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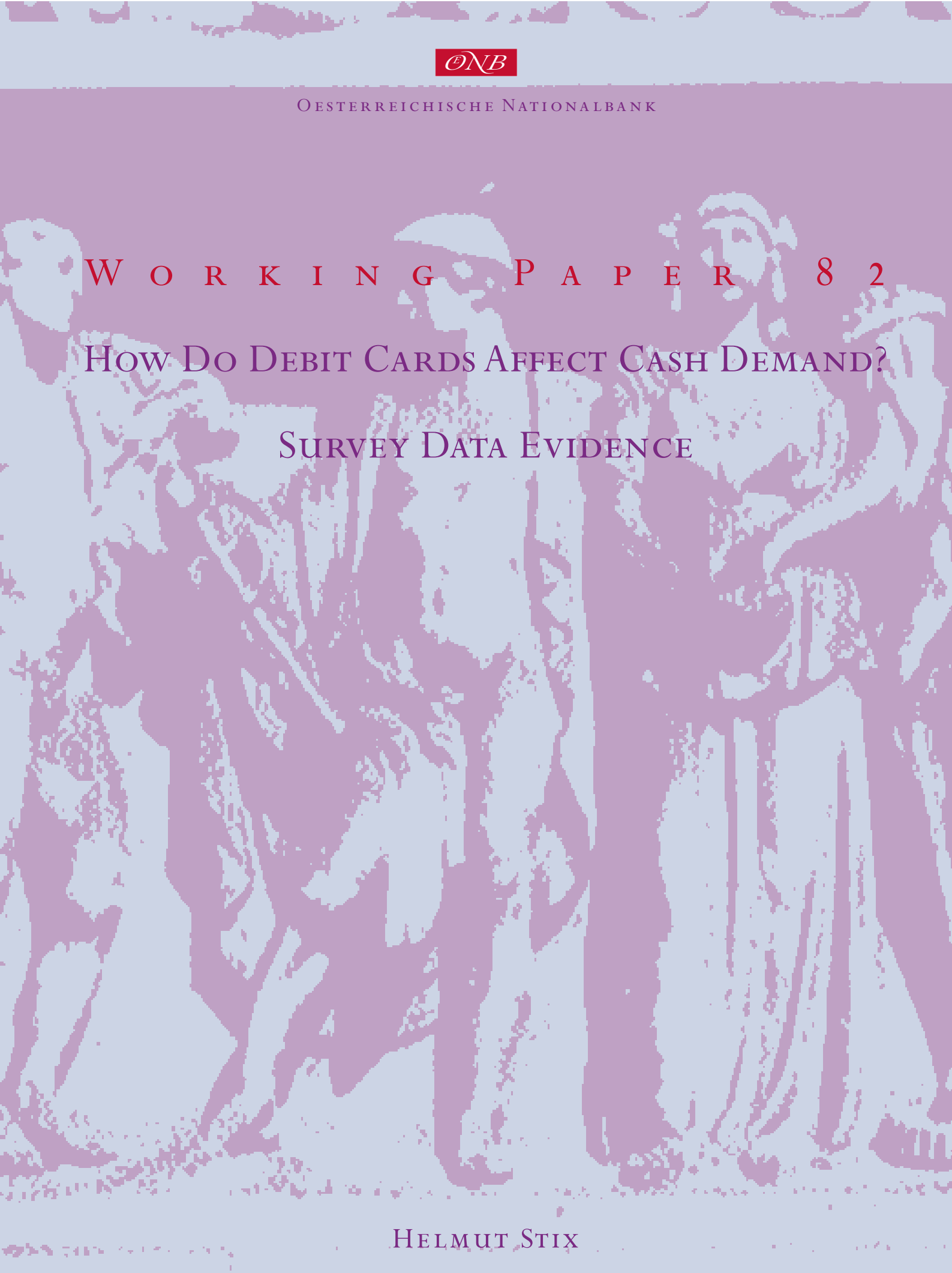

Working Paper 82

How Do Debit Cards Affect Cash Demand?

Survey Data Evidence

Helmut Stix

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Editorial

This paper analyzes how EFT-POS payments and ATM withdrawals affect purse cash demand. In particular, survey data about Austrian individuals are employed to estimate a cash demand equation which takes account of sample selection effects. The results reveal that purse cash demand is significantly affected by debit card usage and that there are significant differences in cash demand for individuals with different debit card usage frequencies. For example, the point estimates imply that individuals who pay frequently with their debit card hold about 20% less purse cash than all others while frequent ATM withdrawals are associated with about 18% less purse cash demand. Due to the relative small share of frequent users, currently, aggregate purse cash demand is not very strongly affected by EFT-POS payments. However, if usage behavior shifts towards higher usage frequencies, then the findings of this study suggest that purse cash demand will decrease substantially.

July 7, 2003

How Do Debit Cards Affect Cash Demand? Survey Data Evidence

Helmut Stix*

Oesterreichische Nationalbank

Abstract

This paper analyzes how EFT-POS payments and ATM withdrawals affect purse cash demand. In particular, survey data about Austrian individuals are employed to estimate a cash demand equation which takes account of sample selection effects. The results reveal that purse cash demand is significantly affected by debit card usage and that there are significant differences in cash demand for individuals with different debit card usage frequencies. For example, the point estimates imply that individuals who pay frequently with their debit card hold about 20% less purse cash than all others while frequent ATM withdrawals are associated with about 18% less purse cash demand. Due to the relative small share of frequent users, currently, aggregate purse cash demand is not very strongly affected by EFT-POS payments. However, if usage behavior shifts towards higher usage frequencies, then the findings of this study suggest that purse cash demand will decrease substantially.

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* Oesterreichische Nationalbank, Economic Studies Division, P.O. Box 61, A-1011 Vienna. helmut.stix@oenb.co.at, Tel.: [+43]-1-40420-7211, Fax: [+43]-1-40420-7299.

1. Introduction

Significant increases of card coverage ratios and rapid expansion of the network density of payment terminals have made card payments the most important cash substitute in many industrialized countries. This development raises important questions: Will the increased use of payment cards lead to the disappearance of cash? How is monetary policy affected? To answer these questions, it is important to assess the current and future extent of cash substitution through payment cards.

Although it is debated whether cash will ever be completely replaced by payment cards[1], even a partial substitution of cash has consequences for central banks: On the one hand, cash substitution directly affects seigniorage income. Although the contemporaneous impact of payment cards on seigniorage is limited, the discounted sum of the loss of future seigniorage incomes can be quite substantial. On the other hand, the extent of cash substitution through card payments has monetary policy implications. For example, Markose and Loke (2003) argue that the interest rate sensitivity of cash card substitution can magnify if the degree of card network coverage increases. In low interest rate regimes this can lead to situation in which "…interest rate rises (cuts) targeted at curbing (expanding) bank lending may prove to be difficult" (ibid, p. 473). Also, Markose and Loke (2001) attribute the decline in deposit interest rates observed over the recent years to the permanent decline in transaction cash balances caused by the usage of alternative payment media.

Despite the growing importance of payment cards in general and debit cards in particular, there are relatively few studies that analyze the extent of cash-card substitution in Europe. The findings of this literature are more or less unambiguous for the effect of payment cards, where a negative impact on cash demand is found. However, the results are more inconclusive concerning the effect of the ATM network on cash demand where some studies report a negative, others a positive effect. What is common to most empirical studies in this field is that they apply time series or panel data analysis and thus measure the impact of payment cards on an aggregate level.

It will be argued in this paper that estimation of the impact of payment cards on cash demand via an aggregate time series approach has some limitations. Among other

[1] For example, see Drehmanfn, Goodhart and Krueger (2002) or Markose and Loke (2003).

things, a macro-econometric approach requires the assumption of a stable (log-)linear currency demand function. Anecdotal evidence from the run up to the introduction of euro cash as well as evidence from the literature suggests that foreign demand and hoardings which constitute by far the largest share of total currency demand fluctuate over time. We think that the presence of such fluctuations in large components of currency demand that can only barely be controlled for may make it very difficult to isolate fluctuations caused by payment and ATM cards in a small component such as currency demanded for transaction purposes.[2] Also, due to the lack of data, the effect of relatively new technologies like electronic purses might be difficult to estimate.

Therefore, this paper contributes to the literature by analyzing the relationship between debit cards and a direct measure of transaction cash demand on the basis of micro data. In particular, the paper presents new evidence on the impact of EFT-POS payments and ATM withdrawals on the average amount of cash that is held in the purse. Also, projections about the future development are given. In the empirical approach we account for sample selectivity.

The data set used in this study is derived from a survey from fall 2002 about Austrian individuals. The significance of results for Austria for other European countries derives from several facts about the current development of the payment system and debit cards market in Austria[3]: First, the share of cash based transactions is rather high in Austria (about 80 percent). Second, an international comparison among EU countries using data from 2000 yields that Austria is among the countries with the highest ATM density (rank 4 out of 15).[4] However, at the same time, Austria is ranked among the countries with the fewest number of ATM transactions per capita (rank 12 out of 14). Third, the EFT-POS network is very immature both according to the number of terminals (rank 14 out of 14) and the average number of transactions per capita undertaken with debit cards (11 out of 15). Thus, evidence about the effect of EFT-POS payments and ATM withdrawals obtained for Austria may indicate the possible extent of cash card

[2] For example, in the run-up to the introduction of euro cash currency in circulation fell by substantial amounts while the number of payment cards increased. A regression with currency in circulation as the dependent variable and, among other variables, the number of payment cards as the independent variable could point to a significant negative relationship. However, it is well known that foreign demand and the stock of currency held for hoarding purposes decreased substantially during 2000.

[3] We focus on debit cards because debit card payments have obtained a high market share at the point-of-sale in Austria. For example, Mooslechner, Stix and Wagner (2002) report that already 11 percent of point-of-sale expenditures (in value terms) are settled with debit cards.

[4] The data are taken from www.ecb.int (Section: Payment and Securities Settlement Systems in the European Union, Blue Book, third edition, 2001 - Addendum incorporating 2000 figures).

substitution also for other countries which are in a similar stage of development. For the number of ATM transactions, Austria is comparable to Greece and Italy. For the number of EFT-POS transactions, Austria is in a similar stage of development as Germany, Ireland, Spain and Italy.

The remainder of the paper is organized as follows: The empirical literature is briefly summarized in Section 2. Some implications for choosing an empirical model which follow from the literature and from some stylized facts about the Austrian EFT-POS and ATM network are discussed in Section 3. The empirical framework and the data set and variables are presented in Section 4 and 5, respectively. Estimation results are summarized in Section 6. Section 7 concludes.

2. Do Payment Cards Affect Money Demand? Evidence from the Literature

In estimating the effect of payment cards on money demand, a log-linear money demand specification of the form $y = f(X, r, Card)$ is assumed as a theoretical starting point. Typically, a variant of this equation is estimated in the empirical literature either along a times series or along a cross-sectional dimension.

In the time series approach, y typically represents the log of currency in circulation, X an appropriate scale variables like income or wealth, r a measure of the opportunity cost of money holdings. $Card$ typically contains several variables measuring payment card "intensity", usually approximated by the number of outstanding payment cards, the number of EFT-POS terminals or the number of ATMs. Within the times series approach some researchers focus on panel data models while others estimate pure time series models.

For example, Rinaldi (2001) analyzes the effect of credit and debit cards, EFT-POS terminals and ATMs on Belgian currency in circulation net of hoarding. She assumes that y, X, r and $Card$ are non-stationary. Furthermore, tests show that these variables are cointegrated. In this long-run equilibrium relationship, the number of EFT-POS terminals and the number of ATMs have a negative impact on currency in circulation while a weak positive effect is found for the number of payment cards. Rinaldi (2001) also estimates an error-correction model in which the number of ATMs is found to have a positive short-run effect on currency demand.

Snellman, Vesala and Humphrey (2001) conduct a panel study for ten European countries and find an insignificant effect of the number of (both debit and charge) cards and a significantly negative effect of EFT-POS terminals and ATMs where the negative effect of ATMs is more than twice as large as the effect of EFT-POS terminals. For forecasting purposes, Snellman, Vesala and Humphrey (2001) apply Gompertz S-curve analyses that account for product-cycle nonlinearities. Their findings suggest that cash transactions account for about 60 percent of the value of point-of-sale payments in countries with a mature card payment network, like Finland and France. In other countries with a high cash share at the point-of-sale and relatively immature card payment networks, the cash share is significantly higher but projected to slowly decrease due to the impact of payment cards.[5]

Drehmann, Goodhart and Krueger (2002) analyze a panel of 16 OECD countries. Apart from payment card variables they also include "bad behavior" variables which proxy the grey and black economy. Furthermore, Drehmann, Goodhart and Krueger (2002) differentiate between the impact of payment cards on small and large bill circulation. Overall, no significant effect of the number of EFT-POS terminals or the number of ATMs on cash demand is found.

In contrast, Duca and Whitesell (1995) and Blanchflower, Evans and Oswald (1998), follow a cross-sectional approach when, on the basis of U.S. household survey data, analyzing the effect of credit cards on the demand for various balances at banks (like checking balances). In these studies, y represents the log of bank balances, X a matrix containing scale variables as well as socio-economic variables controlling for individual characteristics and $Card$ is a dummy variable for credit card ownership.

Duca and Whitesell (1995) find that credit card ownership is associated with lower checking and money balances. For example, a 10 percent increase in the probability of having a card reduces checking balances by 9 percent. One important contribution of Duca and Whitesell (1995) is to highlight the necessity of taking endogeneity and sample selection effects into account when dealing with survey data. This arises for example, if credit card holders have a higher propensity to consume out of income which increases both the amount held in checking accounts and the likelihood of card ownership. Since the propensity to consume is not observable, the error terms in both

[5] The forecasted cash shares for the year 2006 at the point-of-sale for "high cash" share countries are in a range from about 80 to 95% (Snellman, Vesala and Humphrey, 2001).

the money demand equation and a credit card equation will be correlated which renders the parameter estimates in the money demand equation inconsistent if this correlation is not taken into account. A related model is presented in Blanchflower, Evans and Oswald (1998) who also report a negative and sizeable effect of credit card ownership on checking balances of U.S. citizens.

A detailed discussion and many interesting empirical results about the effect of various non-cash payment instruments on cash demand for the Netherlands is presented in Boeschoten (1992). On the basis of data derived from household surveys, the latest conducted in 1990, Boeschoten (1992) analyzes how the use of ATMs, checks, credit cards and debit cards affects various measures of cash demand. In contrast to the other two cross-sectional studies discussed above, no sample selection effects are taken into account in this analysis. For the amount of cash typically held in the purse, Boeschoten reports that the coefficient of a dummy variable measuring ATM usage (usage once per week or more frequently) is negative but insignificant. Similarly, debit card usage does not significantly affect purse cash demand. When, instead of focusing on purse cash demand, a broader measure of cash demand is analyzed, Boeschoten reports that frequent debit card payments as well as frequent ATM withdrawals reduce average cash holdings by 15% and 18%, respectively.

Another important study that analyzes European data is Attanasio, Jappelli and Guiso (2002) who estimate a money demand equation for Italian households accounting for sample selectivity. Their focus lies on the question whether the welfare cost of inflation is different for card holders and non-holders. The estimation results show that ATM users hold significantly lower cash balances than non-users where cash balances are measured broadly, including cash held at home. However, the size of this effect is not quantified.

3. Implications from the Literature and from the Payment Card Data

What are the implications that can be derived from existing empirical studies for choosing an estimation approach? In the following, we discuss five issues:

(i) the effect of nonlinearities and the quality of the proxies used in time series approaches;

(ii) the degree of substitution among non-cash payment instruments;

(iii) the effect of ATMs on cash demand;

(iv) the implications of using an aggregate measure of currency in circulation as a proxy for demand for transaction balances;

(v) the stability of the functional relationship for currency demand over time.

(i) Hardware variables, like the number of outstanding debit cards, the number of EFT-POS terminals or ATMs, are typically used in time series models as proxies for actual transaction volume. In Figure 1 and 2, these hardware variables are plotted against the relevant transaction volume using Austrian data.

Figure 1, which shows the relationship between the number of ATM cards and EFT-POS transaction volume on the one hand and ATM withdrawal volume on the other hand, clearly reveals the presence of nonlinearities, most likely reflecting product-cycle effects. At an early stage of innovation (relatively low number of outstanding cards) ATM or EFT-POS volume is low.[6] Higher growth rates are achieved after some threshold level is reached. At high levels of market penetration, growth rates of transaction volume slow down again. Thus, Figure 1 suggests that the number of cards might not be a good proxy for transaction volume which, in turn, might explain why the number of outstanding cards typically yields ambiguous or insignificant results when included in empirical time series models.[7]

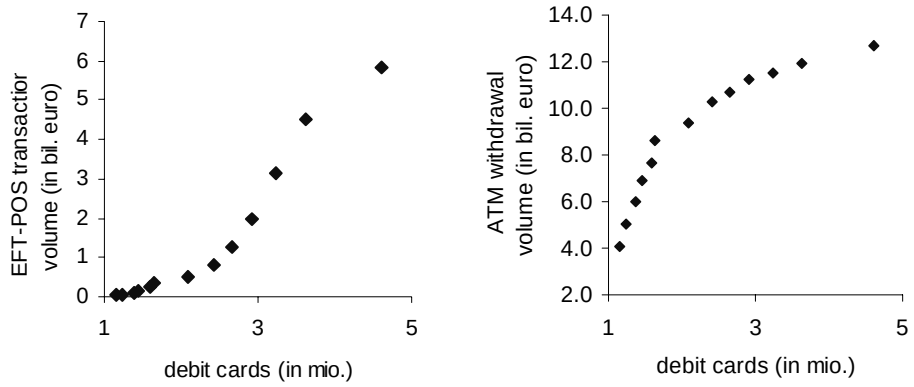
As discussed, in almost all time series empirical approaches significant effects are found for the number of EFT-POS terminals. In fact, the scatter plot in Figure 2

[6] Due to data constraints, there is a missing "flat part" in the product cycle relationship between debit cards and ATM withdrawal volume in Figure 1 (right panel).

[7] This is also represented by relatively low bivariate correlation coefficients between the number of cards and EFT-POS transaction volume (0.78).

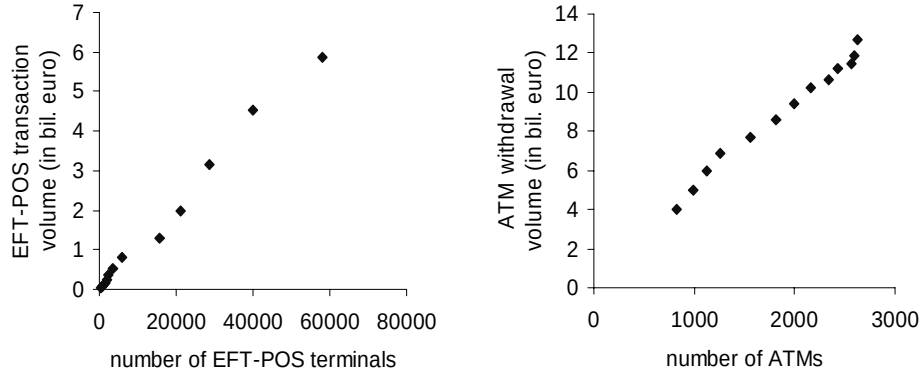
suggests that the number of EFT-POS terminals or the number of ATMs is a much better proxy for transaction volume.[8]

Figure 1.



Note: The figures show Austrian annual data from 1989 to 2001.

Figure 2.



Note: The figures show Austrian annual data from 1989 to 2001.

Although a linear relationship between the hardware variables and transaction volume seems to be a reasonable approximation, one can nevertheless detect some indications for the presence of nonlinearities. For the number of EFT-POS terminals there is a change in the slope at low levels of EFT-POS terminals. For ATM terminals, market saturation seems to have been reached while the volume of ATM withdrawals is still growing. In particular, the latter effect is important for forecasting purposes. Using

[8] The bivariate correlation coefficients between the number of ATM or EFT-POS terminals and the corresponding transaction measure is 0.99.

point estimates derived from an linear model for forecasting the effect of ATM volume on cash demand can clearly be misleading.[9, 10]

In some empirical papers, the number of cards, ATMs and EFT-POS terminals are jointly used as explanatory variables. An analysis of the data shown in Figure 1 and 2 suggests, that joint inclusion of these variables, at least for the Austrian case, ought to be used carefully if a time series approach is followed. The reason for this is that the correlation between the number of cards and the remaining two variables is 0.93, most likely causing serious problems with collinearity.

(ii) In historical perspective, there is not only substitution among cash and cards but also within non-cash payment means. For example, in many European countries checks were the most important cash substitute with a sizeable market share up to the 90s. This share subsequently declined to almost zero in the last years while the use of debit cards increased. Despite the importance of checks for money demand in the past, typically check payments are not taken into account in empirical money demand specification.

Similar effects can arise for payment cards. For example, Mooslechner, Stix and Wagner (2002) report for Austria that the share of credit card payments on total payments decreased from 1996 to 2000 while at the same time the share of debit card payments increased (while the number of both debit and credit cards has increased).[11] In this case, aggregation of both types of cards into one single category (e.g. the number of debit and credit cards), as is sometimes done in empirical analyses, would underestimate the role of debit cards.

(iii) Concerning the effect of ATMs on cash demand one line of reasoning suggests that the existence of ATMs reduces cash demand because individuals can minimize the opportunity costs of idle cash balances. An alternative view holds that ATMs facilitate the use of cash and the ATM network thus may increase cash demand. On balance, the empirical literature does not yield a clear prediction about the size of the effect of ATMs on cash demand: While some studies report a negative effect on cash demand (e.g. Snellman, Vesala and Humphrey, 2001; Attanasio, Jappelli and Guiso, 2002)

[9] Consequently, Snellman, Vesala and Humphrey (2001) use S-curve analysis for forecasting purposes.
[10] The fact that the number of cards, of ATMs and of EFT-POS terminals is bounded has implications for the time series properties of these series (e.g. whether it is reasonable to assume that these variables have a unit root).

others find that cash holdings actually increased with or remained unaffected by the use of ATMs (e.g. Drehmann, Goodhart and Krueger, 2002).

In particular, both findings could be rationalized if there are two groups in the population, one using ATMs frequently and one using ATMs less frequently. For the first group, cash demand decreases while for the latter it remains unaffected (or even increases slightly). In a time series study, the observable aggregate effect would represent a weighted average of the effect of both groups (the magnitude of the change in cash balances caused by ATMs for each group multiplied by their relative size). If, for example, both effects cancel, then a macro-econometric study will not be able to detect an effect even if there is one at an individual level.

(iv) Cash demand for transaction purposes constitutes only a small fraction of currency in circulation, which is usually used as the dependent variable. Unpublished estimates from the Oesterreichische Nationalbank in preparation of the cash changeover indicate that the share of cash held for transaction purposes is only about 10 percent of currency in circulation. In contrast, the share of currency held for hoarding and black market activities on the one hand and the share of currency circulating abroad on the other hand are estimated to be around 55 percent and 15 percent, respectively. This finding of a low share of transaction cash seems to hold also in other countries.[12] This suggests that it might potentially be difficult to identify a close relationship between transaction cash demand and debit card usage because fluctuations in larger components of currency in circulation, like foreign demand, might dominate overall movements in currency in circulation.[13]

(v) Finally, an important assumption in time series studies is that the money demand function is stable over time. However, due to substitution effects between currency and elements contained in M1, the stability of money demand for narrow monetary aggregates, like currency in circulation, is much less likely than the stability of broader monetary aggregates (e.g. Fase, 1994).

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[11] Since checking accounts may be overdrafted, debit cards have a credit function in Austria, suggesting that credit cards and debit cards are to some extent substitutes. In fact, the results from a survey summarized in Mooslechner, Stix and Wagner (2002) about actual payments made by Austrians show that the mean payments made by debit and credit cards were very close (570 ATS and 604 ATS, respectively).

[12] For example, in a related study made at the Bank of Finland (Paunonen and Jyrkönen, 2002) cash used for transaction purposes is estimated to have a share of about 10% of currency in circulation.

[13] For example, Doyle (2000) finds that foreign currency demand for the US dollar, the D-mark and the Swiss franc varies sizeably over time.

Overall, the above discussion suggests that some important aspects of card usage cannot be detected on a macroeconomic level (substitution among non-cash payment means) and that currency in circulation as a measure of transaction cash balances might be dominated by fluctuations that are not caused by card payments. Furthermore, the modeling of the relationship between cash demand and payment cards in a time series context might have some limitations because cash demand is unlikely to be stable over time or because of the presence of product-cycle nonlinearities. Therefore, we think that an analysis of the relationship between debit cards and cash demand based on a micro-econometric perspective can yield insightful results. Such an approach would allow to study the effect of debit cards on cash demand at a particular point in time and to work with a direct measure of transaction cash demand.[14] Furthermore, the microeconometric literature suggests that sample selection effects are likely to be important and should thus be taken into account in an empirical approach.

4. Estimation Method

Consequently, the following log-linear money demand model is estimated,

$$y_i = \beta' \cdot x_i + \gamma' \cdot z_i + u_i \qquad (\forall \text{i}) \tag{1}$$

where y_i represents cash holdings of respondent i, x_i is a vector of explanatory variables, and u_i is an error term. In the empirical section, equation (1) will be estimated for individuals who possess a debit card. The variables that are included in the vector z_i depend on the estimated model. Typically, z_i contains various dummy variables measuring how often an individual is using the card to pay and to withdraw money from an ATM.

In principle, equation (1) can also be estimated for all individuals (owners and non-owners). Restricting the sample to debit card owners is more appropriate if the parameter vector β is different for card holders and non-holders. Evidence obtained in Attanasio, Jappelli and Guiso (2002) suggests that this is likely to be the case. Furthermore, since the card usage frequencies are only observed for card holders, it seems natural to restrict the sample to debit card owners.

[14] Of course, also in a cross-section there can be nonlinearities. However, these are of a different type than product cycle and network nonlinearities that occur over time.

The decision to hold a card is described by the following probit-type specification,

$$\text{card}^*_i = \delta' \cdot v_i + \varepsilon_i \qquad (\text{i} = 1,2,\ldots \text{n}) \tag{2}$$

where $card^*$ is a latent variable for card ownership. It is assumed that individuals hold a card only if the benefits from card ownership are greater than its costs. In this interpretation, $card^*$ measures the unobserved net benefit from card ownership. The observed counterpart to $card^*$ is whether an individual holds or does not hold a card. That is, we observe $\text{card} = 1$ if $\text{card}^* > 0$ and $\text{card} = 0$ if $\text{card}^* \leq 0$. The vector of explanatory variables v_i contains socio-demographic variables as well as other variables that affect card ownership but not cash demand.

The parameter estimate $\hat{\gamma}$ in equation (1) measures the impact of card usage on the level of average cash balances. If individuals self-select into card owners and non-owners, then selectivity bias arises. This may be the case if the unobserved or omitted components behind the decision to have a card and the unobserved or omitted components that determine the level of cash balances are correlated. As mentioned, Duca and Whitesell (1995) suggest that a positive correlation could arise if a higher propensity to consume out of income leads to both a higher propensity to hold a card and larger cash balances. In turn, a negative correlation could arise if a higher propensity to use non-cash payment services (e.g. via banks) leads to both a higher propensity to obtain a card and to lower cash balances.

To account for the potential correlation between u_i and ε_i it is assumed that the errors in equation (1) and (2) are distributed according to a bivariate standard normal distribution with correlation ρ,

$$\varepsilon, u \sim N(0, 0, \sigma^2, 1, \rho). \tag{3}$$

If ρ is significantly different from zero, the complete sample selection model given by equations (1), (2) and (3) will be estimated jointly by full information maximum likelihood. The parameters that need to be estimated are the elements in the vectors β, γ and δ, as well as σ^2 and ρ. In order to identify the model, there needs to be at least one variable in v_i not contained in x_i (Maddala, 1992).

The marginal effect of variables that appear both in equation (1) and (2) in the sample selection model is different from the marginal effect of the single equation OLS model. For example, if the log of income affects both the decision to hold a card and

cash balances, then the overall marginal effect of income on cash demand can be decomposed into the sum of the direct effect from equation (1) plus the indirect effect from equation (2). If it is for simplicity assumed that v_i and x_i contain the same variables, then, as shown in Greene (2002), the composite marginal effect is given by,

$$\frac{\partial E[y_i \mid x_i,\ \text{card}=1]}{\partial x_i} = \beta + \rho \cdot \sigma \cdot (-\lambda_i \cdot \delta' \cdot v_i - \lambda_i^2) \cdot \delta, \qquad (4)$$

where λ_i is the inverse Mills ratio.

Since the term in parentheses is always negative, the sign of the indirect effect from the selection equation (the second term on the right hand side) depends on the correlation between ε_i and u_i. In general, all variables contained in the card-probit equation (2) also affect--- indirectly via their effect on the inverse Mills ratio---cash balances even if they do not appear in equation (1).

A final remark concerns the appropriate variance-covariance matrix for survey data: Since the individuals that are selected in the surveys are chosen according to a clustered random sampling procedure, individuals are not sampled independently.[15] If this violation of the classical regression assumption in equation (1) and (2) is not taken into account, then the estimated standard errors will be inappropriate. Therefore, the reported standard errors are corrected for clustering. Typically, accounting for clustering yields larger standard errors in comparison to the unadjusted variance-covariance matrix.

5. Data and Variables

5.1. Data Description

The data source for this study is derived from a combination of two representative surveys undertaken in August and November 2002 in Austria and commissioned by the Oesterreichische Nationalbank among 4000 individuals above the age of 15. The focus of the surveys is on ownership and usage of non-cash payment means. Also, the surveys contain information on purse cash balances. The data used is cleaned, eliminating all person without own income and persons without answers to some key questions for this

[15] Broadly described the sample is constructed as follows: first all counties are sampled within Austria, then all districts within counties, then cities within districts (if the city is large: then streets within cities). Although sampling is random within the street and then the household, observations within a particular street are not independent. For example, if a working class street was sampled than income would be lower for all households in that street than if a rich neighbourhood was sampled.

study, typically leaving about 2500 individuals. Table A1 in the Appendix presents some summary statistics for the most relevant variables.

5.2. Money Demand Variables

The dependent variable in the cash demand model is the logarithm of the average amount of cash held in the purse. The question asked is: "On a typical day, how much money do you usually carry with you?" Answers to this question give subjective estimates of the average stock of purse cash which, as is hypothesized, is directly affected by EFT-POS payments and ATM withdrawals.

Furthermore, money demand is modeled as depending on a scale variable and various socio-demographic factors. As a measure of transactions we use the logarithm of personal net income (LINCOME).[16] If there are more than two persons in the household or if a persons does not obtain income, then the actual transaction value of this person could be badly approximated by our scale variable. To control for this effect, we therefore exclude all persons without own income and account for the household size (LHHSIZE) as well as for the fact whether a person is the household head (MAINEARN). Additionally, wealth could be an important determinant of cash balances (Duca and Whitesell, 1995). Because we do not have direct data about respondents' wealth, we are limited to proxy wealth by several dummy variables: whether an individual is a home (HOME) or a secondary home owner (SECOND HOME), whether an individual owns stocks (STOCKS), bonds, other assets (ASSETS), whether an individual has a private pension plan (PRIVATE PENSION), a private health insurance (PRIVATE HEALTH) or a savings account (SAVINGS ACC.).[17]

The group of socio-demographic variables comprises: age (AGE), age squared (AGE2), sex (MALE), education (EDU LOW, EDU MED., EDU HI.) and whether kids below the age of 15 years live in the same household (KIDS). Furthermore, occupational dummies are included in the regression. A persons can either be employed, unemployed (UNEMP), retired (RETRIRED) or in education (IN EDU). If the individual is employed then either as a manager in a leading or top position (JOB TP), as a blue (JOB BC) or as a white collar worker (JOB WC). Furthermore, a person can be an owner of a small business (JOB SMALL) or a farmer (FARM).

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[16] For a detailed definition of variables, the reader is referred to the appendix.
[17] In an international comparison, Austria has a comprehensive public health and public pension system. Therefore, the existence of a private health insurance and a private pension plan can proxy wealth.

Also, regional dummies are included (for Bundeslaender) and it is differentiated whether a persons lives in a city, a small city, a village or a small village. These variables might reflect differences in the EFT-POS network density or other differences between urban and rural areas.

5.3. Additional Debit Card Variables

In principle, all socio-demographic variables described above might also affect the probability of card ownership and consequently, are included in the specification search. As argued, to identify the model, there needs to be at least one variable in the card probit equation that is uncorrelated with cash holdings. As plausible candidates, several dummy variables are considered that measure whether an individual uses bank services. Such variables are account ownership (ACCOUNT), whether a person uses telephone banking (TELEBANK), internet banking, pre-authorized transfer (PRE-TRANSFER), direct debit (DIRECT), whether an individual transfers money, pays by carrying money to the bank and then transfers the amount (SLIPS) or owns other payment cards (OTHER CARDS).[18] Similar to Attanasio, Jappelli and Guiso (2002) we also consider the logarithm of the number of ATMs (LATMS) in the province as an instrument. This variable should measure the supply side effect of the ATM network.

The dependent variable in the debit card probit is a dummy variable (DEBIT CARD) obtained from the following question: "Do you personally possess a debit card?" If a person has a debit card, then it is asked how often he or she uses it to for EFT-POS payments. Here the answers are "several times per week" (PAYS F for "pays frequently"), "about once per week" PAYS W), "at least once per month" (PAYS M), "less" (PAYS L) and "never" (PAYS N).[19] Similarly, information is available for usage of ATMs. Correspondingly, the variables are labeled ATM F, etc.

5.4. The Austrian Debit Card Market and Some Stylized Facts about Card Usage

In Austria, the EFT-POS and ATM market is characterized by an agreement of competing commercial banks to operate a centralized network. In particular, the EFT-POS and ATM network is technically operated by a company which is jointly owned by

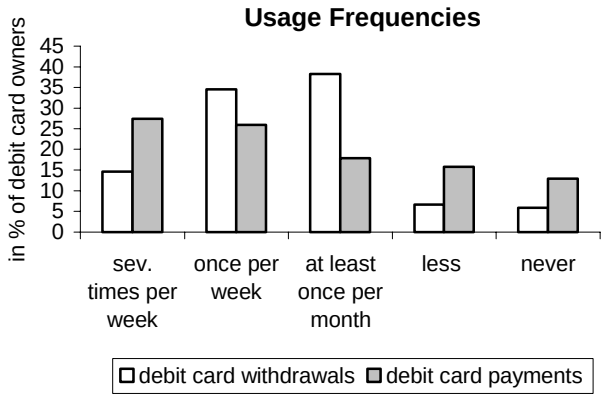
[18] Since it is possible to have a debit card that draws on a different persons' account, account ownership is no prerequisite for obtaining a debit card.
[19] The dummies are defined in an exclusive way. "Several times per month" thus means several times per month but less than once per week.

Austrian banks and the central bank of Austria, while commercially it is operated by another company (Europay Austria) which is owned by commercial banks alone. For example, Europay Austria holds all contracts with retailers who have EFT-POS terminals and it controls interbank fees for ATM usage. Also, Europay Austria is responsible for the product management (centralized marketing) of all debit cards regardless of the card issuer (which are individual banks).

There are no direct withdrawal or payment fees associated with debit cards usage for customers (for payments the retailer has to bear a disagio). However, transaction fees arise indirectly via the checking account. These costs can take various forms, ranging from line fees for each transaction that is printed on an account statement to flat rates with an unlimited number of transactions per period.[20] However, these transaction costs are not special to ATM withdrawals or EFT-POS payments. They also apply to cash withdrawals at the bank or the use of other non-cash payment means.

In Figure 3 the EFT-POS payment and ATM withdrawal frequencies derived from our sample are shown. In total, 13% of the debit card owners in the sample never use their card for EFT-POS payments while about 27% (26%) use it several times per week (once per week). The fact that 73% use it less frequently than several times per week for payment purposes demonstrates that EFT-POS payments still are far from being accepted as a full alternative to cash payments.

Figure 3.



The vast majority of debit cards owners (73%) withdraws cash from ATMs at least once per month. The share of those never withdrawing is about half the share of those

[20] Also, there is an annual fee for the card. This fee can be included in the period flat rate of one account type while in another type the card has to be paid separately.

never paying which possibly can be explained by the (relative) maturity of the ATM in comparison to the EFT-POS network.

Concerning the usage frequencies and transactions volume of EFT-POS payments and ATM withdrawals we have collected actual population data.[21] In September 2002, about 11 million EFT-POS payment transactions and 8 million ATM withdrawals took place. This implies a per capita per month transaction ratio of 1.4 for EFT-POS payments and 1.0 for ATM withdrawals, thus reflecting, by and large, the sample usage frequencies. The population data also yield that the average EFT-POS payment was 52 euro and the average ATM withdrawal 124 euro.

Table 1 summarizes data from the surveys about the average purse cash balances. The figures show that average cash balances for frequent EFT-POS users (those using it several times per week) are sizeably lower than for infrequent users.

Table 1.

	Average purse cash balances for those who pay...
several times per week	69
once per week	79
at least once per month	83
less	91
never	81

Note: The table shows the sample means of cash balances for various EFT-POS usage frequencies.

Whether these differences in cash balances are caused by different debit card usage frequencies or whether they just reflect differences in personal characteristics (e.g. frequent users are younger and therefore have lower cash balances) needs to be analyzed in a multivariate setting.

6. Results

Table A2 summarizes the results from estimating a log-linear cash demand equation for card owners by ordinary least squares (column I). Also, the results of the purse cash demand equation for the sample selection model (SS model) estimated by maximum likelihood are shown (column II). The results for the selection equation of the SS model

[21] We thank Europay Austria for providing these data.

are summarized in Table A3. The reported specifications represent a parsimonious model obtained after a general-to-specific specification search has been applied.[22]

As can be seen in column II, the point estimate for the correlation between the errors of the cash demand and the debit card probit ρ, is negative and significant at a 1% level. This implies that a higher than expected probability of holding a card is associated with lower than expected cash balances. The negative correlation might reflect the omission of an unobserved variable like propensity to use cashless payment services which is associated with a higher likelihood of obtaining a card and lower cash balances.

The significant correlation between the error terms implies that OLS is inappropriate. Not only are the OLS estimates inconsistent but also the preferred model is different, as a comparison of the OLS with the SS model reveals. For example, private health insurance or possession of other payment cards influences cash demand in the OLS model. In the SS model, both variables affect the probability of card ownership but not cash demand. Furthermore, the point estimates for some variables that also enter the debit card probit equation are somewhat different. Given the finding that sample selectivity is important we choose the SS model in column II as the starting point for the subsequent analysis. In the following, the results from the card probit (Table A3) and then those from the cash demand equation (Table A2) are discussed.

6.1. Card Probit Results

The debit card probit equation in the full system generally fits quite well: The probit equation classifies 90% of card owners and 54% of non-owners correctly. The point estimates shows that the probability of card ownership depends positively on income and on two dummy variables which approximate wealth (private health insurance, private pension plan). Evaluating the probit index function at the sample mean of the variables yields that a 1% increase in income is associated with a 0.1% increases in the probability of card ownership. The coefficients for age squared, kids and males all have the expected sign. Since household heads (MAINEARN) have the highest income in their families, the negative coefficient for this variable reflects the effect of family income. Individuals who are not the main earner in their household have a higher probability of card ownership (for a given level of personal income) because family

[22] In the specification search all individually insignificant variables were excluded.

income is higher than indicated by personal income. High and medium educated (relative to low educated) have a higher likelihood of debit card ownership. Furthermore, persons who are in education (IN EDU) have a higher likelihood of debit card ownership than blue collar workers (the reference group). Expectedly, individuals who take cash to the bank and pay with payment slips at the bank branch have a lower likelihood of card ownership.

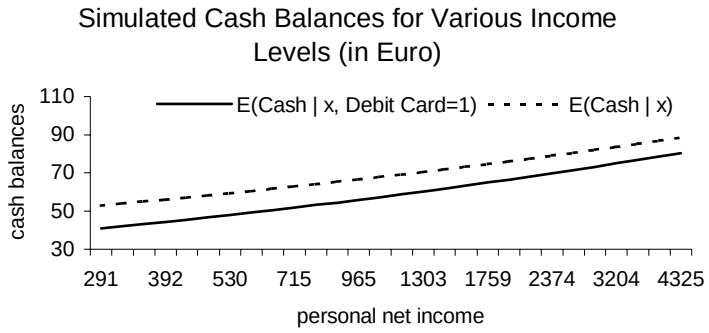
Reassuringly, the variables that were discussed as candidates for model identification enter the card probit significantly but not the cash demand equation. For example, account ownership, usage of pre-authorized transfer services or possession of other payment cards are positively associated with card ownership. In contrast, the number of ATMs in the province is insignificant and therefore excluded from the preferred specification.

Having discussed the variables that affect card ownership we now turn to the determinants of purse cash holdings.

6.2. Cash Demand Results

The point estimates from the cash demand equation (Table A2, column II) imply an income elasticity of cash of 0.19. However, as discussed, this reflects only the direct effect. Evaluating equation (4) at the sample mean yields that the indirect effect stemming from the positive coefficient of income in the card probit equation is 0.06. Thus, in sum, the elasticity of cash balances with respect to income is about 0.25 implying strong economies of scale for cash balances. As in Boeschoten (1992), who reports income elasticities in about the same range, this point estimate is lower than 0.5, the value implied by "square-root formula" (Baumol, 1952). A coefficient lower than 0.5 might, as suggested in Boeschoten (1992), either reflect the presence of uncertainty or a deviation from the implicit assumption of equally spaced expenditures between cash acquisitions in Baumol's (1952) model.

Figure 4.



The responsiveness of cash balances to income is depicted in Figure 4. This figure shows the predicted cash balances implied by the point estimates in column II of Table A2 for various levels of personal net income. The dotted line represents the predicted values obtained when equation (1) is evaluated at the sample means. Thus, the correlation between the money demand and the card probit equation is ignored. In contrast, due to the negative correlation between the errors in the two equations, the predicted values are lower if this correlation is taken into account (solid line).[23] Furthermore, the solid line is slightly steeper than the dotted line because of the presence of the indirect effect arising from the card probit equation.

Among the variables considered as approximating wealth, ownership of a home, stocks and a savings account enter the cash demand equation significantly. Other important variables in the cash demand equation are: Age, AGE<20 and AGE2030 enter significantly and with opposite signs. This suggests that older people hold more cash than younger people. For persons between 20 and 30 or those below 20 the linear relationship is segmented, implying that these respondents hold even less cash than implied by the linear age-cash relationship. Males, farmers, and owners of small businesses hold higher cash balances. For example, the amount of cash held by farmers (small business owners) is on average 65% (36%) higher than that of blue collar workers.[24] The strong positive coefficient for owners of small businesses might reflect income effects not controlled for by LINCOME while that for farmers can be explained by the traditional predominance of cash in farm expenditures. Household heads hold lower cash balances, again reflecting the effect of family income. The effect of family

[23] The predictions are calculated as $E[y_i \mid x_i]=\hat{\beta} \cdot x_i$ and $E[y_i \mid x_i, \text{ debit card=1}]=\hat{\beta} \cdot x_i + (\hat{\rho} \cdot \hat{\sigma}) \cdot \lambda_i$, where λ_i is the inverse Mill's ratio and the parameters are replaced by their estimates.
[24] Calculated as exp(1.5)/exp(1)=1.65.

size is negative while families with kids below the age of 15 hold higher cash balances. As expected, respondents who make payments by cash (SLIPS) hold higher cash balances than non-users.

6.3. Debit Card Usage

In a next step, card usage variables are added to the sample selection model. Column I in Table A4 shows the point estimates for the preferred purse cash demand equation amended by two dummy variables---one for those who use their debit card to pay (PAYS) and another one for those that withdraw money from ATMs (WITHDRAWS).[25] Both variables are insignificantly different from zero. Thus, for an average individual with an average usage frequency, purse cash demand is not significantly affected by EFT-POS payments or ATM withdrawals.

The results obtained from differentiating individuals along usage frequencies are shown in column II of Table A4. For both ATM withdrawals and EFT-POS payments four dummy variables measure the effect of different usage frequencies on cash demand relative to someone who uses the card several times per week (frequent user).[26] Such a differentiation serves two purposes. First, it allows to assess whether individuals who use the card more frequently hold less cash than individuals who use the card less frequently (whether there are significant differences relative to the reference group). And second, it is possible to analyze whether there are statistical differences between different usage frequencies (e.g. between someone using the card less than once per month and someone using it once per week).

As can be seen, all coefficients are highly significant, mostly at a 1% level indicating that there are substantial differences between individuals with different usage frequencies. The percentage differences implied by the point estimates of the EFT-POS payment frequency dummies are summarized in Table 2. The most sizeable difference is found between someone who uses the card less than once per month and frequent users (several times per week). Cash balances are 23% lower for the latter relative to the former, ceteris paribus. Relative to someone who uses the card once per week or at least once per month, cash balances for frequent users are estimated to be about 20% lower.

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[25] Because the card probit results are very similar to those presented in Table A3, the estimates are not reported. The estimates are available from the author upon request.

[26] The choice of the reference dummy is arbitrary. Since we have opted for PAYS F (ATM F), all other dummy coefficients measure the impact relative to this base dummy.

Table 2. Implied Change in Cash Balances for EFT-POS Payment Frequencies

	Implied Percentage Difference in Cash Balances	Significance
pays frequently relative to pays very infrequently (less than once per month)	-23%	***
pays frequently relative to pays at least once per months (but less than once per week)	-20%	***
pays frequently relative to once per week	-19%	***

Note: The numbers give the percentage differences in cash balances between individuals with different EFT-POS usage frequencies implied by the point estimates in column II of Table A4. *** indicate whether the difference is statistically significant at the 1% level. Significance levels are derived from standard errors in Table A4.

Wald tests about the equality of the dummy coefficients show that there are no significant differences in cash holdings for users how pay never, less than once per month, at least once per month and once per week. This implies that only those who pay very frequently are found to have significantly lower purse cash balances. For all others, purse cash demand is unaffected by debit card usage, statistically.

To check for the robustness of the results, the model in column II has been estimated for various sub-samples (only for EFT-POS users, excluding those with top incomes, those with high cash balances and those with low and high cash balances). All regressions yield qualitatively very similar results and do not affect the baseline finding, namely that frequent EFT-POS users hold substantially lower cash balances relative to infrequent users.

Similar to the finding for EFT-POS payments, the coefficients of the dummies measuring ATM withdrawals are highly significant both from a statistical and from an economic perspective. The implied percentage differences are summarized in Table 3. Interestingly, the point estimates imply a hump shaped pattern along usage frequencies. Cash holdings increase from ATM non-users to those that withdraw at least once per month and decrease for those with higher withdrawal frequencies. For example, individuals who withdraw cash several times per week hold about 23% less cash than individuals who withdraw at least once per month. Frequent ATM usage reduces purse cash demand by 15% relative to once per week withdrawals. In contrast to EFT-POS payments, one significant difference among the dummy variables is found: those withdrawing once per week hold 10% less purse cash than those withdrawing at least once per month.

Table 3. Implied Change in Cash Balances

	Implied Percentage Difference in Cash Balances	Significance
withdraws frequently relative to withdraws never	-19%	**
withdraws frequently relative to withdraws less than once per month	-21%	***
withdraws frequently relative to withdraws at least once per month (but less than once per week)	-23%	***
withdraws frequently relative to withdraws once per week	-15%	***

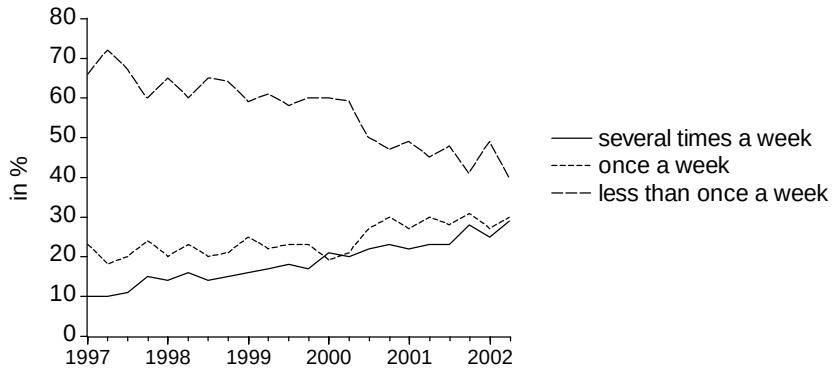
Note: The numbers give the percentage differences in cash balances between individuals with different ATM usage frequencies implied by the point estimates in column II of Table A4. *** (**) indicate that the difference is statistically significant at the 1% (5%) level. Significance levels are derived from standard errors in Table A4.

The finding that ATM usage can lead to both (slightly and insignificantly) higher and lower cash balances suggests that the aggregate effect on cash demand in an economy depends on the relative size of the different users. If the share of infrequent ATM users dominates, then aggregate purse cash demand is likely to remain unaffected. In contrast, when a high share of individuals use ATMs frequently, then a negative effect on cash demand is likely to occur. Consequently, the differences found for the effect of ATMs on aggregate cash demand in times series studies might reflect differences in ATM usage patterns either across countries or across time.

From a monetary policy point of view, it is of relevance how demand for cash will evolve if people made more EFT-POS payments or withdrew cash at ATMs more frequently. Figure 5 contains the development of EFT-POS usage frequencies in Austria from 1997 to 2002. As can be seen there is a steady---however not overly strong---increase in the share of frequent users.[27]

[27] This slow adjustment fits well with the finding that payment patterns change rather slowly in Austria (Mooslechner, Stix and Wagner, 2002).

Figure 5. EFT-POS Usage Frequencies



Note: Answers in percent of debit card owners. Source: OeNB, Survey Results

Even if a strong change in EFT-POS usage frequencies in the next couple of years seems unlikely, it is well imaginable that people pay with their debit card much more frequently in some years from now. How would this affect cash demand? The results presented so far provide no answer to this question because the point estimates measured the differences across individuals with different usage frequencies but not the effect on cash balances for a certain user group relative to all others.

To assess the above question, the model is re-estimated with the dummy for the highest payment frequency (PAYS F) included in the model (column I of Table A5) while holding the effect of ATM usage fixed. The coefficient of this dummy variable thus measures the effect on cash holdings for frequent relative to less frequent EFT-POS users under the assumption that ATM usage behavior does not change.[28] A similar exercise is conducted for ATM withdrawals, keeping EFT-POS payments constant (column II). For the joint effect of both frequent ATM withdrawals and frequent EFT-POS payments, a separate dummy is constructed (column III).[29] The percentage change implied by the point estimates for the dummies are summarized in Table 4.

While the first two figures represent partial effects (always keeping either EFT-POS or ATM usage constant), the last two figures give a "general" effect. The results show that frequent EFT-POS payments are associated with 20% lower purse cash balances (significant at the 1% level). This finding is in contrast to Boeschoten's (1992) result of

[28] Intuitively, this coefficient is minus one times a weighted average of the coefficients in Table A4, column II where the weights are the relative group size of the different usage frequencies.
[29] Since the remaining point estimates do not change qualitatively, they are not reported in Table A5.

no significant effect of frequent EFT-POS payments on purse cash balances. Similarly, individuals who frequently withdraw at ATMs have 18% lower purse cash demand than individuals who withdraw less frequently. Furthermore, individuals who both pay and withdraw frequently hold about 29% lower cash balances than all others.

Table 4. Implied Change in Cash Balances

	Implied Percentage Difference in Cash Balances	Significance
all individuals pay several times per week, ATM usage constant	-20%	***
all individuals withdraw at ATMs several times per week, debit card payment behavior constant	-18%	***
all individuals pay and withdraw several times per week	-29%	***
young individuals (age <= 25 years) pay and withdraw several times per week	-41%	***

Note: The numbers give the percentage differences in cash balances for four scenarios. *** indicate that the difference is statistically significant at the 1% level. Significance levels are derived from standard errors in Table A5.

Currently, the share of frequently paying or withdrawing individuals is low (about 27% of debit card owners for payments and about 15% for ATM withdrawals, respectively). Multiplying these shares with the estimated reduction in cash balances of -20% for frequently paying and -18% for frequently withdrawing persons, shows that currently the aggregate decrease in overall purse cash demand for debit card owners caused by debit usage is moderate: -5.5% for debit card payments and about -2.7% for ATM withdrawals. However, if it is assumed that in the future all of individuals pay or withdraw several times per week, then the figures in Table 4 give a rough projection of the potential extent of cash-card substitution, all other things equal.[30] Another way of projecting the future development is by analyzing how young individuals pay and withdraw today. For this, the model in column III is estimated again with cross effects dummies for various age groups (column IV). If it is assumed that young persons will behave the same when they get older, then the point estimates suggests a reduction in transaction cash demand of 41%, all other things equal.

[30] Of course, this also imples that transaction costs stay constant.

Implicitly, both the amounts spent with the debit card and the EFT-POS and ATM network density are held constant in these estimations. However, in the future one can expect both measures to increase. Therefore, the estimated decline of 29% to 41%, respectively, are likely to reflect a lower bound.

Finally, our estimates also allow a (very) approximate assessment of the future use of cash at the point-of-sale. Currently, the share of cash at the point-of-sale in Austria is about 80%. If it is, at a first rough approximation, assumed that all transaction are carried out only with purse money, that the share of debit card owners remains constant (currently 70%) and that ATM withdrawal behavior remains constant, then the estimate of a reduction in cash balances of 20% for frequently paying card owners would imply that the share of cash at the point-of sale would decreases to about 69%. As mentioned, the cash share is about 60% in countries with a very high EFT-POS network coverage, like Finland (Snellman, Vesala and Humphrey, 2001). Given that our point estimates in Table 4 are likely to represent lower bounds for the future extent of cash substitution, our results imply that the cash share in Austria as well as in countries with a similar payment culture will converge to that of "low-cash" countries if EFT-POS payment frequency increases.

7. Conclusions

The literature has debated whether and to what extent payment innovations such as payment cards will displace cash as a means of payment. In this paper, the current extent of cash card substitution is estimated and projections about the future development are given for the case of Austria which is very "cash-intensive" and currently has a relatively immature debit card payment technology when compared to other European countries.

In contrast to the majority of the literature which employs time series models, we focus on micro data. In particular, information about debit card usage frequency is used to exploit the effects of EFT-POS payments and ATM withdrawals of Austrian individuals on transaction cash demand, which is approximated by the average amount of money held in the purse. It is argued that a micro data based approach has some advantages over a pure time series approach and thus provides valuable complementary evidence.

Results indicate that debit card payments and ATM withdrawals significantly affect cash demand at an individual level. The point estimates imply that users who pay frequently with their debit card hold about 20% less cash balances than infrequent users. In turn, frequent cash withdrawals at ATMs are associated with about 18% less cash demand than infrequent users. Individuals who both pay and withdraw frequently hold about 30% less cash in their purses. Furthermore, point estimates imply that the size of this effect is larger for young debit card owners which, ceteris paribus, hold 41% less cash.

Despite the presence of a substantial degree of cash substitution at an individual level, the relatively small size of the group of frequent EFT-POS users among total population implies that, currently, aggregate purse cash demand is only little affected by EFT-POS payments.[31] However, if usage behavior shifts towards higher usage frequencies, then the findings of this study suggest that the use of cash for transaction purposes will decrease significantly.

[31] Since ATM withdrawals or EFT-POS payments allow to economize on precautionary cash balances, it is likely that the effect of debit cards is stronger if a broader measure of cash holdings, also including cash held at home, would be analyzed. This is left for future research.

References

Attanasio, O. P. – Jappelli, T – Guiso, L. (2002) **The Demand for Money, Financial Innovation, and the Welfare Cost of Inflation: An Analysis with Household Data** Journal of Political Economy, 110(2), 317-351 .

Baumol W. J. (1952) **The Transaction Demand for Cash: An Inventory Theoretic Approach** Quarterly Journal of Economics, 66 (November), 545-556.

Blanchflower D. G. – Evans D. S. – Oswald A. J. (1998) **Credit Cards and Consumers** NERA working paper.

Boeschoten W. C. (1992) **Currency Use and Payment Patterns** Financial and Monetary Policy Studies, Vol. 23, Kluwer Academic Publishers: Dodrecht, The Netherlands.

Costa C. – de Grauwe P. (2001) **Monetary Policy in a Cashless Society** CEPR Discussion Paper No. 2696.

Drehmann M. – Goodhart C. – Krueger, M. (2002) **The Challenges Facing Currency Usage: Will the Traditional Transaction Medium be Able to Resist Competition From the New Technologies?** Economic Policy, 34, Spring, 195-227.

Doyle B. M. (2000), **Here, Dollars, Dollars... – Estimating Currency Demand and Worldwide Currency Substitution** Board of Governors of the Federal Reserve System International Finance Discussion Papers Number 657, January.

Duca J. V. – Whitesell W. C. (1995) **Credit Cards and Money Demand: A Cross-Sectional Study** Journal of Money, Credit, and Banking, Vol. 27, No. 2 (May), 604-623.

Fase, M. M. G. (1994) **In Search for Stability: An Empirical Appraisal of the Demand for Money in the G7 and EC Countries** De Economist 142(4), 421-454.

Greene W.H. (2002) **LIMDEP Version 8.0 User Manual**, Econometric Software Inc. Bellport: NY.

Jyrkönen H. – Paunonen H. (2003) **Card, Internet and Mobile Payments in Finland** Bank of Finland Discussion Paper N. 8/2003.

Maddala, G. S. (1992) **Limited-dependent and qualitative variables in econometrics**. Cambridge: Cambridge University Press.

Markose, S. M. – Loke, Y. J. (2003) **Network Effects on Cash-Card Substitution in Transactions and Low Interest Rate Regimes** The Economic Journal 113 (April), 456-476.

Markose, S. M. – Loke, Y. J. (2001) **The Microstructure of Recent Trends in Cashlessness: UK and USA Compared** mimeo.

Mooslechner P. –Stix H. – Wagner K. (2002) **Austrian Households' Payment Habits -- Results of a Study on the Use of Payment Cards and the Structure of Payment Transactions in 2000** Focus on Austria 1/2002, Oesterreichische Nationalbank, 89-117.

Paunonen H. – Jyrkönen H. (2002) **Cash Usage in Finland – How Much Can be Explained?** Bank of Finland Discussion Paper N. 10/2002.

Rinaldi, L. (2001) **Payment Cards and Money Demand in Belgium** CES Discussion Paper DPS 01.16, KULeuven.

Snellman J. – Vesala J. – Humphrey D. (2001) **Substitution of Noncash Payment Instruments for Cash in Europe** Journal of Financial Services Research, April-June, 19(2-3), 131-45.

Appendix

Definition of Variables

LCASH	= log of cash held in the purse (in euro)
Scale Variables:	
LINCOME	= log of personal net income; constructed from net income which is recorded in 20 categories
HOME	= 1 if the person is a home owner
STOCKS	= 1 if the person is owns stocks
ASSETS	= 1 if the person holds bonds
PRIVATE PENSION	= 1 if the person has a private pension plan
PRIVATE HEALTH	= 1 if the person has a private health insurance
SAVINGS ACC.	= 1 if the person has a savings account
Socio-demographic variables:	
AGE	= age of person in years
MALE	= 1 if the person is male
MAINEARN	= 1 if the person is the household head (the main earner in the household)
LHHSIZE	= the logarithm of the number of people living in the respondent's household
EDU LOW	= 1 if the person has low education (mandatory schooling)
EDU MED.	= 1 if the person has a medium level of education (lower schooling level than high school)
EDU HI.	= 1 if the person has a high level of education (high school and/or university)
KIDS	= 1 if the kids below the age of 15 live in the same household
Occupational Dummies (relative to blue collar workers):	
UNEMP	= 1 if the person is unemployed
RETIRED	= 1 if the person is retired
IN EDU	= 1 if the person is in education
JOB TP	= 1 if the person is employed and has a top or leading position
JOB WC	= 1 if the person is employed and has a white collar position
JOB SMALL	= 1 if the person is employed and owns a small business
FARM	= 1 if the person is employed as a farmer
Debit Card Variables:	
ACCOUNT	= 1 if the person has a checking account
TELEBANK	= 1 if the person uses telephone banking
PRE-TRANSFER	= 1 if the person uses pre-authorized transfers
DIRECT	= 1 if the person uses direct debit
SLIPS	= 1 if the person pays carries cash to the bank to pay bills
OTHER CARDS	= 1 if the person has possesses other payment cards
DEBIT CARD	= 1 if the person possesses a debit card
PAYS	= 1 if the person uses the debit card for payments
WITHDRAWS	= 1 if the person uses the debit card to withdraw cash at ATMs
PAYS F	= 1 if the person uses the debit card to pay several times per week
PAYS W	= 1 if the person uses the debit card to pay about once a week
PAYS M	= 1 if the person uses the debit card to at least once a month (but less than once a week)
PAYS L	= 1 if the person uses the debit card to pay less than once a month
PAYS N	= 1 if the person never pays with debit card
ATM F, etc.	= 1 if persons withdraws cash at ATMS with the same frequency as for PAYS

Table A1. Descriptive Statistics for Debit Card Owners (1761 Observations)

Variable	Mean	Min	Max
CASH	79.09	2	600
LINCOME	6.98	5.7	8.4
HOME	0.43	0	1
STOCKS	0.14	0	1
SAVINGS ACC.	0.84	0	1
CREDIT	0.33	0	1
AGE	45.90	15	93
AGE20	0.04	0	1
AGE2030	0.13	0	1
MALE	0.51	0	1
MAINEARN	0.68	0	1
KIDS	0.29	0	1
LHHSIZE	0.84	0	2.2
IN EDU	0.01	0	1
JOB TP	0.08	0	1
JOB FARM	0.01	0	1
JOB SMALL	0.02	0	1
JOB WC	0.37	0	1
UNEMP	0.04	0	1
RETIRED	0.27	0	1
SLIPS	0.76	0	1

Table A2.

OLS			Sample Selection Model		
Dependent Variable: LCASH			Dependent Variable: LCASH		
CONSTANT	1.902 ***	(0.327)	CONSTANT	2.430 ***	(0.387)
LINCOME	0.260 ***	(0.045)	LINCOME	0.191 ***	(0.055)
HOME	0.082 **	(0.038)	HOME	0.077 **	(0.037)
PRIVATE HEALTH	0.101 **	(0.041)			
STOCKS	0.149 ***	(0.054)	STOCKS	0.188 ***	(0.052)
ASSEST	0.100 **	(0.049)			
SAVINGS ACC.	0.126 **	(0.051)	SAVINGS ACC.	0.130 ***	(0.049)
CREDIT	-0.081 **	(0.040)	CREDIT	-0.088 **	(0.041)
OTHER CARDS	0.092 **	(0.040)			
AGE	0.004 *	(0.003)	AGE	0.009 ***	(0.003)
AGE<20	-0.550 ***	(0.116)	AGE<20	-0.481 ***	(0.117)
AGE2030	-0.223 ***	(0.073)	AGE2030	-0.191 ***	(0.072)
MALE	0.234 ***	(0.044)	MALE	0.223 ***	(0.046)
MAINEARN	-0.202 ***	(0.049)	MAINEARN	-0.181 ***	(0.053)
LHHSIZE	-0.075 **	(0.038)	LHHSIZE	-0.127 ***	(0.046)
IN EDU	-0.089	(0.146)	IN EDU	-0.251	(0.158)
JOB TP	0.015	(0.088)	JOB TP	-0.028	(0.094)
JOB FARM	0.465 ***	(0.125)	JOB FARM	0.501 ***	(0.118)
JOB SMALL	0.265 **	(0.128)	JOB SMALL	0.316 **	(0.135)
JOB WC	-0.079	(0.053)	JOB WC	-0.118 **	(0.056)
UNEMP	0.045	(0.085)	UNEMP	-0.038	(0.089)
RETIRED	0.083	(0.073)	RETIRED	0.071	(0.075)
SLIPS	0.080 **	(0.040)	SLIPS	0.097 **	(0.042)
			KIDS	0.105 *	(0.056)
			RHO	-0.571 ***	(0.117)
R^2	0.21		Log L	-3012.75	

Note: The table shows the point estimates of the OLS and the cash demand equation of the sample selection model. The debit card probit equation is summarized in Table A3. Robust standard errors, adjusted for clustering in sample design, in parentheses. The point estimates of regional dummies are not shown. The sample selection model is estimated by maximum likelihood. *** (**) [*] denotes significance at the 1% (5%) [10%] level. 2518 observations (1761 uncensored, 757 censored). The parameter estimates of the regional dummies are not shown.

Table A3.

Sample Selection Model		
Dependent Variable: DEBIT CARD		
CONSTANT	-2.074 ***	(0.500)
LINCOME	0.312 ***	(0.074)
PRIVATE HEALTH	0.193 **	(0.076)
PRIVATE PENSION	0.186 **	(0.086)
AGE SQ. (x1e2)	-0.017 ***	(0.003)
MALE	0.135 **	(0.069)
MAINEARN	-0.199 **	(0.095)
KIDS	-0.259 ***	(0.099)
LHHSIZE	0.144 *	(0.081)
EDU MED.	0.231 ***	(0.073)
EDU HI.	0.386 ***	(0.101)
IN EDU	0.973 **	(0.486)
JOB TP	0.359	(0.235)
JOB FARM	-0.238	(0.261)
JOB SMALL	-0.386	(0.239)
JOB WC	0.124	(0.094)
UNEMP	0.268	(0.167)
RETIRED	0.014	(0.120)
PRE-TRANSFER	0.491 ***	(0.077)
SLIPS	-0.160 **	(0.080)
TELEBANK	0.276 *	(0.148)
ACCOUNT	0.223 ***	(0.079)
OTHER CARDS	0.715 ***	(0.083)

Note: The table shows the point estimates of the sample selection model for the debit card probit equation. Robust standard errors, adjusted for clustering in sample design, in parentheses. The sample selection model is estimated by maximum likelihood. *** (**) [*] denotes significance at the 1% (5%) [10%] level. 2518 observations (1761 uncensored, 757 censored). The parameter estimates of the regional dummies are not shown.

Table A4.

	Dependent Variable: LCASH			
	(I)		(II)	
CONSTANT	2.491 ***	(0.395)	2.136 ***	(0.365)
LINCOME	0.189 ***	(0.053)	0.203 ***	(0.051)
HOME	0.077 **	(0.037)	0.070 *	(0.037)
STOCKS	0.187 ***	(0.052)	0.218 ***	(0.052)
SAVINGS ACC.	0.129 ***	(0.049)	0.102 **	(0.047)
CREDIT	-0.086 **	(0.041)	-0.057	(0.041)
AGE	0.009 ***	(0.003)	0.007 **	(0.003)
AGE<20	-0.487 ***	(0.117)	-0.461 ***	(0.111)
AGE2030	-0.188 ***	(0.071)	-0.171 **	(0.068)
MALE	0.224 ***	(0.045)	0.200 ***	(0.046)
MAINEARN	-0.181 ***	(0.051)	-0.161 ***	(0.052)
KIDS	0.107 **	(0.055)	0.119 **	(0.056)
LHHSIZE	-0.128 ***	(0.045)	-0.133 ***	(0.046)
IN EDU	-0.252 *	(0.152)	-0.192	(0.148)
JOB TP	-0.024	(0.091)	0.052	(0.090)
JOB FARM	0.506 ***	(0.112)	0.494 ***	(0.118)
JOB SMALL	0.316 **	(0.129)	0.333 **	(0.140)
JOB WC	-0.115 **	(0.053)	-0.079	(0.054)
UNEMP	-0.036	(0.084)	-0.036	(0.090)
RETIRED	0.071	(0.074)	0.103	(0.075)
SLIPS	0.096 **	(0.041)	0.083 **	(0.041)
PAYS	-0.060	(0.063)		
WITHDRAWS	0.010	(0.089)		
PAYS N			0.236 ***	(0.071)
PAYS L			0.267 ***	(0.058)
PAYS M			0.228 ***	(0.058)
PAYS W			0.207 ***	(0.051)
PAYS F			---	
ATM N			0.204 **	(0.102)
ATM L			0.231 ***	(0.083)
ATM M			0.266 ***	(0.056)
ATM W			0.162 ***	(0.056)
ATM F			---	
Log L	-3012.119		-2975.429	

Note: The table shows the point estimates of the cash demand equation of a two equation system with sample selection. The results from the card probit part and the point estimates of regional dummies are not shown. Robust standard errors, adjusted for clustering in sample design, in parentheses. Estimated by maximum likelihood. *** (**) [*] denotes significance at the 1% (5%) [10%] level. "---" denotes the omitted reference dummy variable. 2518 observations (1761 uncensored, 757 censored).

Table A5.

	Dependent Variable: LCASH							
	(I)		(II)		(III)		(IV)	
PAYS N	---		0.250 ***	(0.068)				
PAYS L	---		0.291 ***	(0.057)				
PAYS M	---		0.258 ***	(0.057)				
PAYS W	---		0.207 ***	(0.051)				
PAYS F	-0.225 ***	(0.044)	---					
ATM N	0.215 **	(0.096)	---					
ATM L	0.252 ***	(0.079)	---					
ATM M	0.273 ***	(0.057)	---					
ATM W	0.161 ***	(0.056)	---					
ATM F	---		-0.202 ***	(0.053)				
PAYS & ATM F					-0.344 ***	(0.061)		
PAYS & ATM F <25y							-0.533 ***	(0.153)
PAYS & ATM F 2545y							-0.312 ***	(0.080)
PAYS & ATM F >45y							-0.300 ***	(0.107)
Log L	-2976.01		-2978.53		-2996.12		-2995.03	

Note: The table shows the point estimates for the frequency dummies of the cash demand equation of a two equation system with sample selection. The results for the remaining variables are not shown. Robust standard errors, adjusted for clustering in sample design, in parentheses. Estimated by maximum likelihood. *** (**) [*] denotes significance at the 1% (5%) [10%] level. “---“ denotes the omitted reference dummy variable. 2518 observations (1761 uncensored, 757 censored).

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1) vergriffen (out of print)
2) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1990, S 74 ff
3) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1991, S 44 ff
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