Nuorisotutkimus 2002' -survey of the Finnish Banker's Association

Figure 4.1 displays the distribution of n_i conditional on a_i. The figure suggests that use of multiple payment media and consumer awareness are not independent, as consumer awareness clearly shifts the distribution of n_i to the right. As many as

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[13] One respondent used four payment methods. We recoded her answer to equal three.

65.4% of the uninformed consumers (with $a_i = 0$) use only one payment medium, while the corresponding percentage for the informed is 39.1%. Put differently, 83% of those who use many payment methods are better informed. To formally assess for the presence of dependence between n_i and awareness, we compute Pearson's χ^2-test. The test for independence obtains a value of 55.75 (d.f. = 2), which allows us to firmly reject the null hypothesis at the 1% significance level.

Figure 4.1 **Use of multiple payment media by the uninformed (a = 0) and the informed (a = 1)**

Note: Data source is 'Nuorisotutkimus 2002' -survey of the Finnish Banker's Association

Figure 4.2 displays the distribution of the most typical way of paying (based on answers to Q1), conditional on n_i and a_i. Approximately 3/4 of the respondents keeps cash as their most typical way of paying for their purchases or consumption of services and awareness seems to have little to do with the consumers' preference for cash. In particular, if a young only uses a single payment method ($n_i = 1$), she uses cash almost certainly. The figure also shows that of those who use many payment methods ($n_i > 1$), more than half regards cash as their first choice: A simple t-test allows us to reject at 5% significance level (but not at 1% level) the null hypothesis that the binary variable indicating that the most typical way of paying is cash, has a mean of 0.5 (conditional on $n_i > 1$). Awareness, or lack of it, is not associated with the use of cash as the primary method of payment, conditional on $n_i = 1$ or $n_i > 1$. Pearson's χ^2-tests confirm that the null hypothesis of independence cannot rejected in either case.

Figure 4.2 **The most typical way of paying by the uninformed (a = 0) and the informed (a = 1)**

The most typical way of paying
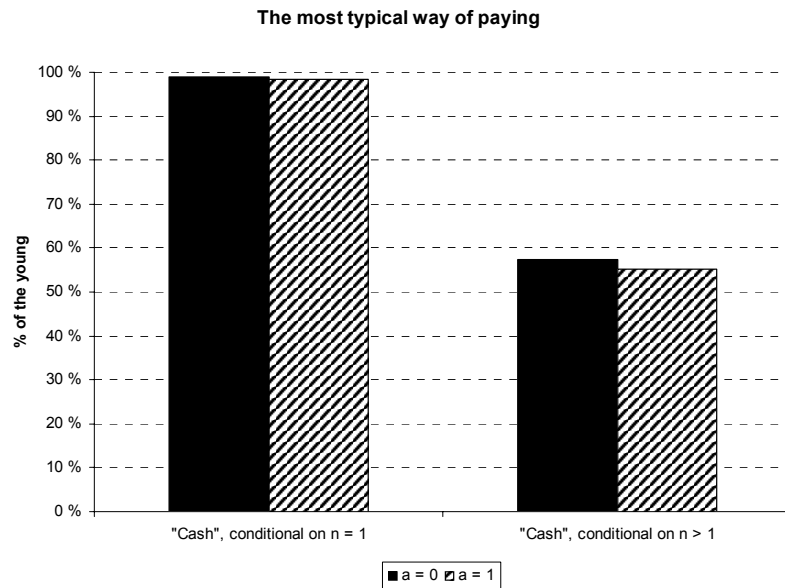
Figure 4.3a and 4.3b takes a closer look at the methods of paying among the young who use many payment methods. Figure 4.3a displays the distribution of the most typical way of paying (based on answers to Q1), conditional on $n_i > 1$ and the first choice *not* being cash. Figure 4.3b displays, in turn, the distribution of the second most typical way of paying (based on answers to Q2), conditional on $n_i > 1$ and the first choice being cash. These figures show that debit card is the most typical way of paying among those who use many payment media and who do not use cash as their primary method of payment. Together with Visa Electron (which from the consumer's point of view is close to a regular debit card), debit card is also the second most typical way of paying among those who use many payment media and whose first choice is cash. Pearson's χ^2-tests indicate that these (conditional) choices are not related to awareness, as the null hypothesis of independence cannot rejected in either case.[14]

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[14] While not shown in the figures, we can also report that cash is the second most typical way of paying, conditional on n > 1 and the first choice not being cash. To be specific, about 95% of these young use cash.

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Figure 4.3a   **The most typical way of paying, conditional on n and the first choice not being cash**

**The most typical way of paying,
conditional on n > 1 and the first choice not being cash**
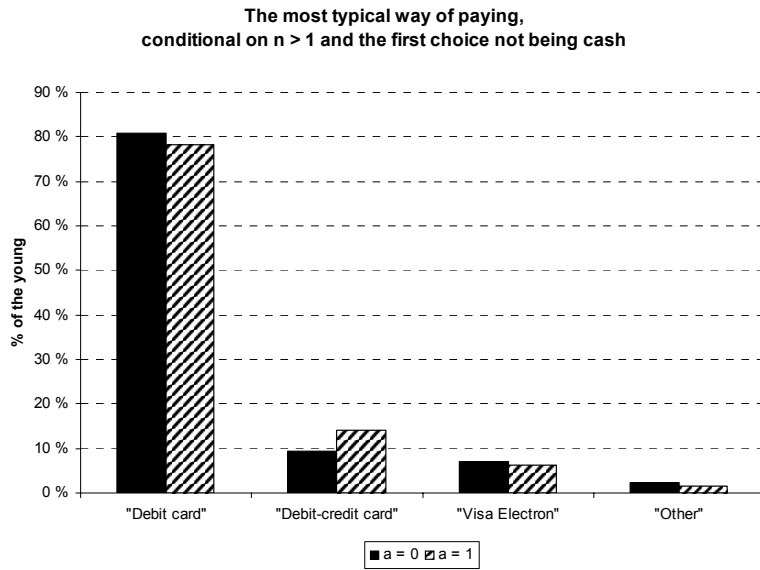
Figure 4.3b   **The most typical way of paying, conditional on n and the first choice being cash**

**The second most typical way of paying,
conditional on n > 1 and the first choice being cash**
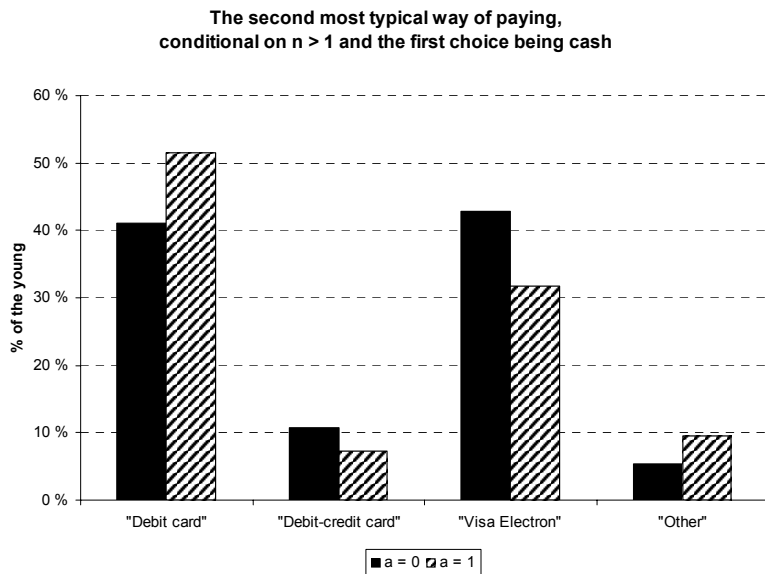
Taken together, Figures 4.1–4.3a,b suggest that awareness is correlated with use of multiple payment media and, while a priori it needed not be the case, this behavior is closely related to the decision to use debit card either as a primary or secondary method of payment in addition to cash. However, the relationship between awareness and debit card use is nuanced: Those who only use one payment method use cash irrespective of their awareness and while awareness

induces a shift towards the use of multiple media, 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 of paying.

4.2   Econometric analysis

To provide quantitative evidence on the relationship between the use of multiple payment media and information provision, we estimate a number of regression models. In these models, the dependent variable is the use of multiple payment media (n_i or $USEMANY_i$) and the main interest is in estimating the effect of consumer awareness (a_i) on the usage. For now, we maintain the assumption of exogenous consumer awareness.

In column (1) and (2) of Panel A of Table 4.2 we present the results of Ordered-Probit (O-Probit) and quasi maximum-likelihood Poisson (QML-Poisson) estimations of models in which n_i is the dependent variable and in which only the first set of control variables is included.[15] In column (3), the dependent variable is $USEMANY_i$ and the method of estimation Probit. Panel B reports the results for the same models, but with both sets of controls included. We use the standard Huber-White sandwich estimator to obtain a heteroscedasticity-robust variance-covariance matrix.

The results of Table 4.2 show that the dummy for consumer awareness obtains a positive coefficient that is statistically significant at the 1% level, irrespective of the estimation method and the included set of control variables. This finding confirms that the use of multiple payment media by a Finnish young is related to her awareness. The Probit results allow us to compute that holding the other variables constant, the difference between $Prob(USEMANY_i = 1 \mid a_i = 1)$ and $Prob(USEMANY_i = 1 \mid a_i = 0)$ is on average 12.6 percentage points (= 56.6%–44.0%). This difference is not negligible when compared eg to the mean of $USEMANY_i$.

As to other determinants of n_i and $USEMANY_i$, they are mostly in line with expectations. Propensity to use many payment media is increasing in $INCOME_i$, but the positive relation begins to weaken after a threshold. Financial asset ownership also increases the likelihood of using multiple payment media. If the findings are not entirely driven by different consumption patterns of the affluent, they may also indicate that the young care about the monetary costs of adoption. As the coefficients of SEX_i and $HIGH_i$ suggests, females, university students and

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[15] An advantage of the Poisson quasi-likelihood method is that the consistency of estimation requires only a correct specification of the (conditional) mean function (see, eg Wooldridge, 1997). Moreover, in an earlier working paper version (Hyytinen and Takalo, 2004) we show how such a conditional mean of a count (Poisson) regression model can be derived from a simple consumer payment behaviour model of the Baumol-Tobin type and given structural interpretation.

graduates use more payment media than their otherwise identical counterparts. From Panel B we can observe that a considered choice of bank relationship and membership in a bank's youth club also have an effect on the likelihood of using multiple payment media.

Table 4.2   **Regression results: exogenous a_i**

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	***
INCOME	0.04	0.01	***	0.01	3.9E-03	***	0.04	0.02	***
INCOMESQ	-8.0E-04	4.7E-04	*	-2.2E-04	1.2E-04	*	-1.1E-03	5.2E-04	**
AGE	0.38	0.18	**	0.11	0.04	**	0.18	0.20	
AGESQ	-0.01	3.8E-03	*	-1.8E-03	9.5E-04	*	-1.7E-03	4.4E-03	
SEX	0.24	0.09	***	0.06	0.02	***	0.30	0.10	***
LIVCITY	0.11	0.09		0.03	0.02		0.24	0.10	**
WEST	-0.11	0.10		-0.03	0.03		-0.02	0.11	
EAST	0.07	0.14		0.02	0.04		0.20	0.16	
NORTH	0.03	0.13		0.01	0.03		0.15	0.15	
EMP	0.03	0.14		5.7E-03	0.04		0.11	0.16	
UNEMP	-0.07	0.17		-0.02	0.05		0.06	0.20	
HIGH	0.77	0.25	***	0.17	0.06	***	0.86	0.27	***
MEDIUM	0.50	0.22	**	0.10	0.05	**	0.53	0.22	**
NOHOUSEH	-0.05	0.13		-0.01	0.03		-0.01	0.13	
CHILDREN	0.08	0.15		0.02	0.04		0.04	0.19	
RWEALTH	0.21	0.13	*	0.06	0.03	*	0.32	0.16	**
FWEALTH	0.30	0.10	***	0.08	0.02	***	0.28	0.11	**
LWEALTH	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		

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

| 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 ***
INCOME	0.04	0.02 ***	0.01	4.1E-03 ***	0.05	0.02 *
INCOMESQ	0.00	0.00 **	-2.8E-04	1.3E-04 **	-1.3E-03	5.8E-04 *
AGE	0.16	0.19	0.05	0.05	-0.06	0.21
AGESQ	0.00	0.00	-6.8E-04	1.0E-03	0.00	0.00
SEX	0.20	0.09 **	0.05	0.02 **	0.23	0.11 *
LIVCITY	0.16	0.10 *	0.04	0.02 *	0.32	0.11 ***
WEST	-0.08	0.10	-0.02	0.03	-0.01	0.12
EAST	0.00	0.14	1.8E-03	0.04	0.10	0.17
NORTH	0.04	0.15	0.01	0.04	0.16	0.17
EMP	0.05	0.15	9.8E-03	0.04	0.13	0.17
UNEMP	-0.03	0.19	-0.01	0.05	0.12	0.22
HIGH	0.87	0.27 ***	0.20	0.06 ***	0.99	0.29 ***
MEDIUM	0.57	0.23 **	0.13	0.05 **	0.65	0.24 ***
NOHOUSEH	-0.07	0.14	-0.02	0.04	-0.01	0.14
CHILDREN	0.13	0.17	0.03	0.04	0.16	0.21
RWEALTH	0.26	0.13 **	0.07	0.03 **	0.39	0.16 *
FWEALTH	0.21	0.10 **	0.05	0.03 **	0.20	0.12 *
LWEALTH	0.13	0.10	0.03	0.03	0.02	0.12
MBANK_1	0.64	0.47	0.14	0.12	0.53	0.54
MBANK_2	0.77	0.47	0.18	0.12	0.73	0.54
MBANK_3	1.05	0.50 **	0.25	0.12 **	1.10	0.57 *
MBANK_4	0.66	0.48	0.15	0.12	0.49	0.55
MBANK_5	1.05	0.56 *	0.25	0.14 *	0.60	0.59
MBANK_6	0.83	0.54	0.19	0.13	0.88	0.62
NOSBANK	-0.12	0.10	-0.03	0.03	-0.06	0.12
BCHOICE	0.25	0.11 **	0.07	0.03 **	0.29	0.13 *
BLENGTH	0.00	0.11	3.6E-03	0.03	0.11	0.13
BCLUB	0.24	0.09 ***	0.06	0.02 ***	0.29	0.10 ***
SWBANK	-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

4.3   Robustness tests

We have run a number of additional regressions to assess the robustness of the documented effect of awareness. In these regressions, the regressors are the same as those used in Panel B of Table 4.2. For brevity, we discuss the results only informally.

Robustness test 1: To address the potential problem of omitted variables, we construct a new set of control variables that allows us to better control for heterogeneity in the young Finns' consumption habits (beyond what their basic demographic and socio-economic characteristics capture). The new set of controls

consist of loan market status ($BORROWS_i = 1$ if currently has outstanding debt), use of the Internet ($USEINT_i = 1$ if uses the Internet regularly), and planned consumption ($SPEND\_c_i = 1$, $c = 1, 2, \ldots, 6$, in which c indexes planned near-term spending on education ($c = 1$), housing ($c = 2$), traveling ($c = 3$), computers ($c = 4$), sport or outdoor clothing and equipment ($c = 5$), and other ($c = 6$); the omitted seventh category is for the respondents without near-term spending plans). The use of the new set of controls does not change the main finding: In all estimations (O-Probit, QML-Poisson, and Probit) the coefficient of consumer awareness is positive and statistically significant at the 1% level.

Robustness test 2: Both theoretical and empirical research suggests that pricing of the payment media matters for the rate of adoption and use of many payment methods (Santomero and Seater, 1996, Humphrey et al, 2001, and Rochet and Tirole, 2003, and Borzekowski et al, 2006). While we trust that the regressors reflecting consumers' banking relationships also capture differences in the pricing, a further robustness check is in order. As explained in section 2, it is typical that at the age of 26, the various banking service packages to which cards are often attached cease to be free of charge. Crossing this age may thus trigger search and reoptimization. We therefore include a dummy variable equalling one for those who are 26 or over. The dummy does not get a significant coefficient.[16] The coefficient of consumer awareness changes only a little, if at all, and it is highly significant in all three cases (O-Probit, QML-Poisson, and Probit).

Robustness test 3: To address the concern that it is the maintained definition of consumer awareness that drives the results, we use an alternative proxy for a_i. The alternative proxy equals 1 if the respondent, in addition to acknowledging that she had either received or had been offered a lot of information about debit or credit cards, ways of paying bills, use of transaction accounts, or borrowing using credit cards, indicated in another series of questions that she needed no further information about these products and services. The new proxy effectively captures consumers whose demand for information is 'saturated'. Using the new proxy reduces slightly the estimated effect of consumer awareness. Nonetheless, the effect remains positive and significant in the Probit model at the 5% level and in the O-Probit and QML-Poisson at the 10% level.

Robustness test 4: As a final robustness test, we use a log-transformed depend variable, $\log(n_i)$, and estimate the model (from Panel B of Table 4.2) using OLS. The results do not change.

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[16] It is still possible that in the anticipation of reoptimization, consumers start adjusting their demand for payment media before they reach the threshold age. But dummies allowing for this type of forward-looking behavior gain no significance.

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5 Is consumer awareness endogenous?

5.1 Sources of endogeneity

In this section we relax the assumption of exogenous consumer awareness. As we have defined it, consumer awareness reflects consumers' knowledge about the existence and characteristics of payment media. If a consumer's awareness reflects existence, it typically cannot be her choice variable (Guiso and Japelli, 2005): One can rarely choose to know something that is not known to exist. If a consumer's awareness reflects characteristics of the payment media she knows to be available, awareness can be a choice variable – but it does not have to be.

The foregoing discussion suggests two main sources of endogeneity of a_i. First, if awareness is not a consumer's choice variable, endogeneity can originate from the marketing strategies of the issuers of the payment media. Some consumers are more likely to be a target of (informative) advertising campaigns than others. Endogeneity arises if the propensity to be a target of such a campaign is related to consumers' unobserved propensity to use multiple payment media. Second, if a consumer's awareness is her choice variable, endogeneity can originate from self-selection. Self-selection arises if consumers choose their level of awareness on the basis of their unobservable propensity to use multiple payment media.

Signing the direction of the (potential) endogeneity bias is difficult a priori, as it can go either way. For example, we cannot identify which consumers in our data have parents who use multiple payment media. Such heirs of multihomers can be subjected to campaigns of the payment media issuers and simultaneously have, say, a lower than average cost of adoption. This source of endogeneity would presumably bias the estimated effect of consumer awareness upwards. In contrast, a downward bias would probably follow, if the heirs simply receive payment media from their parents and are therefore less likely to be a target of systematic information provision.

As the ability to pay abroad (see section 2) often prompts young Finns to acquire a payment card, travelling is another potential source of endogeneity where the bias can go either direction. On the one hand, frequent travellers are likely to be targets of the campaigns of the payment media issuers and their heavy users. An upward bias might therefore follow. On the other hand, many young Finns spend long periods abroad, eg as exchange students or working.

Consequently, they acquire cards but receive little information from their domestic issuers, suggesting a downward bias.[17]

5.2   Estimation and instruments

To relax the assumption of exogenous consumer awareness, use two different methods of estimation: The first one corresponds to a standard count regression (see column (2) of Table 4.2), but allows for 'an endogenous treatment effect' (Mullahy, 1997, and Windmeijer and Santos Silva, 1997). The method of estimation is GMM (GMM-Poisson). The second method is a recursive Bivariate Probit, which is an extension of the Probit model of column (3) of Table 4.2 (see, eg Greene, 2008, pp. 823–826): In this two-equation model, the dependent variables are $USEMANY_i$ and a_i and the latter is included in the former's equation as an (endogenous) binary-regressor. We identify the model by excluding some variables (the instruments) from the equation for $USEMANY_i$.

We use two sets of instruments: The first set consists of two indicators that capture whether a respondent had received or had been offered a lot of information about some banking products *other than* those related to paying and payment media: The first indicator, $INFO\_F_i$, equals 1 if the information was about housing loans, student loans, term deposits, or investing in stocks, mutual funds, etc., and is 0 otherwise. The second indicator, $INFO\_M_i$, equals 1 if the information was about using banking services via the Internet or via mobile phone, and is 0 otherwise. The assumption underlying the instruments is that there are advantages associated with the joint marketing and production of financial services (see, eg Berger, Humphrey and Pulley, 1996).[18] These instruments are valid (ie relevant and exogenous) if they are a determinant of consumer awareness (a_i) and if the extent to which a consumer is supplied information, for example, about term deposits or housing loans, have no direct effect on her propensity to use multiple payment media.

The second set of instrumental variables is built on the following three indicators: $FIN\_FO_i = 1$, if the consumer responded that she follows regularly banking and financial news in media and = 0 otherwise, $FIN\_IM_i = 1$, if she found

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[17] Self-selection can induce both negative and positive correlation, too. There are, for example, so called early adopters who are enthusiastic about new technologies. The early adopters choose to be knowledgeable about the payment media and start to use them eagerly. This self-selection results in an upward bias. A downward bias would instead follow, if some consumers actively acquire information about the payment media because of having (for some unobserved reason) a limited access to them.

[18] If there are such advantages, it pays for banks to cross-sell financial products and services and pursue 'one-stop banking'. Cross-selling means that when consumers are informed about a banking product, they are *simultaneously* offered information about other financial services, such as payment media.

it important to be literate in banking and financial issues and = 0 otherwise, and FIN_IN_i = 1, if she were interested to know more about banking and banking services, and = 0 otherwise. These instruments are valid if a consumer's overall interest in financial and banking affairs determines her awareness about payment media and if the overall interest has no direct impact on the use of multiple payment media.

We report below two test statistics to illustrate how these two sets of instruments work. The first is an F-test statistic for 'weak instruments' (Staiger and Stock, 1997), which we implement by testing the joint significance of the instruments in the first stage. The second is an overidentification test.

5.3   Results

Table 5.1 reports the results of the estimations that allow for the (potential) endogeneity of a_i.[19] The exogenous variables are the same as those used in Panel A of Table 4.2. The set of instruments is {$INFO\_F_i$, $INFO\_M_i$} in columns (1)–(2) and {$INFO\_F_i$, $INFO\_M_i$, FIN_FO_i, FIN_IM_i, FIN_IN_i} in columns (3) –(4).

The results confirm our earlier findings: Consumer awareness is directly related to the propensity of consumers to use multiple payment media, as the coefficient of a_i is positive and statistically significant at better than the 1% level in all columns.[20] The GMM-Poisson estimates of column (1) suggest, for example, that the informed use about 1.2 times more payment media than the less informed. Another interpretation can be obtained from the Bivariate-Probit: Using the estimated parameters we find that the difference between $Prob(USEMANY_i =1 \mid a_i = 1)$ and $Prob(USEMANY_i =1 \mid a_i = 0)$ is 23.9 percentage points (= 60.0%– 36.1%). This effect is quantitatively significant and confirms that awareness increases the likelihood using multiple payment media, particularly the likelihood of using a debit card either as a primary or as a secondary method of payment. This shows that not controlling for the endogeneity of awareness may result in a downward biased estimate.

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[19] The GMM estimations of the Poisson model were implemented using a Gauss programme ExpEnd, written by Frank Windmeijer. The programme contains an estimation code for non-linear GMM estimation of exponential models with endogenous regressors (for details, see Windmeijer, 2002). The reported numbers are based on the two-step estimates and multiplicative moment conditions (see Mullahy, 1997, Windmeijer and Santos Silva, 1997, and Windmeijer, 2002). Somewhat surprisingly, using additive moment conditions yield almost identical results.

[20] The null hypothesis that the residual correlation in the Bivariate-Probit is zero is not rejected at the 5% level (p-value of the LR-test is 0.0673).

Table 5.1   **Regressions results: endogenous a_i**

	$Y = n$ GMM-Poisson		$Y = USEMANY$ Bivariate-probit		$Y = n$ GMM-Poisson		$Y = USEMANY$ Bivariate-probit	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
a	0,18	0,05 ***	0,77	0,22 ***	0,19	0,05 ***	0,77	0,22 ***
INCOME	0,01	3,9E-03 **	0,04	0,02 *	0,01	3,9E-03 **	0,04	0,02 *
INCOMESQ	-2,0E-04	1,0E-04 *	-1,0E-03	5,3E-04 *	-2,0E-04	1,0E-04	-1,0E-03	5,3E-04 *
AGE	0,07	0,05	0,10	0,20	0,07	0,05	0,10	0,20
AGESQ	-1,0E-03	1,0E-03	-1,4E-04	4,5E-03	-1,0E-03	1,0E-03	-1,4E-04	4,5E-03
SEX	0,07	0,02 ***	0,30	0,10 ***	0,07	0,02 ***	0,30	0,10 ***
LIVCITY	0,04	0,02 *	0,24	0,10 *	0,04	0,02 *	0,24	0,10 *
WEST	-0,02	0,03	-0,01	0,11	-0,01	0,03	-0,01	0,11
EAST	0,02	0,04	0,17	0,16	0,02	0,04	0,17	0,16
NORTH	0,02	0,03	0,18	0,15	0,02	0,03	0,18	0,15
EMP	0,02	0,04	0,11	0,16	0,01	0,04	0,11	0,16
UNEMP	-0,02	0,05	0,02	0,20	-0,02	0,05	0,02	0,20
HIGH	0,18	0,06 ***	0,83	0,27 ***	0,17	0,06 ***	0,83	0,27 ***
MEDIUM	0,09	0,05 **	0,53	0,22 *	0,09	0,05 **	0,53	0,22 *
NOHOUSEH	-0,01	0,04	0,01	0,13	-0,01	0,04	0,01	0,13
CHILDREN	0,02	0,04	0,02	0,19	0,02	0,04	0,02	0,19
RWEALTH	0,06	0,03 *	0,31	0,15 *	0,06	0,03 *	0,31	0,15 *
FWEALTH	0,08	0,03 ***	0,26	0,11 *	0,08	0,02 ***	0,26	0,11 *
LWEALTH	0,03	0,03	0,05	0,11	0,03	0,03	0,05	0,11
Instruments:	INFO_F, INFO_M		INFO_F, INFO_M		INFO_F, INFO_M, FIN_FO, FIN_IM, FIN_IN		INFO_F, INFO_M, FIN_FO, FIN_IM, FIN_IN	
Observations	942		942		942		942	
Log pseudo-likelihood			-920,99				-916,49	
Over-identification test (p-value)	0,88				0,12			

Note 1: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level
Note 2: GMM-Poisson based on two-step estimates and multiplicative moment conditions
Note 3: The instrumented variable in GMM-Poisson is "a".
Note 4: The dependent variable in the second equation of the (recursive) Bivariate-Probit is "a".
Note 5: In the (recursive) Bivariate Probit, the variables that are excluded from the equation for USEMANY are the instruments.

It seems that weak instruments do not bias the instrumental variable estimations: For example, when we estimate a first stage regression by OLS, the value of the F-test statistic is 106.24 and 49.05 when the joint significance of {INFO_F$_i$, INFO_M$_i$} and {INFO_F$_i$, INFO_M$_i$, FIN_FO$_i$, FIN_IM$_i$, FIN_IN$_i$} is tested, respectively.[21] These values exceed clearly the rule-of-thumb threshold (F-statistic >10), suggested by Steiger and Stock (1997). The (Sargan) overidentification tests, implemented using the GMM-procedure, do not reject the exogeneity of the instruments.

We can also consider the robustness of the estimations that allow for the endogeneity of a_i. First we repeat the estimations using the alternative proxy for consumer awareness (described in robustness test 3 of Section 4.3). The estimated effect increases and is statistically significant at (better than) the 5% level in both the GMM-Poisson and recursive Bivariate-Probit estimations. Second, the results do not change, when we use the full set of exogenous variables (ie the

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[21] As for the other determinants of the consumer awareness, our results are less clear cut: Most of the demographics (ie the exogenous variables) do not seem to predict it.

specification used in Panel B of Table 4.2). For example, when we use recursive Bivariate-Probit and the set of instruments is {INFO_F_i, INFO_M_i}, the coefficient of a_i is positive and highly significant. Third, some may find the exclusion restriction underlying {FIN_FO_i, FIN_IM_i, FIN_IN_i} more convincing than that underlying {INFO_F_i, INFO_M_i}. When we use recursive Bivariate-Probit and the set of instruments is restricted to {FIN_FO_i, FIN_IM_i, FIN_IN_i}, the coefficient of a_i is positive and highly significant. Finally, the results of Table 5.1 hold if the depend variable is log(n_i) and the method of estimation 2SLS.

6 Conclusions

It is widely thought that, holding consumer characteristics and merchant acceptance constant, information provision constitutes a major instrument besides pricing that affect the use and diffusion of payment media. However, there is little evidence on the quantitative importance of consumer information in the market for payment media. This paper delivers such evidence using a random sample of young Finnish consumers.

We find that more than half of the young consumers use more than one payment medium. We also find that the better informed a consumer is, the more likely she is to use many payment methods. It turns out that the use of multiple payment media is closely related to the decision to use debit card in addition to cash. However, there is no straightforward link from awareness to debit use: Those who use only one payment method use cash irrespective of their awareness and while awareness induces a shift towards using many payment methods, 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. The effect of awareness on the probability of using multiple payment media is quantitatively large, especially if the potential endogeneity of consumer awareness is controlled for.

Limited participation in the market for modern payment media can have important implications for individual welfare, especially if individuals have no other access to banking services. Our findings imply that holding income, wealth, banking relationship and other consumer characteristics constant, making consumers better informed could accelerate the adoption of new payment media, such as electronic money and mobile payments. The findings also suggest that increases in consumer awareness may have been underlying the rise of debit card use around the world. Beyond this, the implications of our findings for the payment media industry are less clear-cut. Because consumer multihoming intensifies platform competition over merchants (Rochet and Tirole, 2003), increasing consumer awareness may be a two-edged sword for the payment media

industry. On the one hand, it could be advantageous for the merchants, but on the other hand, the issuers of payment media may encounter a dilemma of prisoner type: Each issuer can have an incentive to increase consumer awareness of its own preferred medium, but the industry as a whole might be better off with a limited number of consumers who use multiple payment media. The implications for antitrust authorities are also ambiguous. To the extent the perceived failure of competition in the market for payment media is due to lack of information, our results suggest that improving consumer awareness could be a remedy. However, it is well known that improved transparency can also facilitate collusive behaviour.

Although the positive effect of consumer awareness on use of payment media suggests that allocating more resources on marketing new payment media might increase their adoption rates, a caveat should be borne in mind. We are unfortunately unable to identify whether consumer awareness reflects the consumers' exposure to informative advertising or persuasive advertising, or something else (cf. Ackerberg, 2001). We cannot therefore tell what kind of information provision or advertising would boost the demand for payment media. Isolating the mechanisms through which consumer awareness influences the adoption of new payment media is an area that clearly deserves further research.

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