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Determinants of non-cash payments

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Abstract

The development of the card payment system allows for lowering the costs of money emission and circulation and thereby leads to significant economic gains. Yet relatively small amount of research has been dedicated to the analysis of the determinants of these developments. Therefore, the aim of the article is to seek cross-country determinants of retail card payments. The focus of was put on two econometric models. One was constructed using survey data for Poland, the second model was based on panel data from the EU countries in the years 2000-2012. Based on the results from the second model forecasts for the number of cards and the value of card transactions per person were compiled.

Keywords: card payments, noncash transactions, retail payments
JEL codes: E42, E58

1. Introduction

In recent years, we have been witnesses to an extensive technological revolution, which is manifested most notably through the spread of the Internet. The decrease in the cost of computing power facilitated the transfer of technology and knowledge on an unprecedented scale and made possible to push further the internationalization of financial and trade flows. This applies mainly to the Europe, where the integration of the European market for payment services allowed the competition between banks and non-banks to manifest itself in swift application of the newest means of payment. In this context, one of the underrated aspects of this change in our everyday life has been the sudden revolution in the methods of retail payment. In many countries cash is no longer the unique possibility of making a payment and it shares the retail payment market with other payment instruments like cards, direct debits or other electronic means of making transactions. At the same time, other means of paper-based payments are becoming obsolete. This extension of the consumer and the entrepreneur choice regarding different payment methods leads towards increasing dematerialization of money circulation.

The importance of this process lies in the fact that the payment system is more than a mechanical act carried out every day by consumers or businesses, it is precisely the possibility of payment that allows for the existence of markets. Therefore, the act of payment is a base for the society to reap gains from exchanges in the economy. In this context, the process of transition to a cashless payment method has an important economic dimension. Existing studies indicate a relationship between the development of the system of cashless transactions and economic growth (Hasan, 2012). Achieving an appropriate scale of the system allows for reducing the costs of emissions money and its circulation that is, the costs associated with the delivery and storage of cash by all individuals in the economy. In line with this cost reduction, some of the retailers now accept only payment cards to capture greater sales and increase transaction speed. Another positive effect is the decrease in the shadow economy due to the much greater transparency of noncash transactions, which seems to be particularly important for the whole financial system and counter crime and tax defiance branches of the state.

The primary objective of the study is to identify the main determinants of the development of noncash transactions, and in particular the use of debit and credit cards in lieu of cash payments. Besides an attempt to answer the above question, the paper presents an attempt to identify the key factors for the development of card payments, which can be affected by the central bank. This indication would allow adjustment of its policy to foster card payment development. Determination of key factors enables an attempt to forecast the value of noncash payments and the share in the market in various scenarios for Poland.

The paper focuses mostly on the model based on ECB panel data on card payment in the EU countries. One of the factors that potentially determine popularity of payments with the use of credit and debit cards is peoples' trust in the security of the system. In order to motivate the use of trust variable in the main equations of the model, a model that explains the popularity of payment cards is estimated first based on cross-sectional individual data that come from a large 2013 TNS survey funded by the National Bank of Poland. The results of its estimation are also used to identify such factors that on the country-level macro data could not be revealed. These are gender, education, age, or family status of the individuals. Confirming or rejecting their influence on the payment customs of the agents might suggest particular factors that should be included in the macro-data-based equation or identify important drivers of cashless transactions popularity itself.

On the macro level, four equations are estimated, each relating to a different part of the process of card payment, since the factors that influence the popularity of noncash payments are likely to be different for the payer of the transaction and for the merchant accepting payment. The selected four measures are:

1. Total value of annual card payments per capita
2. Number of terminals per 1 million inhabitants
3. Number of cards per 1 thousand inhabitants
4. Card transactions as a fraction of total noncash transactions.

System Generalized Method of Moments (GMM) and Dynamic Fixed Effects estimators are used to estimate these payment measures on selected explanatory variables such as general trust, availability of ATM and EFTPOS

terminals, past habits, cash holdings per capita, GDP and private consumption per capita. Using panel data techniques allows particular attention to be paid to the country heterogeneity and the dynamic features of the model. However, the popularity of transactions using credit cards depends on the factors that determine on one hand, the popularity of the possession and use of cards by individuals, and on the other hand - the popularity and availability of payment terminals (POS terminals). This necessitates the usage of different controlling explanatory variables for each measure in our investigation.

Section two, which follows this introduction, presents a brief review of literature that treats the problem of cashless transaction. In the third section, the model based on microdata is described, whereas section four describes the macro-data investigation. Section five presents forecasts for Poland and the last section concludes the research with policy implications.

2. Literature review

Much interest has been dedicated to the growing use of noncash instruments in retail payments. A payment occurs when one economic agent transfers value to another agent for the purpose of discharging a debt (Kahn, Roberds 2009). In the literature, "retail payment" is a term used to describe payments that are made among the non-bank public, be that between individuals, between businesses, or between individuals and businesses (Cronin and McGuinness, 2010). ECB defines retail payments to be mainly consumer payments of relatively low value and urgency. A retail payment usually involves a much smaller value being exchanged compared to an interbank, or wholesale, payment, which takes place between financial institutions. The volume of retail payments, however, is far greater than that in the wholesale payment system and the non-trivial costs of handling retail payments amount to 3% of GDP (Humphrey et al., 2000).

The two payment areas are differentiated further by the range of retail payment instruments available to consumers, in contrast to the common shared technical platform used by banks in settling payments among themselves. Owing to improved computer technology and to the deregulation of banks, the past decade has been characterized by rapid financial innovation, which brought about the extended use of various payment instruments other than cash and cheques for instance credit and debit cards, credit transfer, and direct debits.

However, little attention has been given to understanding the underlying factors that actually influence the trends and developments of noncash payment mechanisms at retail level. The empirical investigations of the subject are relatively scarce and it could be argued that they are mostly analytical in scope. Most of the economic literature on the subject is dedicated to the network effect property of retail payments and this aspect is difficult to measure using econometric methods. A different strand in the literature analyses various aspects of the interchange fee and non-optimality of this payment.

The formal-theoretic literature on the subject assumes a substitution between different means of payments, especially cash and noncash transactions. The next

step in this approach is to model the choice of a payment instrument to transfer value between payor and payee. Payees try to minimize the cost of accepting different instruments under the constraint of sales maximizations through the broadening of the range of payor payment options. What is more important the payee is not wanting to adjust his prices according to the payment instrument chosen by the payor because of consumer sentiment of no extra cost involved or regulation preventing charging different prices to different means of payment. The aim of the payor is to minimize the transaction costs subject to the convenience and safety constraints when using different instruments and general willingness of payees to accept them.

The social optimum of the retail payment marker would be to differentiate costs along different payment methods. However, the consumers are generally overly reluctant to pay directly any additional fees on a marginal cost basis and the banks are not willing to charge the payor with costs on a transaction-basis led by the desire to hinder informative price comparisons between financial institutions. Therefore, the payments that the payor pays are direct monthly account maintenance fees or indirect minimum balance requirements. This has led to prices that deviate from the social optimum and results in a situation in which the payor is not motivated to use the optimal payment methods.

The result is that any instrument chosen once by a given consumer is then overused and the decisions of payees to support new payment methods are not influenced by opportunity costs, but rather the costs of permanent switching from one type of payment to another. The overuse of a given payment method in consumer choice and network effects relating to costs of establishing a payment system have a result in wide disparities in the payment patterns across developed countries, showing a significant persistence in the once chosen mode of handling transactions in retail. Thus, the relative importance of different payment media varies across countries and payment choices may not always be driven by efficiency concerns. Humphrey (2008) goes even as far to say that a reliance on particular instruments is often the result of ‘‘historical accidents’’.

When analyzing the choice of relatively irreversible switching means of payment one has to take into account a number of factors, which are not necessarily economic in nature, but sociological like general trust, trust in financial institutions, relative safety, the ease of enforcing private contracts of overdue payments etc. (Irreversible in the sense that there are significant non-refundable costs of choosing one instrument of payment - for instance many card issuing agents charge additional fees for not using a card.) Obtaining a card also requires incurring costs associated with paperwork. These factors therefore are similar determinants of the development like the economic factors related to the Baumoll and Tobin model (transaction cost, transaction demand, and interest rates).

While it would be interesting to understand how economical and social-institutional factors affect these disparities relatively small amount of research has been dedicated to this aim. Unfortunately, a large part of the studies in this field is descriptive and most of the literature concerning the growth in noncash transactions is dedicated only to analytical or case study analysis.

Definitely, the scarcest are the studies dedicated to the analyses of direct payment data. Amromin et al. (2007) examine the choice of motorists to pay highway tolls by cash or by electronic toll-payment devices, using data provided by a toll authority, and estimate the sensitivity of demand for electronic payment to factors such as price, estimated income, time in making a payment, and other factors that influence convenience of use. Rysman (2007) analyzes transactions data collected by Visa and shows that "network effects" matter a lot in practice — while consumers may hold multiple payment cards, in practice they tend to concentrate all of their card payments using a single card.

While these analyses have been informative, their lack of transaction-specific data has limited researchers' abilities to model the microeconomic behavior of consumers. Therefore, in the field of noncash transactions surveys of cardholders predominate. The drawback of this is that these surveys are not repeated over time and include very different factors, which makes them largely incomparable. These studies indicate that a large number of factors can potentially affect decisions about payment by debit or credit card. Although seemingly the most obvious factor

affecting the size of noncash transactions appears to be the level of technology and the wealth of the country where payment is done, this may be the wrong starting idea. Kosse (2010) based on a survey among Dutch credit card owners indicates the level of confidence in financial institutions, the risks of counterfeiting or theft of data as the most important factors determining the willingness to pay cashless. For this reason, the literature indicates that the noncash payment level is lower in Germany, where relatively warily approaches to financial institutions, despite the high technological level of the financial sector in the country.

Borzekowski, et. al (2006) estimate demand functions for various methods of payment using data from a nationally representative sample of 1,501 distinct households from the Michigan Survey of Consumers. Moreover, in the United States, there is an unique literature on developed countries the prevalence of paper cheques - see Humphrey (2002) and later works by the same author. Altogether, these studies indicate a very important effect. The overall level of development of the financial sector, i.e. the number of transactions is beneficial for the development of cashless transactions. Moreover, the surveyed studies indicate both the large delayed effects, probably related to existing consumer habits. This points out the need for special attention devoted to the project to these issues.

There are only a few studies in which theoretical elements are combined with empirical research. Among the exceptions, Alvarez and Lippi (2009) show how the growth of cashless transactions affected the demand for money. The authors develop a theoretical model using the Baumol-Tobin framework and show that due to reduction in the opportunity cost of ATM withdrawals and transaction costs the sensitivity of money demand to interest rates decreases. These results are then confirmed in a panel data of Italian households. The authors also show that the welfare costs of disinflation in Italy proved to be smaller than expected, because of financial innovation aimed towards the dematerialization of money. Even rarer is the panel study approach of the determinants of noncash transactions. The literature using this method was initiated by Humphrey et al. (1996), uses data for a panel of 14 developed countries over the period 1986–1993 to study the determinants of the volume of transactions conducted in five noncash payment instruments, namely

credit and debit cards, paper and electronic cheques. Recent examples may include the research by Ardizzi and Iachini (2013), who show the differences between countries in consumption habits in different countries with respect to the method of payment for their examination and much older Guariglia and Loke (2004) and Humphrey et al. (2000), based on data from the years 1990 to 1998 on a sample of only 13 OECD countries. Among the variables of interest, the authors usually use interest rates, the real value of cash in circulation and consumption. However, due to the small number of countries and considerably older data, it is advisable to repeat some aspects of this type of research on a much larger sample. It seems, the literature in this area is either outdated, concentrates on the innovations in technology or "has fast forwarded into futurology" (Markose, Loke 2002).

In the Polish literature, a series of statistical reports prepared by the Payment Systems Department of the NBP is particularly noteworthy. These present a number of important insights for the study of scale cashless statistics. Among them particularly interesting study analyzes the acceptance of payment cards from the perspective of entrepreneurs made based on surveys of businesses (Górka, 2012). Marzec et al. (2013) present the results of a research concerning the usage of two basic payment methods in daily shopping in Poland, i.e. cash and debit card. The data was obtained through a survey conducted in the late 2010 and in the beginning of 2011. The research allowed determining payment habits and preferences of Polish customers. However, the only study describing international differences is the National Bank of Poland report (2011), which does not include analysis of the causes of the current discrepancy between the relatively low development of the Polish noncash market and much faster growth in other European Union countries. As highlighted by the authors themselves in the introduction "this material is not intended to indicating or clarifying the causes of variation in level of each indicator." Therefore to the knowledge of the authors there are no econometric studies analyzing the relative discrepancy between Poland and other EU countries in noncash payments.

3. Microdata based model

Despite the fact, that the key model in this research is based on panel data, it should be noted that the macrodata represent the `common' or `averaged' decisions of society members and thus represent the grouped decisions whether to hold (and use) a payment card on the individual level. That suggests that they are the individual data that might shed some light on the reasons for holding payment cards by the citizens and could suggest the relevance of particular determinants of the popularity of card transactions.

In this section a model based on cross-sectional set of microdata that explains people' decisions on holding vs. not holding payment cards is proposed. Section 3.1 provides the information about the dataset, the shape of which strongly determines the type of model that can be used. Section 3.2 presents the results of the estimation of the model, whereas section 3.3 concludes.

3.1. Model selection and data

In 2013, The National Bank of Poland performed a "Polak i płatności bezgotówkowe: nasze zachowania i obawy" study, within the frame of which TNS Polska performed a survey on the group of 1000 Polish citizens. The questions in the survey regarded bank accounts and payment cards held by the respondents as well as their payment customs. Additionally, a number of questions that regarded the sociodemographic status were asked. 967 respondents were adult at the time of research and their answers were used in this research. The distribution of the answers to particular questions considered in this paper can be viewed in tables 3.1-3.9.

The question of main interest from the point of view of this research referred to the number of payment cards held by the respondents. Out of the 967 adults, 41% (393 persons) declared no payment cards, 55% (532 persons) declared possessing one card, 4% (38 people) declared two, while only 4 people (0,4%) declared holding three or more payment cards. This variable represents the popularity of payment cards among the consumers and as such could be used as a dependent variable in the model equation. However, mean number of cards per person in the sample is 0,64,

while its standard deviation is only 0,32, which equals just about 50% of the mean. That means that the usual Poisson regression approach should not be used as it requires the expected value and standard deviation in the distribution of the dependent variable to be equal. In addition, usual mixtures of the Poisson regression (such as the most popular negative binomial) tackle the problem of overdispersion rather than underdispersion of the dependent variable and the solutions for underdispersion (such as the Conway-Maxwell-Poisson regression) have not gained popularity. At the same time, the zero-inflated Poisson is not adequate since it is not an excessive number of zeros that cause the underdispersion of the considered distribution. However, the number of people who hold more than one credit card is so low (just about 4,5% of the whole sample) that seems reasonable to consider a black-and-white situation: whether a person holds a payment card or not. This can also be motivated economically: one might suspect that the people who hold more than one payment card shall not perform more transactions than the holders of a single card and having more than one card is rather a consequence of e.g. a loan contract than the deliberately arranged situation by the card holder. This brings about the idea that a usual logistic regression should be a proper tool.

A number of factors can be supposed to determine people's decisions as whether to hold a payment card or not. Firstly, they might be a number of demographic factors, such as age, gender or the number of children in the household, size of the place of living. Tables 3.1-3.4 describe the distribution of the dummy variable explaining the fact of holding a payment card with respect to gender, age category, the number of children in the household and the size of the place of residence, respectively.

Table 3.1 The distribution of card possession vs gender.

Gender	Holding payment cards:				
	No		Yes		Total
M	194	42,08%	267	57,92%	461
F	199	39,33%	307	60,67%	506
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(1)$= 0,76(0,38), Cramer's V=0,028, Kendall's τ_b =0,028.

Table 3.2 The distribution of card possession vs the number of children.

number of children	Holding payment cards:				
	No		Yes		Total
0	284	43,23%	373	56,77%	657
1	56	30,94%	125	69,06%	181
2	45	41,28%	64	58,72%	109
3+	8	40,00%	12	60,00%	20
total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(3)$= 8,91(0,03), Cramer's V=0,096, Kendall's τ_b =0,062.

Table 3.3 The distribution of card possession vs age.

Age	Holding payment cards:				
	No		Yes		Total
18-20	32	76,19%	10	23,81%	42
21-30	60	31,75%	129	68,25%	189
31-40	47	26,26%	132	73,74%	179
41-50	41	27,89%	106	72,11%	147
51-60	77	43,26%	101	56,74%	178
61+	136	58,62%	96	41,38%	232
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(5)$= 85,05(0,00), Cramer's V=0,296, Kendall's τ_b =-0,131.

Table 3.4 The distribution of card possession vs the size of the place of residence.

Size of the place of residence	Holding payment cards:				
	No		Yes		total
Country	198	54,70%	164	45,30%	362
City <500,000 inhabitants	167	34,29%	320	65,71%	487
City > 500,000 inhabitants	28	23,73%	90	76,27%	118
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(2)$= 51,77(0,00), Cramer's V=0,231, Kendall's τ_b =0,221.

It can be easily seen that the hypothesis of stochastic independence of the card possession and each of the analyzed demographic factors should be rejected on virtually any significance level. The only exception seems to be the gender, whose relation with cards possession is doubtful. However, Marzec et. al. (2013) conclude that they are women who make more payment transactions. It must be noticed that the relevance of the gender variable might not be revealed in a simple cross-tabulation analysis and besides it might serve as an important control variable, which suggests its inclusion in the final model despite its unconfirmed significance. In contrast to gender, the number of children in the family is not independent from the card possession, though the share of cardholders is not a monotonous function of a number of children in a family. This is quite surprising that the people with one child are most likely to possess a payment card and the Kendall's measure, which is sensitive to proper ordering, is close to zero as a consequence of the non-monotonuous shape of this dependence. Nevertheless, it should be emphasized that these findings might be spurious and partly due to other socioeconomics variables, mostly the income, and as a result it shall only be reasonable to draw conclusions regarding the relationship between the number of children and the fact of holding payment cards in a multi-variable analysis when other demographic factors are included at a time. The somewhat surprising non-monotonuous relation between the number of children and the card possession is not the case for the age and the size of the place of residence. As expected, the popularity of payment cards is decreasing in age despite the two youngest age categories, however in their case this is certainly

due to a high rate of students without permanent source of financing among them. Yet the typical statistics confirm the significance of the expected relationship. Similarly, payment cards are least popular among the tenants of villages and most popular among the inhabitants of the big cities.

Secondly, one might suspect that the better-educated people might be more likely to be attracted by "modern" methods of payment, thus the level of education is next included. Table 3.5 presents the joint distribution of education and card possession in the sample.

Table 3.5 The distribution of card possession vs the level of education.

Level of education	Holding payment cards:				
	No		Yes		Total
Primary	120	84,51%	22	15,49%	142
Secondary*	139	46,33%	161	53,67%	300
Secondary**	119	30,36%	273	69,64%	392
Tertiary	15	11,28%	118	88,72%	133
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. `secondary*' stands for a 3-year-long professional formation, while `secondary**' stands for a 5-year-long professional formation or general secondary education; Pearson's $\chi^2(3)=$ 182,01(0,00), Cramer's V=0,434, Kendall's τ_b =0,379.

Just as expected, the higher the education, the more popular the payment cards with their extremes of just about 15% of the people with primary education who have at least one payment card and the almost 89% of the people with tertiary education who possess a payment card. However, the level of education is treated here rather as a proxy for "open-mindedness" for novelty and itself might not be sufficient as it partly `consumes' the influence of the wages, which on average are an increasing function of the level of education. Thus, another proxy for this category could perhaps be the frequency of the use of Internet. The distribution of the frequency of the use of internet cross tabulated with card possession is described in table 3.6 and it reveals the tendency to possess payment cards by mostly the `modern' part of the society – that is the people who frequently use the Internet.

Table 3.6 The distribution of card possession vs the frequency of the use of Internet.

Frequency of the Internet use	Holding payment cards:				
	No		Yes		Total
Daily	104	24,19%	326	75,81%	430
A few times per week	46	32,86%	94	67,14%	140
At most once per week	80	51,95%	74	48,05%	154
No connection	161	67,93%	76	32,07%	237
Do not know	2	33,33%	4	66,67%	6
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(4)$= 133,25(0,00), Cramer's V=0,371, Kendall's $\tau_b$ excluding the `I do not know' answers=-0,336.

Thirdly, it can be supposed that people with little or no disposable income shall not be highly interested in any novelties including card payments, whereas people with high income are more likely to. Thus, the next factor included in the model represents the material status of the individual. However, the question is: if the richer are more likely to have and use payment cards, then is it rather the income of an individual or the financial status of the family (household) that determines this decision whether to hold a payment card. In the first case the individual's level of earnings, while in the second case – the earnings in the household should be included in the model. Naturally both individual's and household's earnings are strongly related and it seems that just one of them could be used in a model as a factor determining cards possession at a time. On the one hand, it could be expected that since households should have common budgets and access to common bank accounts, it should be the family income rather than the individual's income that is a better determinant of card possession. On the other hand, in the families with high income variation between its members it might be the person who earns most who is the main owner of the account with a free payment cards offered by the bank in which case they might be the individual's earnings that play the key role. The two-dimensional distribution of card possession and the income of an individual and the household are given in tables 3.7 and 3.8 respectively and they shade little light on which of the factors could be closer to reality.

Table 3.7 The distribution of card possession vs earnings of the respondent.

Earnings of the individual (zł/month)	Holding payment cards:				
	No		Yes		Total
<500	55	67,90%	26	32,10%	81
501-1000	61	65,59%	32	34,41%	93
1001-1500	67	46,53%	77	53,47%	144
1501-2000	37	29,37%	89	70,63%	126
2001-2500	10	14,93%	57	85,07%	67
2501-3000	8	17,78%	37	82,22%	45
3001+	1	2,86%	34	97,14%	35
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(6)=$ 106,50(0,00), Cramer's V=0,331, Kendall's τ_b excluding the answer refusals=0,370.

Table 3.8 The distribution of card possession vs. total earnings in the respondent's household.

earnings of the household (zł/month)	**Holding payment cards:**				
	No		Yes		Total
<1000	30	76,92%	9	23,08%	39
1001-1500	40	57,14%	30	42,86%	70
1501-2000	38	56,72%	29	43,28%	67
2001-2500	37	46,84%	42	53,16%	79
2501-3000	43	43,88%	55	56,12%	98
3001-4000	25	23,36%	82	76,64%	107
4001-5000	13	18,84%	56	81,16%	69
5001+	4	9,09%	40	90,91%	44
refused to answer	163	41,37%	231	58,63%	394
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(6)=$ 83,30(0,00), Cramer's V=0,293, Kendall's τ_b excluding the answer refusals=0,323.

Clearly there is a stochastic dependence between the card holding and the earnings of both the individual and the household and in both cases the popularity of payment cards is an increasing function of earnings. It can be observed that both Cramer's V and the Kendall's τ_b are slightly higher for individual's earnings, yet the difference is insufficient to be viewed as a proof of superiority of individual's

earnings, especially considering the significance of both variables. That suggests a twofold analysis with the use of both categories.

Lastly, one can suspect that the decision of using a payment card might be determined by peoples trust in the banking system. One of the reasons for which elderly people prefer to pay and settle their accounts with e.g. energy or telephone providers is their aversion to the unknown, while the other is probably their fear related with using `non-material' and thus not palpable means of payment, which cannot be touched and which could possibly be taken away without being noticed. It might be supposed that also the younger members of the society do not have full trust in the banking system and prefer such means of payment which – in their opinion – provide a better control of what is happening with their money, which in turn might result in their mistrust in the card payments. One survey question that could be used as a proxy for trust in the system is whether a person believes in the security of pay-pass. The agents who find it insecure are more likely to be uneasy about the security of the system as a whole, which might influent their decision of having any kind of a payment card. The cross-tabulation of cards possession and views on the security of contactless cards are given in table 3.9.

Table 3.9 The distribution of card possession vs trust in the security of contactless cards.

Views on the security of contactless cards	holding payment cards:				
	no		Yes		total
Definitely secure	9	15,79%	48	84,21%	57
Rather secure	98	30,91%	219	69,09%	317
Rather insecure	80	36,20%	141	63,80%	221
Definitely insecure	73	51,77%	68	48,23%	141
No opinion	133	57,58%	98	42,42%	231
Total	393	40,64%	574	59,36%	967

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. Pearson's $\chi^2(4)$= 63,53 (0,00), Cramer's V=0,256, Kendall's $\tau_b$ excluding the `no opinion' answer=-0,175, Kendall's τ_b for all the answers (ordering as it is in the table)=-0,226.

It can be clearly seen that people's trust in the credibility of the contactless cards is transmitted to their approach towards the card payments in general: almost

85% of the people who are convinced about the security of contactless cards hold the payment cards, whereas this figure is almost twice lower in the case of people who are convinced about the insecurity of this system. Interestingly, people who do not have any opinion about it are the least likely to possess a payment card, which suggests that their `I do not know' is far closer to mistrust rather than trust and could perhaps be interpreted as a fear from the banking system due to lack of proper knowledge which would allow to draw rational conclusions regarding system's security.

As a result, each of the considered factors should be viewed as potentially relevant in the process of the decision making regarding card possession – either on the basis of basic tests or suggestions from the literature.

3.2.Model selection and data

Using the rationale described in the previous subsection, a typical model for binary outcome has been estimated. All of the factors discussed in section 3.1. are included as explanatory variables, yet the following remark needs to be made. The basic results given in section 3.1. did not provide a clear explanation regarding which of the incomes should be considered as a determinant of card holding: the individual's or the household's. Naturally these are strongly correlated. The exact value of income for particular individuals is not known, however on the basis of the income groups that are distinguished in the dataset Spearman's correlation coefficient is equal to 0,716 (0,00) for the whole sample. That suggests the estimation of two separate regressions: with the inclusion of household income and with the inclusion of individual's income as explanatory variables.

The complete list of the variables used in the estimation is given in table 3.10, while estimates of the main models are given in table 3.11 (specification 3.1 includes the income of the household, whereas the specification 3.2 includes the income of an individual).

Table 3.10 Variables used in the analysis.

Name	Definition	Values (variants) and their sample frequencies
card	Does a person hold a payment card; **dependent variable**	No (40,6%), yes-one or more cards (59,4%)
pay_sec	Do you think that paying with contactless cards is secure?	definitely yes (5,9%), rather yes (32,8%), rather not (22,9%), definitely not (14,6%), do not know (23,9%)
gender		male (47,7%), female (52,3%)
age	Age group at the time of TNS survey (2013)	18-19 (4,3%), 20-29 (19,5%), 30-39 (18,5%), 40-49 (15,2%), 50-59 (18,4%), 60+ (24,0%)
location	Size of the place of residence of the respondent	village (37,4%), city with fewer than 500,000 citizens (50,4%), city with more than 500,00 citizens (12,2%)
int_use	Frequency of Internet connection	daily (44,8%), a few times per week (14,5%), at most once per week (15,9%), have no connection (24,5%), do not know (0,6%)
Edu	Respondent's level of education	primary (14,7%), 3-year secondary professional formation (31,0%), 4/5-year secondary technician/general prep. (40,5%), tertiary (13,7%)
Child	The number of children in the household	0 or 1 (86,7%), 2 or more (13,3%)
ea_hh	The value of earnings in the household of the respondent (zł)	upto 1000 (4,0%), 1001-1500 (7,2%), 1501-2000 (6,9%), 2001-2500 (8,2%), 2501-3000 (10,1%), 3001-4000 (11,1%), 4001-5000 (7,1%), 5001+ (4,6%), answer refusal (40,7%)
ea_ind	The value of earnings of the respondent (zł)	upto 500 (8,4%), 501-1000 (9,6%), 1001-1500 (14,9%), 1501-2000 (13,0%), 2001-2500 (6,9%), 2501-3000 (4,7%), 3001+ (3,6%), answer refusal (38,9%)

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. In the original research more answer possibilities were available for some of the questions, but the neighbouring answer categories were merged in the case of rarely chosen options.

Table 3.11 Microdata logit models for the possession of payment cards.

	(3.1)			(3.2)		
	$\hat{\beta}$	*T*	*P*-value	$\hat{\beta}$	*T*	*P*-value
Opinion on contactless cards security						
Definitely yes			Reference category			
Rather yes	-0.8840	-1.96	0.050	-0.8491	-1.86	0.063
Rather no	-0.8563	-1.85	0.064	-0.7459	-2.60	0.010
Definitely no	-1.2119	-2.54	0.011	-1.1502	-2.39	0.017
Do not know	-1.4070	-3.05	0.002	-1.3160	-2.83	0.005
Gender						
Male			Reference category			
Female	0.0710	0.42	0.673	0.2265	1.30	0.193
Age						
18-19			Reference category			
20-29	1.7631	3.69	0.000	1.5505	3.27	0.001
30-39	2.3204	4.64	0.000	1.9987	4.02	0.000
40-49	2.4815	4.82	0.000	2.0556	4.03	0.000
50-59	2.0298	4.03	0.000	1.6407	3.27	0.001
60+	2.0122	3.99	0.000	1.5296	3.04	0.002
Location						
Village			Reference category			
City, <500ths	0.7382	4.24	0.000	0.6253	3.54	0.000
City, >500 ths	1.2332	4.12	0.000	1.0724	3.53	0.000
Internet use						
Daily			Reference category			
A few times/week	-0.6289	-2.45	0.014	-0.8402	-3.18	0.001
At most once/week	-1.0970	-4.19	0.000	-1.1699	-4.31	0.000
No connection	-1.5615	-5.75	0.000	-1.7811	-6.35	0.000
Do not know	0.0568	0.06	0.954	-0.1390	-0.14	0.890
Level of education						
Primary			Reference category			
Secondary*	1.4740	4.96	0.000	1.5500	5.06	0.000
Secondary**	1.6542	5.56	0.000	1.6384	5.35	0.000
Tertiary	2.4330	6.00	0.000	2.4456	5.88	0.000
Children						
<2			Reference category			
2+	-0.8177	-3.24	0.001	-0.8460	-3.30	0.001
Household's earnings						
<1000			Reference category			
1001-1500	1.0713	2.00	0.045			
1501-2000	0.5803	1.07	0.284			
2001-2500	0.6906	1.30	0.193			

2501-3000	0.7227	1.41	0.159			
3001-4000	1.5965	3.01	0.003			
4001-5000	1.6520	2.81	0.005			
5001+	1.9671	2.67	0.008			
No answer	0.7353	1.56	0.120			
Individual's earnings						
<500			Reference category			
501-1000				0.8593	2.12	0.034
1001-1500				1.7508	4.65	0.000
1501-2000				1.6663	4.41	0.000
2001-2500				2.4340	4.93	0.000
2501-3000				2.0177	3.73	0.000
3001+				3.8734	3.54	0.000
No answer				1.2225	3.74	0.000
Constant	-2.6839	-3.50	0.000	-2.7958	-4.13	0.000
	AUC=0,830; Pseudo R2=0,272; BIC=1150,7			AUC=0,841; Pseudo R2=0,293, BIC=1115,7		

Source: own calculation with the use of NBP and TNS data from the `Polak i płatności bezgotówkowe: nasze zachowania i obawy' survey. In both cases N=967.

Firstly, it must be stated that both models are actually very sensible and on the basis of the descriptive statistics should be considered very good: high pseudo-R2, very good discriminating features, most variables significant on any reasonable significance level. Also the conclusions drawn from the estimates of parameters that stand by the respective explanatory variable in both models are virtually the same except for the household and individual income variables, which appear in only one of the specifications each. It should be emphasized that both models are very good in discriminating the card holders from the rest: the value of AUC equals 0,82 and 0,84 respectively, which suggests adequacy of the analysis.

The influence of the demographic factors on the probability of card possession in the considered group confirms the conclusions from the single-variable analysis. Gender turns out not to be a significant driver of the considered decision: though the estimate of the parameter is positive, its statistical significance is not confirmed by the test.

The results are on the contrary very clear for age. With the 18- and 19-year-olds being the reference category, clearly in all the other groups card possession is

much more probable with its top in the group of the 40-49-year-olds. Followed by the 30-39-year-olds, 50-59-year-olds and the 60+ group. The relatively lower card popularity in the group of the 20-29-year-olds at the first sight might be somewhat surprising, but it is certainly due to the fact that in this group – just as within the 18-19-olds – numerous respondents are not in the labor market yet and get the support from their parents, which vastly reduces their interest in having their own bank account and thus also their own payment card. All the other results referring to age are just as expected with possibly a minor positive surprise with the result for the 60+ group: one could suspect that the people in the oldest group category could perhaps be more card-averse, yet the seniors do not seem to demonstrate any outstandingly high fear from card transaction.

As expected, payment cards are more popular among the citizens of big cities and smaller cities and are least popular in the villages. This certainly partly might be due to revealing by the place of residence some other socio-demographic factors: it turns out that in the analyzed sample people in big cities were on average better educated and had higher wages, which seem to be crucial determinants of popularity of card transactions. Yet it also suggests the existence of the effect on its own: possibly lower popularity of payment cards in the villages is caused by the more difficult access to their facilities: insufficient number of POS terminals or cash dispensers make payment cards a unattractive option.

No statistically significant differences were found among the people with 0 or 1 child when the respective dummy variables were included in the model, however there is a slightly lower difference in the probability of card possession in the group with 2 or more children as compared to the rest. This might be due to the fact that having numerous children is still popular among the less educated people with lower inclination to novelty seeking. However surprisingly in the considered sample only 6,34% of the people with primary education have 2+ children and this fraction increases till the group of people with tertiary education among whom the number of respondents with 2+ children constitutes 21,1% of the sample. It is, however, the size of the place of residence that is notably related with the number of children: although just above 37% of the sample live in villages as a whole, this

turns out to be just above 36% in the group of people with at most one child and 46,5% in the group of people with 2+ children and, as previously stated, people from rural area showed less interest in card possession.

The second group of possible card popularity determinants are the educational variables. Indeed, clearly there is strong correlation between the formal level of education and the probability of card possession. That is probably partly due to the fact that better educated people in general are expected to be more `open-minded', more aware of threats of paying (and thus also carrying) cash, but also more frequently occupy jobs were the salary is paid directly by bank transfer rather than in cash, which makes the payment cards yet more convenient. The effect of novelty seeking is also partly demonstrated by the frequency of the use of Internet: the more frequently the respondent uses Internet, the more likely he is to hold a payment card. It would be tempting to state that this is because of the additional services that are available for the users of Internet, such as Internet payment with credit cards. However, the latter seems not to be the core: people with no access to Internet are still much less likely to hold a payment card than those who use it at most once per week: should it be the Internet-related facilities of credit/debit cards that matter that much to the respondents, the difference between these two categories would not be as clear. This further suggests the effect of `open mind' rather than the true meaning of Internet availability to the potential cardholders. In consequence, if the Internet was to be used as a tool stimulating the development of card transactions, the emphasis should not be put on increasing the availability of the network but rather on the range of additional services available to the cardholders with the use of Internet connection.

Although the statistical measures such as McFadden's pseudo R squared, information criteria or AUC for both models are similar with minor preference for the model (3.2), the set of estimates of income parameters sheds some light on the relevance of income categories. Roughly, 50% of dummy variables that define the income group of the household are significant in the specification (3.1) and they are the variables denoting the more wealthy households. At the same time, each of the dummy variables denoting the individual income turns out to be significant in the

model (3.2). That suggests that the decision of card holding is due to individual's convenience rather than the family's financial status and the specification (3.2) is possibly the more relevant one. Still both models suggest that the probability of holding the payment card is basically an increasing function of wealth, yet the increase of the probability of card possession is not strictly monotonous with respect to earnings.

Finally yet importantly, both structures clearly show the importance of people's trust in the banking system. It can be clearly seen that they are the people with biggest trust in the security of contactless cards who are most likely to hold a payment card. The trust in the security of one of the financial services is used here as a proxy for the trust in the security of the system as a whole: people who raise doubts on the security of contactless cards are certainly more likely to mistrust other card transaction possibilities as well, which in turn increases the risk that they will decide not to hold any payment card. The results further show that people who are not sure whether the contactless cards are secure or not ans say `rather yes' or `rather no' are quite similar in their approach to payment cards: less likely to possess a card than the people convinced about the security, but more willing to than the people who find this instrument definitely insecure. Quite surprisingly, they are the people who have no opinion about the security of contactless cards who are least likely to be payment card owners. That reveals the risk aversion of this group: many of them will not hold a payment card just in case something is wrong with it. However, their anxiety is due to insufficient information they have. It seems to be an issue to address this group as properly constructed, understandable campaign convincing people not about the convenience but the security of the system might result in a notable increase of card popularity, in particular among this group.

3.3.Concluding remarks

The constructed micromodel provides rationale for the choice of some of the socio-demographic factors for the model based on panel data. These include: age structure, level of education and income. It might be that the size of the place of residence shall be transmitted to the index of urbanization in the macroscale,

however as discussed here, it might be the low availability of cash-dispensers and POS terminals that cause lower popularity of payment cards in the country and so these factors might be more relevant from the country perspective. The level of education and frequency of the use of Internet suggest that it would be useful to include some proxy for the society's openness to novelty – if available and not demonstrated to a sufficient extent with the level of education.

An important issue is the problem of trust. The importance of the belief in the security of contactless cards is interpreted here as the importance of trust in the financial system. However, the mistrust here could be due to either lack of proper knowledge of the financial instruments functioning or, on the contrary, enough knowledge to think – for one reason or another – that indeed, the system is not secure. Yet it is also possible that they are the people who do not trust their society rather than the system of financial instruments, who will be anxious to use modern payment options. The latter would suggest that that the problem might lay in the low level of social capital more than in the low level of trust in the banking system. That in turn would suggest including certain index of social trust in the macro data model – its influence might be notable in particular thanks to the cross-sectional nature of the macroanalysis.

Apart from the implications for the shape of the macrodata-based model, the obtained regression also provided two guidelines on the possible policy. Firstly, it can be suggested that if Internet was to be used as a tool to speed up the development of payment cards market, it should be the `extra offer' available to the cardholders that use Internet which might be a driver – possibly more than increasing the availability of the Internet. Secondly, as discussed above, the importance of trust might mean the importance of trust in the society for the development of the market of card transactions. However, the anxious approach of the people who are unable to judge the security of contactless cards suggests that a campaign providing proper information about the functioning and first of all the security of this and other instruments might attract people to it.

4. Macrodata based model

4.1 Introduction

This section examines how usage of the card retail payments has evolved in recent years in the countries of the European Union. One of the main uses of debit cards and credit cards is to make retail payments. These involve monetary value being exchanged between purchaser and merchant by using the card in conjunction with an electronic funds transfer terminal at the point-of-sale (known as POS terminals). Thus, the card usage can be measured by quantifying each aspect of this exchange. The following four sub-sections of the paper are devoted to quantitative analyses of the determinants of card retail transactions. Each of the sub-sections relate to different measures adapted to quantify the growing noncash means of payment usage. These are:

1. Total value of annual card payments per capita
2. Number of terminals per 1 million inhabitants
3. Number of cards per 1 thousand inhabitants
4. Card transactions as a fraction of total noncash transactions.

The multitude of the variables used in the study is a significant improvement over most analytical studies usually dedicated to the analysis of just one of these measures. Each of the measures used has some advantages and disadvantages that will be discussed in detail in each section. The data is drawn from the European Central Bank Data Warehouse and concerns all of the European Union countries as of 2012 and follows them over the period of 2000-2012. All variables are annual end of year time series data. For ease of international comparisons, where appropriate, payment data are given in per capita terms and, where values are involved, they are deflated to adjust for inflation. Additional control variables were compiled from Eurostat, World Bank, and the European Social Survey. The data and their sources are presented in table 4.1.

The data starting with "log", are logarithmized - this is transformation is done for all of the data representing levels. The data representing fractions and rates were

not logarithmized due to lack of interpretation of estimated parameters. The results for estimation without logarithms are presented in the appendix.

Table 4.1 Data used in the macroeconomic equations

Variable group	Abbreviation	Description
Card means of	valuetot_pop	Total value of annual card payments per capita
payment usage	logvalue	Logarithm of the total value of annual card payments per capita
EBC (2014)	eftpos_pop	Number of terminals per 1 million inhabitants
	logeftpos	Logarithm of the number of terminals per 1 million inhabitants
	card_pop	Number of cards per 1 thousand inhabitants
	logcardno	Logarithm of the number of cards per 1 thousand inhabitants
	s_cards	Card transactions as a fraction of total noncash transactions.
Trustindex (European Social Survey, 2014)	trustindex	Trust Index = 100 + (% Most people can be trusted) - (% Can´t be too careful)
Control variables	noatm_pop	Number of Automatic Teller Machines per 1 million inhabitants
EBC (2014)	logATM	Logarithm of the number of Automatic Teller Machines per 1 million inhabitants
	pop	Number of inhabitants (in millions)
	M2	M2 money aggregate (% of GDP)
	DC	Domestic Credit(% of GDP)
	inflation	Consumer price annual inflation (%)
	adr	Age dependency ratio (old + young)
Control variables Eurostat (2014)	urban	Proportion of population living in cities (%)
	secondary	Secondary school enrollment (% total)
	tertiary	Tertiary school enrollment (% total)
Control variables WDI (2014)	McapGDP	Market Capitalization of stock market listed companies
	GDP	Gross Domestic Product PPP (in constant 2005 int. dollars)
	logGDP	Logarithm of Gross Domestic Product PPP (in constant 2005 int. dollars)
	GNI	Gross National Income per capita (PPP)

	logGNI	Logarithm of Gross National Income per capita (PPP)
	cons	Consumption (% of GDP)
	interest	Interest lending rate
	openess	Trade to GDP (in %)
	services	Services value-added (% of GDP)
	travel	Travel as % of exports.
	credreg	Credit regulation index
Doing Business	ec_cost	Enforcing Contract costs (% of GNI)
(2014)	ec_time	Enforcing Contract time (in days)

Source: Own

Across all measures covered in the report, card payments have risen over the sample period in all the countries covered. There has been a steady rise in most countries, although the pattern has displayed some periodic downturns. Payment method selection by consumers shows high stability over time, due to the tendency to stick to a once selected method of payment and network effects. This indicates the need to use dynamic panel models. We employ different econometric techniques commonly used in this literature to address strong serial correlation that is present when analyzing annual cross-country data. We show that results depend significantly on the choice of the econometric model owing to the relative time-stability of most factors examined in our sample.

The noncash payment measures are regressed on selected explanatory variables such as general trust, availability of ATM and EFTPOS terminals, past habits, cash holdings per capita and private consumption per capita. Using panel data techniques allows particular attention to be paid to the country heterogeneity and the dynamic features of the model. On the macro-level, the popularity of transactions using credit cards depends on the factors that determine on one hand, the popularity of the possession and use of cards by individuals, and on the other hand - the popularity and availability of payment terminals (POS terminals). Factors that influence the popularity of noncash payments are likely to be different for the payer and for the merchant accepting payment. This necessitates the usage of different controlling explanatory variables for each measure in our investigation.

It has already been argued in the paper that the key factors determining the volume of card payments among individuals factors are of economic nature (level of

disposable income, consumption, the level of financial market development, the current level of technology), but also sociological factors are important determinants of card transactions (the level of confidence in the rest of society, enforcement of contracts). These variables can be summarized in the following equation:

$$CMeasure_{i,t} = \alpha + \theta CMeasure_{i,t-1} + \sum_j \beta_j x_{it} + \eta_i + \gamma_t + \varepsilon_{it}, \qquad (4.1)$$

where i denotes one of 27 EU countries, t denotes 13 years in the sample, $CMeasure_{i,t}$ is the value of one of the four noncash card measures described above, $CMeasure_{i,t-t}$ is the lagged value of the dependent variable. The lagged dependent variable coefficient θ is used to capture how resistant to change payment behaviors are and it is included to measure the influence of past habits on the current use of selected payment. x_{it} is a vector of characteristics measured during or at the start of the period. β_j, for j =1, 2,...,b are the regression coefficients. Among other things, the unobserved country-specific effects η_i reflect differences in the initial level of efficiency, while the period-specific intercepts, γ_t , capture changes that are common to all countries, ε_{it} is the i.i.d. error term.

Two methods were chosen to estimate (1), the System GMM Blundell-Bond (1998) estimator and the Kiviet (1995) LSDV estimator. Under the assumption of exogenous explanatory variables, the Kiviet estimator derives an approximation of the bias of the LSDV estimator in panel models where the set of regressors contains a lagged dependent variable. In small N samples, this estimator is usually better than GMM and most of other instrumental-variable estimator and has been shown to compare favorably with other consistent estimators (Kiviet, 1995; Bruno 2005). However, in the case of this study, the endogeneity is created by the relation of reverse causality that may arise between the card payment values and the number of cards, EFTPOS terminals. Therefore, the use of the bias-corrected LSDV estimator could potentially lead to inconsistently estimated coefficients. Therefore, to address the likely endogeneity issues, the technique of consistent System Generalized Method of Moments (System-GMM) estimator suggested by Blundell and Bond

(1998) has been applied. This method is particularly relevant to estimation of dynamic panels in which the stochastic data generating process of the dependent variable follows a random-walk showing in the large value of autoregressive parameter. Moreover, this method is particularly superior to the Fixed Effects methods in our investigation, since it allows to consistently estimate effects of variables that show very small variation over time in our sample, such us trust in other members of the society, urbanization, age dependency ratio, or even GDP over 13 year period. To this end, the selected GMM estimator incorporates, in a single system, the regression equation in both changes and levels, each with its specific set of instruments. In each specification, instruments for differenced equation were the lags of second order and higher of the autoregressive term and its lagged first differences, differences of other explanatory variables. Instruments for level equation were the lagged first differences of the autoregressive term.

The principal contribution of this study is that, contrary to the previous literature, it comprehensively analyses both micro and macro level determinants of card usage across a wide selection of countries over a relatively long time period.

4.2 Card transactions value per capita

The most interesting development in noncash-transactions on the macro-level is that card-based payment instruments have come to play a prominent role in retail payment activity in recent years. This reflects improved electronic technology making a relatively new instrument, the debit card, feasible and rendering the card more attractive to purchasers, merchants, and banks alike. This is visible both in the growth of value of card transactions per capita and in the everyday recurrence of card possession showing in the growing number of cards per inhabitant. The model developed in this section is the first of the two used to determine the popularity of card payments among consumers and concerns the measure of the card transactions value per capita.

Figure 4.1 presents a comparison of total value of annual card payments per capita (EUR) in the analyzed countries between 2000 and 2012. The figure shows a sharp rise in the value of card transactions over time among all the countries shown.

This reflects the relative newness of the debit card proving to be an attractive payment instrument since it enables the holder to have his payment for purchases directly charged to funds in his bank account.

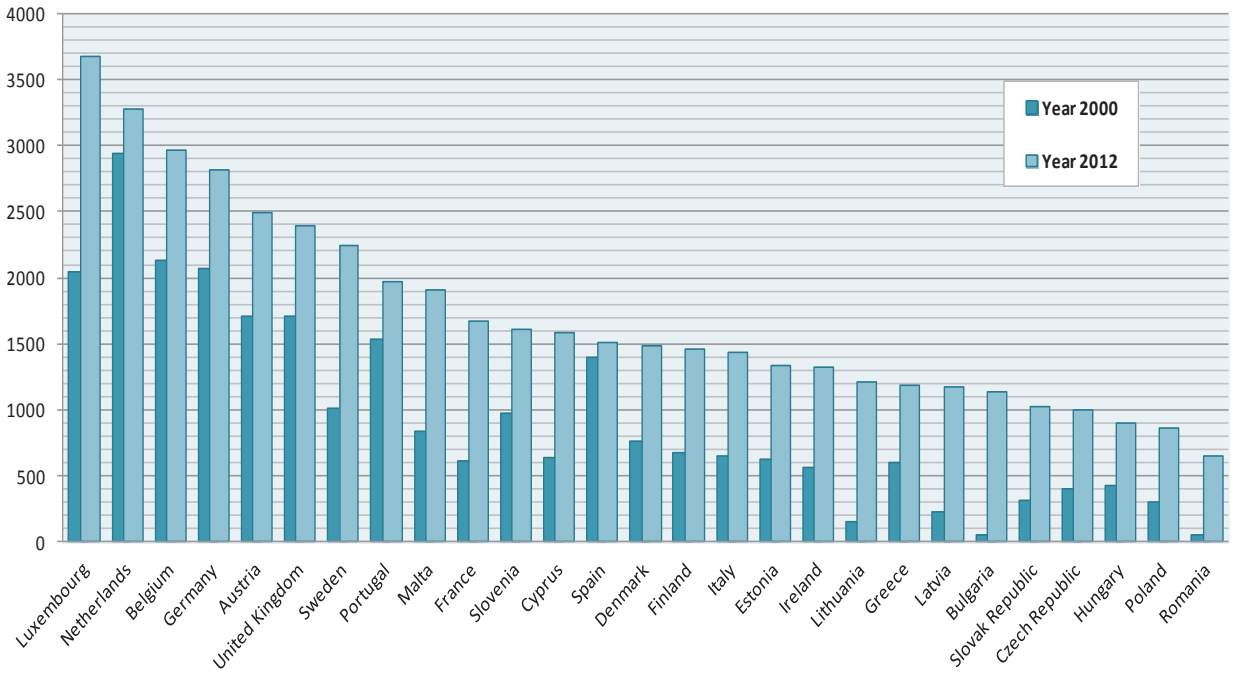

Figure 4.1 Total values of annual card payments per inhabitant (in EUR)

Source: Own based on the EBC data

The obtained results for the GMM model are similar to other examples in the literature and are summarized in Table 4.1. For brevity, the Fixed Effects model results were moved to the Appendix. As for card payment value per capita, as for all other payment instruments, we found a positive impact of the force of habit. This can be seen both in the high significance of the lagged value coefficient and the robustness of this variable to the inclusion of other variables. The only variable weakening this relationship was the logarithm of total GDP for a given country, representing the transaction demand for payments It could be argued that in smaller countries in terms of GDP the force of habit is weaker or it is easier to finance the relatively smaller fixed costs associated with investment in payment networks.

The interplay between different measures of card facilities and usage seems to be the most interesting part of the results. First, the lack of significance of card number per capita (last column of Table 4.2) suggests that owning a card does not necessitate its usage. It could be that in many countries credit and debit cards are used mostly for cash withdrawals. Second, the number of ATMs per 1 million inhabitants was added to the specification to measure the relationship between cash and noncash payment instruments. On one hand, ATMs increase the benefits of holding a credit of debit card without using it for making retail payments. Markose and Loke (2002) argue even that that the cost effectiveness of ATM cash dispensation has enabled cash to maintain its competitiveness vis-à-vis EFTPOS instruments such as credit cards and debit cards. In line with these arguments, it can be hypothesized that the availability of ATMs increases the convenience of cash payments. These contrasting effects result in a general lack of significance of this variable in the value of payments investigation, but overall the effect of ATMs on card payments seems to be small but negative on the 10% level of significance. This suggests a relationship neither of substitution nor of complementarity between the two types of payment instruments (cash and cad) leaning toward a relation of two not very close but substitutes.

The variable "trustindex" seems to be the most significant and robust variable aside the habit component. It portrays general trust toward other members of the society. It seems that the more people trust other, the more they are inclined to substitute cash with cashless card payment. This relates to the microeconomic analysis in which it was established that belief in security of the payment is one of the most significant variables. It could be argued, that trust to other people in general is related to trust in given type of payment transactions.

Table 4.2 Determinants of card transactions value per inhabitant.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.logvalue	0.823***	0.507***	0.610***	0.432***	0.658***	0.810***	0.379***
	(22.40)	(9.44)	(12.06)	(7.39)	(14.01)	(15.96)	(5.89)
Logatm	-0.0440	-0.186*	-0.124	-0.119	-0.102	0.00354	-0.211*
	(-0.43)	(-2.02)	(-1.24)	(-1.30)	(-1.00)	(0.03)	(-1.97)
Trustindex	0.0307***	0.0151**	0.0226***	0.0124*	0.0187**	0.0136	0.0206***
	(6.40)	(2.71)	(4.00)	(2.22)	(3.21)	(1.94)	(3.34)
Logeftpos		0.379***	0.340***	0.416***	0.479***	0.0700	0.313***
		(4.95)	(3.85)	(5.04)	(5.15)	(0.71)	(3.55)
Loggni		1.012***					
		(5.16)					
Cons		0.0159*					0.0158
		(2.02)					(1.69)
Mcapgdp		-0.000038					
		(-0.07)					
Adr			0.0119	0.0228			0.0270
			(0.63)	(1.30)			(1.44)
Urban			0.0146	-0.00626			-0.0174
			(1.77)	(-0.72)			(-1.72)
Secondary			0.000122	0.000318			0.00174
			(0.05)	(0.15)			(0.78)
Loggdp				1.152***			1.453***
				(5.02)			(5.47)
Inflation					-0.0039*		-0.000755
					(-2.47)		(-0.11)
Interest						-0.0186*	
						(-2.01)	
Logcardno							0.226
							(1.87)
Const	-1.204*	-11.22***	-2.925***	-11.88***	-2.61***	-0.347	-15.71***
	(-2.08)	(-6.22)	(-4.74)	(-6.35)	(-4.30)	(-0.42)	(-6.46)
N	219	212	198	198	219	117	197
Ab_ar(2)	0.7255	0.5745	0.5741	0.5479	0.8274	0.2646	0.8375

Source: Own

Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001

Relating again to the Baumol-Tobin model it can be hypothesized that EFTPOS terminals increase the convenience of card use. The coefficient on the number of EFTPOS terminals per person is positive. The variable denoting lending interest rates is negatively related to card payment value, in line with the predictions of the theoretical payment model. The interest rate can be interpreted as the opportunity cost of holding money in cash form. Therefore, the higher the interest rate, the higher the value and volume of noncash transactions. This latter variable was not used in all specifications - it cuts the number of observations in half, because it was not available for some of the periods in the sample. Inflation was used as another way of measuring opportunity costs of holding cash. This variable has a negative impact on the value of card payments, but only in some of the specifications. The other was not significant, since the sample period covers a time of very moderate inflation. It could be hypothesized ex post that this opportunity cost of cash holdings was not a very binding one.

Turning to other variables of interest established by the B-M model, the second column of table 4.2 indicates that other control variables such as consumption (% of GDP) or GNI per capita significantly and positively impacts the card payment value. The positive relation between private consumption, income, and card transactions can be explained by the fact that the higher the consumption and income, the higher the potential benefits accruing from making payments (the transaction demand for money is an increasing function of GDP and consumption per capita).

It is interesting to note that the financial development as portrayed by the number of stock market listed companies (Mcap) or other variables, such as domestic credit (not portrayed in the table), are not significantly related to the value of card payments. Surprisingly, the number of cards does not translate into higher payment value per capita. It could be hypothesized that this first variable is very closely correlated with the financial development.

The micro data analysis showed an important role of socio-demographic factors. These have been investigated also in the macro data investigation, but with mixed results. The proportion of inhabitants living in cities came out to be

insignificantly related to the value of card payments. This was a plausible effect, since a city allows for concentrating different types of retail on a relatively small area decreasing convenience costs and increasing benefits from all types of payments. Moreover, neither age-dependency ratio, nor secondary schooling has a significant impact on the value of card payments on 5 % level. The not reported tertiary schooling variable results show no impact of tertiary education on the variable of interest.

Overall, it seems that card payment value is mostly influenced by past habits and factors relatively stable over time and the Baumol-Tobin model is confirmed to be a good approximation of reality. The former is confirmed by the results of Fixed Effects estimation reported in the appendix in which none of the investigated variables, except for the autoregressive term, are in any way significant.

4.3 Number of terminals

The number of EFTPOS terminals per 1 million inhabitants measures the availability of the technology and its impact on the use of cash and cards through the payee supply problem. Figure 4.2 shows a steady increase over time in the number of POS terminals per one million inhabitants both in Poland, Euro area and the EU. Poland is not only significantly lagging behind in the relative popularity of the terminals, but more importantly, the discrepancy is still growing.

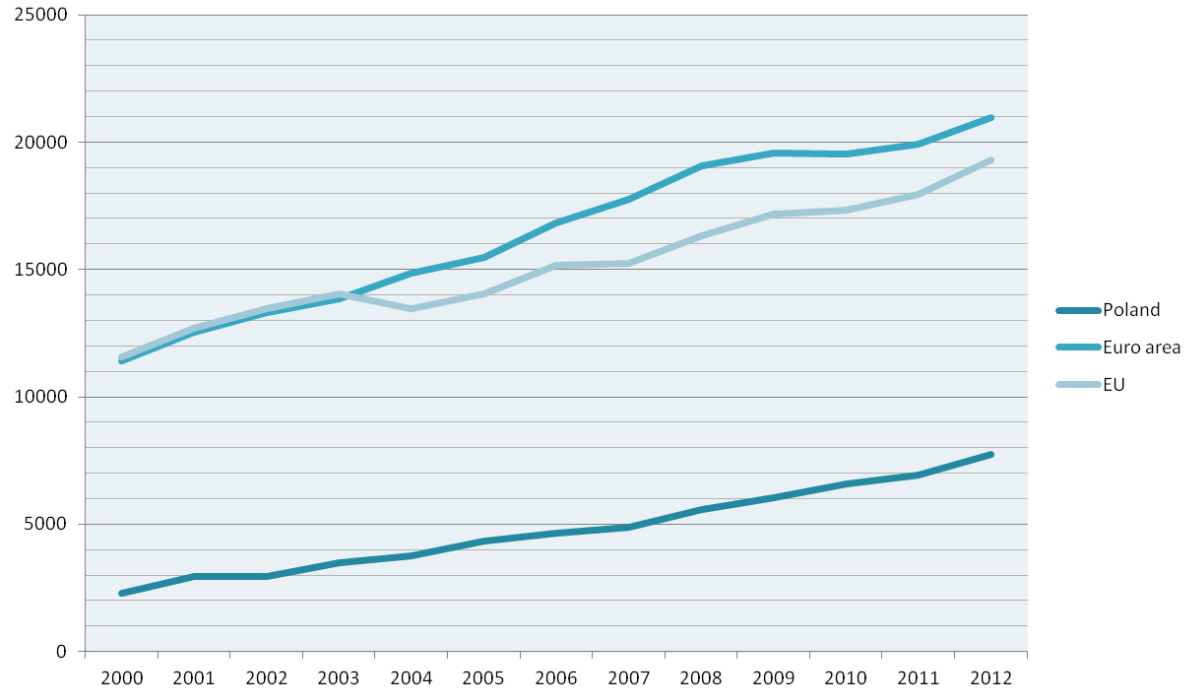

Figure 4.2 Number of terminals in Poland, Euro area and the EU per 1 million inhabitants

Source: Own based on the EBC data

The empirical investigation carried out in this subsection aims to investigate the determinants of EFTPOS terminals. The estimated results have been gathered in Table 4.3. We find that the effect of lagged number of EFTPOS terminals portraying the habit component is smaller in the terminal number regressions compared to the card payment value regressions. The terminals are supposed to decrease the relative use of cash by reducing the convenience costs of using cards. Therefore, we expected this variable to be positively correlated with card popularity. This was confirmed in the data (Column 3).

Insignificant results were obtained for financial development, consumption, GDP, GNI. Surprisingly, neither the total size of the market for payments as proxied by total GDP nor inflation as another way of measuring opportunity costs of holding cash have any impact on the pattern of terminals across countries.

Moreover, neither of the variables relating to the consumption or income or the dependence on tourists (travel as percentage of exports), came out to be significant, but negative, contrary to expectations. While it could be argued that the growth of household final consumption expenditure is primarily used for consumable products and services that are most often paid by card, such as leisure, travel, entertainment, healthcare and so forth, unfortunately, coefficients for these variables are not significant.

In contrast, other variables such as age dependency ratio, the number of ATMs and card, came out to be the most significant regressors in the specifications displayed in Table 4.3. It seems that the advances in the number of terminals are preceded by growing number of cards and ATMs. It could be hypothesized (GMM estimation instrumenting allow for interpreting the endogenous results in the Granger casuality sense) that the card issuers first give out as many cards as possible and invest in a large ATM network. Having done that they switch to EFTPOS payments. As Borzekowski et al. (2008) notes ATM cash withdrawals are then declining, while debit card payment is becoming the dominant form of payment for many consumers. This finding relates to the investigation on the number of card in possession carried out in the next subsection.

Again, the discussion of the results relate to the GMM specification, since the Fixed Effect estimation results are similar to the earlier FE estimations showing only two significant variables - fixed effects and lagged dependent variable. For brevity, these FE result tables were transferred to the appendix.

Table 4.3 Determinants of EFTOPOS number per 1 million inhabitants.

	(1)	(2)	(3)	(4)	(5)	(6)
L.logeftpos	0.597***	0.606***	0.568***	0.593***	0.535***	0.605***
	(16.39)	(17.22)	(15.19)	(14.09)	(13.33)	(17.15)
Logatm	0.174***	0.154**	0.120*	0.179**	0.178**	0.173***
	(3.50)	(2.91)	(2.22)	(2.99)	(3.04)	(3.49)
Trustindex	0.00348	0.00453	0.00552	-0.00248	-0.00778	0.00264
	(1.05)	(1.29)	(1.57)	(-0.61)	(-1.76)	(0.76)
Adr	0.0352***	0.0350***	0.0287***	0.0309**	0.0465***	0.0344***
	(4.22)	(4.20)	(3.35)	(3.01)	(4.86)	(4.15)
Urban	0.00462	0.00566	0.000119	-0.00932*	-0.00400	0.00460
	(1.43)	(1.67)	(0.03)	(-1.97)	(-1.08)	(1.43)
Secondary	-0.00217*	-0.00219*	-0.00137	-0.00184	0.00428	-0.00219*
	(-2.05)	(-2.08)	(-1.26)	(-1.59)	(1.43)	(-2.08)
Loggni	0.0338	0.0191	-0.0430	0.231	0.230*	0.0211
	(0.36)	(0.20)	(-0.45)	(1.83)	(2.27)	(0.23)
Cons	0.00210	0.00227	0.000806	0.00323	0.00301	0.00134
	(0.43)	(0.47)	(0.17)	(0.57)	(0.61)	(0.27)
Mcapgdp	-0.0000367					
	(-0.13)					
Inflation		0.00340	0.00241			
		(1.05)	(0.74)			
Logcardno			0.231***			
			(3.71)			
Services				0.0113*		
				(2.16)		
Travel					-0.00383*	
					(-2.29)	
Ec_cost						-0.00473
						(-0.85)
Const	1.000	1.002	2.454*	-0.209	0.363	1.302
	(1.16)	(1.16)	(2.47)	(-0.19)	(0.47)	(1.44)
N	202	202	202	173	139	202
Ab_ar(2)	0.1599	0.1501	0.1543	0.1812	0.2015	0.1825

Source: Own

Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001

4.4 Number of cards

As already noted, debit cards are being more heavily used in recent years. Consumers, for the most part unknowingly, added debit cards to their wallets because they were mainly seen as devices to access cash and make deposits at automated teller machines (ATMs) that became popular almost a decade before widespread debit card usage. They were unable to use their cards as efficiently as it is done today to make purchases until merchants adopted debit EFTPOS terminals in place of more risky and costly imprint terminals. It is frequent that the adoption of payments technology by end-users does not guarantee its widespread usage and it could be argued that in the case of debit cards this was true (Amromin and Sujit Chakravorti, 2007). As Figure 4.3 shows, Poland is lagging behind both EU and Euro area significantly in the number of cards, though there is some catching up toward the end of the sample period.

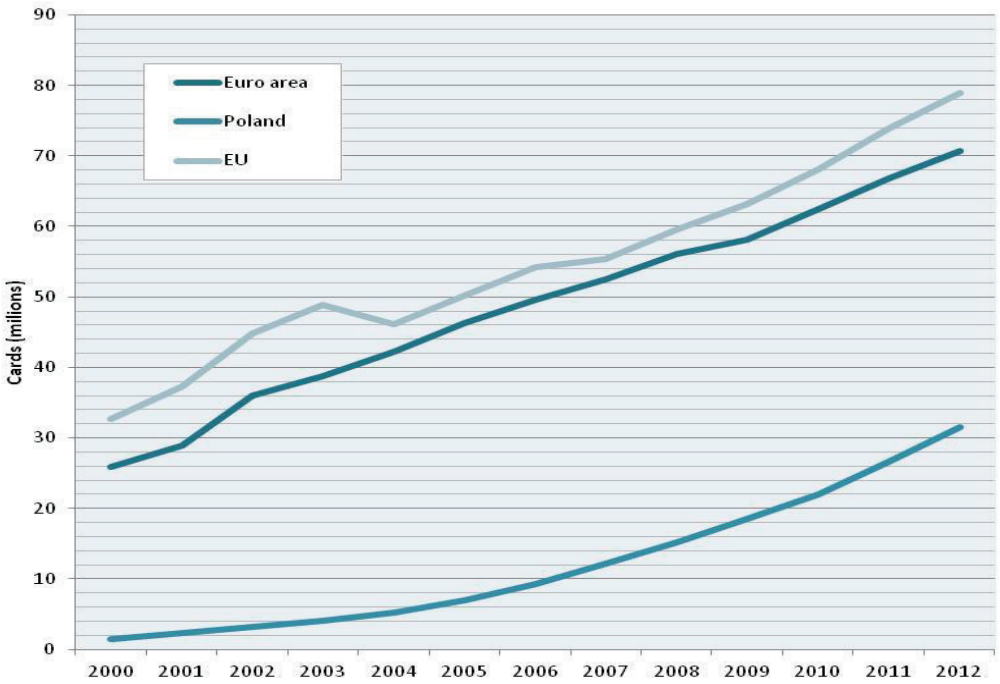

Figure 4.3 Total number of cards in EU, Euro area, and Poland

Source: Own based on the EBC data

Overall, the investigation of the determinants of the number of cards per 1 million inhabitants brought interesting results. These were summarized in table 4.4. Similarly, to the previous investigations concerning card popularity, it can be seen that in all models, both the EFTPOS and ATM variables are positively and significantly associated with the card popularity.

However, it is difficult to interpret these results, since they are inconclusive due to their lack of robustness to the inclusion of other variables. The reason is that the most important fact to be acknowledged when determining the relevant variables is that owning a card does not necessitate its usage. For instance, the availability of ATMs decreases convenience costs of using cash and increases the card popularity. However, credit and debit cards can be used for cash withdrawals, ATMs increase the benefits of holding such a card without using it. The cost effectiveness of ATM cash dispensation has enabled cash to maintain its competitiveness vis-à-vis EFTPOS instruments as in the previous parts of the investigation.

The other significant determinants of card holdings is the age dependency ratio, total GDP and GNI per capita, suggesting that the number of possible clients in the working age, the size of the market, and the income accruing to each member of the society are all positive and significant determinants of card holdings. These effects are very straightforward. However, this was not a by-product of financial development associated with higher economic development, but rather the sheer number of clients in the market.

In contrast to other studies, the coefficient for the private consumption is not significant. Not in line with the microeconomic investigation, the education variables were in general not significant and not of the expected sign. Neither secondary, nor tertiary education has any macroeconomic effects. Generally, it could be argued that education is one of the investigated card payment determinants that significantly affects whether a given individual holds a card or does not, but in the aggregate these effects do not matter significantly. The only other interesting variable was the fraction of non-performing loans, suggesting that banks are unwilling to give out cards in high credit risk environment.

Table 4.4 Determinants of the number of cards per 1 thousand inhabitants.

	(1)	(2)	(3)	(4)	(5)	(6)
L.logcardno	0.539***	0.515***	0.476***	0.484***	0.526***	0.539***
	(11.16)	(10.34)	(8.23)	(9.49)	(10.64)	(11.08)
Logeftpos	0.148***	0.162***	0.219***	0.133**	0.134***	0.146***
	(3.74)	(4.05)	(4.14)	(3.24)	(3.30)	(3.76)
Logatm	0.135**	0.0974	0.105	0.110*	0.118*	0.142**
	(2.89)	(1.91)	(1.82)	(2.17)	(2.28)	(2.98)
Nonperform	-0.00368	-0.00587*	-0.00508	-0.00744*	-0.00558	-0.00433
	(-1.42)	(-2.06)	(-1.58)	(-2.57)	(-1.96)	(-1.58)
Trustindex	-0.00255	-0.00449	-0.00390	-0.00355	-0.00716*	-0.00305
	(-0.98)	(-1.61)	(-1.21)	(-1.28)	(-2.33)	(-1.12)
Inflation	0.00892**	0.00728*	0.00725	0.00698*	0.00861*	0.00891**
	(2.67)	(2.12)	(1.94)	(2.06)	(2.47)	(2.61)
Cons	0.00493	0.00360	0.00271	0.00220	0.00244	0.00489
	(1.12)	(0.81)	(0.50)	(0.50)	(0.55)	(1.09)
Loggdp	0.245*	0.274**	0.206*	0.225*	0.222*	
	(2.52)	(2.81)	(2.07)	(2.28)	(2.27)	
Credreg		0.000821	0.000761	0.000631	0.000816	
		(1.78)	(1.48)	(1.37)	(1.77)	
Secondary			-0.000963			
			(-0.89)			
Tertiary			-0.000949			
			(-0.56)			
Adr				0.0209*		
				(2.38)		
Urban					0.00622*	
					(2.19)	
Loggni						0.240*
						(2.54)
Const	-1.452	-1.242	-0.707	-0.812	-0.794	-1.366
	(-1.57)	(-1.34)	(-0.72)	(-0.87)	(-0.85)	(-1.52)
N	215	215	186	215	215	211
Ab_ar(2)	0.4668	0.4759	0.5015	0.4832	0.4681	0.4789

Source: Own

Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001

It should be stressed that the results of this subsection are not having much policy implications due to impossibility to influence the significant variables (GDP, GNI per capita, urbanization, or Age Dependency), should be regarded as the least important part of macrodata investigation. The relative widespread of cards could be an effect of promoting ATM withdrawals by the banks and therefore not a measure of cashless payments. As noted earlier, owning a card does not necessitate its usage in retail payments.

4.5 Card transactions as a fraction of total transactions

In mapping out the usage of cards versus noncash in retail payments over time, there is a prevalent problem. While the usage of debit and credit cards has been handled by banks and automated clearinghouses from the start of operation, a structural registration of transactions in cash is impossible. Exact figures on the number and value of cash payments for consecutive years are therefore not available. Therefore, it is impossible to describe the exact pattern of cards versus other forms of noncash means of payment in retail and hence the aim of this sub-section is a more modest one. The goal here is to distinguish between different types of noncash payments versus cards while controlling for the number of ATMs.

Figure 4.4 presents card transactions as a fraction of total transactions in the analyzed countries. It seems as in other studies that the card share in the retail payment sector was still far from widespread in the portrayed sample. Only after the adoption of debit card terminals by petrol stations and largest chains of supermarkets the card usage begins to take off (Jonker, Kettenis, 2007). It is interesting to note that in Austria and Germany the usage of cards is relatively low, despite the fact that these countries are technological leaders in the EU. This is not caused by e-money transactions since the share of e-money transactions in these countries is 1.16% and 0.18% respectively. Therefore, it is more likely that this is caused by direct debit prevalence in the two countries.

Figure 4.4 Card transactions as a fraction of total noncash transactions

Source: Own based on the EBC data

The lack of cash usage data is side stepped through the number of ATMs as a proxy for cash transactions as proposed in the seminal paper by Humphrey et al. (1998). Since ATMs do not dispense large denomination notes, it is plausible that in terms of the network effects of ATM cash and EFTPOS are similar and consumers view these retail payment instruments as almost perfect substitutes. Hence, in an equilibrium in which consumers use both media, their network costs must be equal at the margin under conditions of optimal money management. This is supported in the data, since the ATM variable is significantly and negatively related to the card transaction share. This means that given an increase in the number of ATMs, the rise in the use of cash attributable to greater availability surpasses the decrease in the need to hold large amounts of it.

Turning to the other variables of interest, the number of EFTPOS is significantly an positively related to card share. The number of EFTPOS terminals turns out to matter quite much. The force of habit proxied by the lagged card transaction share is relatively the smallest out of the four analyzed measures. It could be that this is visible in the data through the increasing role of direct debit and decreasing role of direct credit transactions in e-commerce. It seems that "trustindex" is related positively to the usage of cards, though this variable is not statistically significant in all specifications at 5% level, though on 10% level, it is always significant.

Table 4.5 Determinants of the card transactions as a fraction of total noncash transactions.

	(1)	(2)	(3)	(4)
L.s_cards	0.465***	0.437***	0.425***	0.454***
	(8.94)	(8.00)	(7.81)	(8.69)
Logatm	-7.053***	-7.430***	-8.663***	-7.335***
	(-3.89)	(-4.01)	(-4.81)	(-4.02)
Logcardno	7.400***	7.899***	3.785*	6.660***
	(4.69)	(4.90)	(2.15)	(4.14)
Logeftpos	4.678**	4.774***	3.647*	4.779**
	(3.23)	(3.29)	(2.51)	(3.29)
Trustindex	0.210*	0.187	0.197	0.269**
	(2.11)	(1.62)	(1.95)	(2.62)
Adr	-0.425	-0.338	0.211	-0.362
	(-1.68)	(-1.36)	(0.77)	(-1.42)
Urban	0.537***	0.523***	0.585***	0.512***
	(4.07)	(3.80)	(4.33)	(3.86)
Secondary	0.0252	0.0293	0.00788	0.0391
	(0.80)	(0.93)	(0.25)	(1.22)
Gni	-0.000164	-0.000176	-0.0000411	-0.0000992
	(-1.39)	(-1.32)	(-0.34)	(-0.83)
Cons	-0.162	-0.142	-0.119	-0.0101
	(-1.27)	(-1.04)	(-0.94)	(-0.07)
Ec_time		-0.00709		
		(-1.57)		
Dc			0.0339**	
			(2.92)	
Openness				0.0420**
				(2.59)
Const	-68.76***	-65.78***	-46.48*	-83.40***
	(-3.93)	(-3.50)	(-2.31)	(-4.53)
N	201	197	198	201
Ab_ar(2)	0.2280	0.2824	0.2618	0.1334

Source: Own

Notes: t statistics in parentheses, * p<0.05, ** p<0.01, *** p<0.001

As expected in the microdata-based investigation, the size of the place of residence transmits itself into the index of urbanization in the macroscale. This effect is particularly interesting since this variable was not that strong for card holding, but was one of the most significant determinants of card payments. It seems that countryside inhabitants hold cards on a level on par with urban inhabitants, however, the latter have more possibilities to use them for retail payments. In contrast to the microdata-based investigation, the variables related to education, income and age were estimated not to be significantly different from zero. Generally, it could be argued that overall the social demographic factors that significantly affect whether a given individual holds a card or does not, taken together the effects cancel out and do not have very important consequences in the aggregate.

Other control variables were generally not robust, including consumption as a fraction of GDP, and GNI per capita. However, country openness and the total size of domestic credit used as a proxy for financial development were positively and significantly related with the investigated share of card transactions in most specifications.

4.6 Concluding remarks

The macrodata analysis brought interesting results, due to large differences in the results concerning the four variables used to measure card transaction popularity. These were:

1. Total value of annual card payments per capita
2. Number of terminals per 1 million inhabitants
3. Number of cards per 1 thousand inhabitants
4. Card transactions as a fraction of total noncash transactions

It seems that investigation aimed at establishing the factors related to the evolution of the number of cards brought the most mixed results. This measure was

most difficult to relate to card retail payment usage, since owning a card does not necessitate its usage. It was interesting to note however that countryside inhabitants hold cards on a level on par with urban inhabitants, however, the latter have more possibilities to use them for retail payments due to larger number of EFTPOS on a relatively more dense area. In contrast to the microdata-based investigation, the variables related to education, income and age were estimated not to be significantly different from zero other than age being positively related to the number of EFTPOS terminals.

Concerning the policy implications it can be pointed out that trust was a positively related to card payment value. In the case of payer, payee, and the banks, trust can be defined as a belief that the bank, as the agent in a principal-agent relationship, will deliver on its stated policy - deliver the payment amount from the payer to the payee. There is little doubt that public trust in policy-making institutions, not only banks, is of fundamental importance for their long-term success. This is an important implication visible both in the macro and in micro data investigations.

This is important to note, since in general we find that payment choices are mainly driven by habits, which are generally difficult to change. This suggests a public trust card campaign would be relatively costly and long-term in its scope in order for the people who do not trust in the economic system in general to gain trust in the card-system in particular.

5. Forecast for Poland

In this part of the report, we intend to forecast two figures of major interest for Poland: the number of cards and the value of card transactions per person. Although the number of EFTPOS terminals is not the variable of main interest, it is used as an independent variable in other equations. That is why it needs to be forecasted as well. The forecasts of the number of EFTPOS are thus made and provided.

The following approach has been adopted in the process of forecasting. Firstly, it should be stated, that the basic statistics as well as economical meaning of the estimated models do not allow for clear identification of the `best' of them. In view of that, none of the proposed models can be rejected ex ante as a useless forecasting tool. Thus all of the models provided in tables 4.2-4.4 are first used to provided forecasts of the dependent variable (typical expected value approach is adopted). The forecasts are provided for both the in-sample period and out-of-sample period. The in-sample period is limited to the 2002-2012 slot as values of a number of variables for the 1999-2001 period are not available for Poland. The out-of-sample period ranges 2013-2020: again most variables values for the 2013 are not available yet at the time of writing, thus the year 2013 must be treated as most `future'. Despite the fact that the forecasts are given up to 2020, they should be handled with caution – the authors trust that in the case of such a dynamic phenomenon the relatively short horizon forecasts (say, until 2016 or 2017) are trustworthy, whereas all that goes beyond that point is given rather for reference.

The in-sample forecasts are used to provide the root mean square errors (RMSE) of particular models. As it can be noticed, no particular preference for any of the specifications can be pointed out. In view of that, firstly a final out-of-sample forecast of each of the variables - the logarithmized number of EFTPOS terminals (logeftpos), logarithmized total value of annual card payments per 1 capita (logvalue) and logarithmized number of cards per 1 thousand inhabitants (logcardno) are computed as weighted averages of forecasts from each of the specifications with the given dependent variables, while the weights are proportional

to the inverse of RMSE of each specification[1]. The weights along with the RMSE (for the 2002-2012 period) of each specification are given in table 5.1.

Table 5.1. RMSE and weights adopted in forecasting process for particular specifications.

Logarithmized number of EFTPOS terminals						
Specification in table 4.2	(1)	(2)	(3)	(4)	(5)	(6)
Rmse	0,1090	0,1084	0,1197	0,1082	0,1353	0,1075
Weight	0,1741	0,1751	0,1586	0,1754	0,1403	0,1765
Logarithmized number of cards per 1 thousand inhabitants						
Specification in table 4.3	(1)	(2)	(3)	(4)	(5)	(6)
Rmse	0,0765	0,0871	0,0906	0,0758	0,0763	0,0752
Weight	0,1738	0,1527	0,1468	0,1755	0,1744	0,1768
Logarithmized value of annual card payments per capita						
Specification in table 4.1	(1)	(2)	(3)	(4)	(5)	(6)
Rmse	0,1011	0,0625	0,0769	0,0639	0,0797	0,1015
Weight	0,1285	0,2080	0,1691	0,2034	0,1631	0,1280

Source: Own.

There is a number of variables which are treated as exogenous in the models. In the process of forecasting out-of-sample, their values need to be assumed. A couple of scenarios are proposed: these differ in the GDP and GNI growth. Table 5.2 describes the assumptions that have been adopted in all the five considered scenarios for each of the variables except GDP and GNI growth and the five different paths of the GDP and GNI for each considered case: between very pessimistic, pessimistic, baseline, optimistic and very optimistic.

[1] As the number of EFTPOS terminals i san explanatory variable in other specifications, for the out-of-sample forecasts the weighted mean forecast is taken as its value.

Table 5.2. Assumptions regarding exogenous variables in forecasting for the 2013-2020 period.

trustindex	**Trust Index**	**constant, as in 2012**
Cons	Consumption (% of GDP)	constant, as in 2012
Urban	Proportion of population living in cities	constant, as in 2012
Secondary	Secondary school enrollment (% total)	constant, as in 2012
Tertiary	Tertiary school enrollment (% total)	constant, as in 2012
Services	Services value-added (% of GDP)	constant, as in 2012
Travel	Travel as % of exports.	constant, as in 2012
ec_cost2	Enforcing Contract costs (% of GNI)	constant, as in 2012
credreg2	Credit regulation index	constant, as in 2012
ec_time	Enforcing Contract time (in days)	constant, as in 2012
ATM	Number of ATMs per 1 million inhabitants	linear trend from 2009-2012 preserved all along
McapGDP	Market Capitalization of stock market listed companies	linearly increasing till 45% until 2020
Adr	Age dependency ratio (old + young)	increase by 0,5pp p/a
Interestlending	Interest lending rate	decrease by 1 pp in 2015, remains constant afterwards
Inflation	Consumer price annual inflation (%)	2,5% in 2013, 1,5% in 2014, 1% in 2015, 1,5% in 2016, 2% afterwards
Nonperform	Bank nonperforming loans to total gross loans (%)	linearly decreasing till 5% until 2020
Openess	Trade to GDP (in %)	increase by 2pp p/a
DC	Domestic Credit	linearly increasing till 75% until 2020
GDP	Gross Domestic Product **PPP (in constant 2005 int. dollars)**	very pessimistic: 2% increase in 2014, 1% increase p/a afterwards
		pessimistic: 2% increase in 2014, 1,5% increase p/a afterwards
		baseline: 2% increase in 2014, 2,5% increase p/a afterwards
		optimistic: 2% increase in 2014, 3% increase p/a afterwards
		very optimistic 2% increase in 2014, 3,5% increase p/a afterwards
GNI	Gross National Income per capita (PPP)	same as GDP

Source: Own.

Most of the projected variables are quite steady over time. This applies mostly to variables relating to indexes and shares. These were assumed to be constant as in the last data point - that is 2012. Other variables, mostly those that have shown significant trends in the past, are assumed to be preserving the trend in the future. For example, this includes the share of trade in GDP and number of ATMs. Stock

market capitalization and domestic credit are expected to increase to achieve some steady level at 45 % of GDP and 75 %, respectively. Inflation and interest rates are compiled according to market central projections. Age dependency ratio is increasing, as shown by GUS demographic projections. The number of nonperforming loans is expected to fall, since all of the scenarios, including the very pessimistic one, assume positive GDP growth and some inflation. This will allow for the effects of the recent financial crisis to die out.

Having adopted the above described assumptions, the following forecasts are obtained: these are provided in table 5.3. Although in the equations, it is the logarithm of particular variables that is computed, the data in the table are ex-post exponentiated and the values given refer to the non-logarithmized values of the variables of interest.

Table 5.3. Final forecasts for Poland.

year	2014	2015	2016	2017	2018	2019	2020
value of annual card payments per 1 million inhabitants							
VERY OPTIMISTIC	860,9405	882,9806	927,6149	995,3364	1085,991	1200,009	1338,361
OPTIMISTIC	860,9405	880,982	922,0574	984,7178	1068,656	1174,02	1301,405
BASELINE	860,9405	878,9881	916,5344	974,2161	1051,606	1148,608	1265,495
PESSIMISTIC	860,9405	875,0144	905,5906	953,5582	1018,341	1099,47	1196,696
VERY PESSIMISTIC	860,9405	873,0345	900,1696	943,3995	1002,118	1075,718	1163,751
number of EFTPOS terminals							
VERY OPTIMISTIC	8743,135	8943,276	9472,022	10249,3	11236,96	12416,23	13787,46
OPTIMISTIC	8743,135	8939,988	9462,717	10231,19	11206,93	12370,66	13722,13
BASELINE	8743,135	8936,701	9453,421	10213,11	11176,98	12325,3	13657,18
PESSIMISTIC	8743,135	8930,131	9434,86	10177,07	11117,38	12235,17	13528,44
VERY PESSIMISTIC	8743,135	8926,848	9425,595	10159,1	11087,71	12190,41	13464,64
number of cards per 1 million inhabitants (ths. units)							
VERY OPTIMISTIC	1020,763	1104,094	1177,759	1262,953	1360,809	1465,161	1578,075
OPTIMISTIC	1020,763	1102,77	1174,171	1256,328	1350,412	1450,299	1558,019
BASELINE	1020,763	1101,448	1170,595	1249,738	1340,094	1435,588	1538,219
PESSIMISTIC	1020,763	1098,808	1163,475	1236,661	1319,696	1406,614	1499,376
VERY PESSIMISTIC	1020,763	1097,491	1159,931	1230,174	1309,614	1392,349	1480,326

Source: Own.

As it can be seen, the results for the reasonable considered behavior of particular demographic, macroeconomic and sociologic variables reveal quite positive expectations as regards the development of non-cash transactions. Each of

the considered variables is expected to grow fast, even if the GDP growth slowed down below expectations (the very pessimistic variant). This naturally could have been expected: as it was stated in chapter 4, Poland trails behind most of the EU countries, whereas in face of permanent globalization of all sorts of markets, the technological development should affect Poland in the forthcoming years as well, which should result in catching up with the EU in this respect. Obviously, the faster economic growth should be expected to speed up this process.

Nevertheless, it should be emphasized that these forecasts should be taken with great caution. It can be expected that people's attitude to card payment is strongly related with the existence of interchange fee and its rate. Its changes might have huge impact on the development of the non-cash transactions market, however it is difficult to predict what the influence will exactly be as there are virtually no historical data that would enable for the estimation of its influence on people's payment habits. In view of that, the above quoted results should be treated rather as a bottom point – the true development might be even higher. A good example of the transmission mechanism in this respect is the newly taken measure by the retail discount store network of "Biedronka". Officially "for the convenience of customers" yet in reality – probably in response to the interchange decrease the network are introducing card payments. Considering its big popularity, this may attract many customers to indeed setting an account and obtaining a payment card to it, whereas smaller shops can be expected to follow "Biedronka's" example.

6. Summary

Over the recent years, popularity of card payments has grown at an unprecedented rate. At the same time, cards have become the most used non-cash payment instrument in Europe in terms of the number of transactions. The aim of the presented research was to investigate this phenomenon by seeking determinants of card usage including the value of transactions and the number of cards held by the citizens. This was carried out on two levels of aggregation. The microeconomic investigation was based on an econometric analysis of data gathered through survey of individuals in Poland. The results showed a significant influence of demographic, social and economic variables on the number of card payment transactions. The macroeconomic investigation focused on cross-country variation in levels of card usage (mostly value of transactions and the number of cards held) and its determinants. The results were mostly in line with the literature.

While previous research focused mostly on determinants that were mostly outside of policy-makers' options, as GDP, consumption as % of GDP, or sociodemographic determinants of surveyed individuals, our investigation focused on more viable policy instruments. Above all, we found that trust was a positively related to card payment value. There is little doubt that public trust in policy-making institutions, not only banks, is of fundamental importance for their long-term success. So is the case with card payments, since these require trusting unknown individuals with one's money. This is an important implication visible both in the macro and in the micro data investigations.

It is important to note that payment choices are mainly driven by habits, which, as the investigation shows, are difficult to change. This suggests a public trust card campaign would be relatively costly and long-term in its scope in order for the people who do not trust in the economic system in general to gain trust in the card-system in particular.

Most of the investigated card usage determinants were quite steady over time. This allowed presenting a range of forecasts of card usage in Poland, including the value of transactions and the number of cards held. Each of the considered variables is expected to grow fast, even if the GDP growth slowed down below

expectations in the very pessimistic variant. The technological development associated with transferring the non-cash payments into more and more convenient electronic means of payment should affect Poland in the forthcoming years as well, which should result in catching up with the EU in this respect. Obviously, the faster economic growth the quicker this process will be.

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7. Appendix: Statistical tables

Table A.1 Determinants of card transactions value per capita (Kiviet, logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.logvalue	0.857***	0.730***	0.787***	0.733***	0.813***	0.902***
	(25.09)	(11.41)	(22.68)	(26.47)	(20.41)	(14.50)
logATM	-0.0297	-0.0661	-0.00485	-0.0747	-0.0119	0.0181
	(-0.31)	(-0.62)	(-0.04)	(-0.56)	(-0.10)	(0.16)
trustindex	0.00256	0.00563	0.00260	0.00246	0.00336	0.00446
	(0.53)	(0.88)	(0.34)	(0.32)	(0.67)	(0.40)
logeftpos		0.113	0.0685	0.0387	0.105	-0.116
		(1.21)	(0.84)	(0.44)	(1.29)	(-1.06)
logGNI		0.574				
		(1.86)				
cons		0.0193*				
		(2.08)				
McapGDP		0.000801				
		(1.25)				
adr			0.00743	0.00809		
			(0.38)	(0.41)		
urban			0.00192	0.0102		
			(0.10)	(0.52)		
secondary			-0.000624	0.000111		
			(-0.35)	(0.06)		
logGDP				0.694*		
				(2.03)		
Inflation					-0.00137	
					(-0.62)	
Interest						-0.0123
						(-1.70)
N	219	212	198	198	219	117

Table A.2 Determinants of card transactions value per capita (Kiviet non-logarithmized).

	(1)	(2)	(3)	(4)	(5)
L.valuetot~p	0.865***	0.787***	0.918***	0.768***	0.895***
	(16.94)	(15.89)	(16.44)	(16.03)	(17.01)
noatm_pop	-0.0728	0.128	-0.231	0.0101	0.133
	(-0.19)	(0.28)	(-0.44)	(0.02)	(0.29)
trustindex	15.97	9.884	28.36	7.784	12.48
	(0.80)	(0.43)	(1.40)	(0.34)	(0.93)
eftpos_pop	0.0208	0.0156	0.00646	0.0152	0.0205
	(1.47)	(0.98)	(0.47)	(0.96)	(1.40)
GNI	0.0246		0.0189		
	(0.79)		(0.81)		
Cons	51.38		13.25		
	(1.77)		(0.86)		
McapGDP	4.389*		2.296		
	(2.17)		(1.37)		
Adr		8.308		0.392	
		(0.15)		(0.01)	
Urban		61.45		71.50	
		(0.97)		(1.11)	
Secondary		-6.036		-5.183	
		(-1.03)		(-0.92)	
RIR			-18.54		
			(-1.41)		
GDP				0.0295	
				(0.85)	
Inflation					-3.123
					(-0.52)
N	212	198	115	198	219

Table A.3 Determinants of EFTOPOS number per 1 mln inhabitants (Kiviet, logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.logeftpos	0.854*** (20.81)	0.859*** (20.98)	0.862*** (21.19)	0.841*** (21.00)	0.789*** (15.59)	0.835*** (20.27)
logATM	0.0393 (0.55)	0.0627 (0.84)	0.0631 (0.92)	0.0534 (0.69)	-0.0385 (-0.42)	0.0420 (0.57)
trustindex	-0.00567 (-1.28)	-0.00658 (-1.53)	-0.00657 (-1.53)	-0.00625 (-1.26)	-0.0104* (-2.42)	-0.00549 (-1.24)
adr	-0.00109 (-0.11)	-0.000846 (-0.09)	-0.000876 (-0.09)	-0.00101 (-0.10)	0.0196 (1.22)	0.00146 (0.15)
urban	0.0176 (1.91)	0.0188* (2.09)	0.0191 (1.79)	0.0134 (0.99)	0.00525 (0.30)	0.0189* (2.13)
secondary	-0.00176* (-2.46)	-0.00184* (-2.47)	-0.00187* (-2.44)	-0.00180 (-1.72)	-0.00109 (-0.34)	-0.00176* (-2.40)
logGNI	-0.00803 (-0.05)	-0.102 (-0.52)	-0.107 (-0.50)	0.0906 (0.46)	0.0380 (0.19)	0.0287 (0.15)
cons	-0.00118 (-0.23)	-0.000578 (-0.12)	-0.000526 (-0.10)	0.00164 (0.24)	-0.00146 (-0.28)	-0.000613 (-0.12)
McapGDP	0.0000523 (0.17)					
inflation		0.00864 (1.79)	0.00871 (1.84)			
card_pop			-0.00000328 (-0.06)			
services				-0.00267 (-0.51)		
travel					-0.00656 (-1.80)	
ec_cost2						0.00334 (0.59)
N	202	202	202	173	139	202

Table A.4 Determinants of EFTOPOS number per 1 million inhabitants (Kiviet, non logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.eftpos_pop	1.006***	1.010***	1.014***	1.029***	0.973***	0.999***
	(22.39)	(23.08)	(22.30)	(28.56)	(29.10)	(22.56)
noatm_pop	0.643	1.028	1.161	1.160	-0.143	0.612
	(0.47)	(0.72)	(0.86)	(0.78)	(-0.07)	(0.44)
trustindex	-67.85	-77.72	-77.29	-78.19	-101.3	-66.15
	(-1.04)	(-1.22)	(-1.22)	(-1.16)	(-1.58)	(-1.05)
Adr	-33.52	-45.16	-23.78	-68.15	228.0	-34.99
	(-0.25)	(-0.34)	(-0.17)	(-0.52)	(0.98)	(-0.26)
urban	171.2	184.0	216.4	87.27	144.7	175.0
	(1.27)	(1.45)	(1.44)	(0.52)	(0.62)	(1.41)
secondary	-28.87*	-30.73**	-33.20**	-26.43	-71.43	-30.26**
	(-2.57)	(-2.68)	(-2.78)	(-1.87)	(-1.41)	(-2.61)
GNI	-0.0880	-0.119	-0.105	0.00691	-0.0237	-0.0735
	(-0.95)	(-1.20)	(-0.96)	(0.08)	(-0.24)	(-0.77)
cons	-23.32	-26.47	-20.45	65.11	-47.85	-28.11
	(-0.30)	(-0.35)	(-0.26)	(0.66)	(-0.64)	(-0.37)
McapGDP	3.190					
	(0.67)					
inflation		128.8	129.8			
		(1.67)	(1.70)			
card_pop			-0.439			
			(-0.54)			
services				-97.02		
				(-1.10)		
travel					-37.41	
					(-0.73)	
ec_cost2						10.08
						(0.12)
N	202	202	202	173	139	202

Table A.5 Number of cards per 1 thousand inhabitants (Kiviet logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.logcardno	0.876*** (21.69)	0.877*** (22.08)	0.895*** (15.16)	0.868*** (21.41)	0.847*** (24.36)	0.879*** (14.66)
logeftpos	0.0395 (0.95)	0.0426 (1.01)	0.0265 (0.53)	0.0341 (0.78)	0.0283 (0.61)	0.0360 (0.74)
logATM	-0.0102 (-0.17)	0.00214 (0.03)	-0.0376 (-0.53)	0.00655 (0.10)	-0.00938 (-0.13)	-0.0133 (-0.29)
nonperform	-0.00616** (-2.68)	-0.00546** (-2.68)	-0.00480 (-1.23)	-0.00583** (-2.74)	-0.00630** (-2.89)	-0.00666** (-2.66)
trustindex	-0.00782* (-2.15)	-0.00688 (-1.75)	-0.00777* (-2.10)	-0.00669 (-1.70)	-0.00539 (-1.34)	-0.00874 (-1.64)
inflation	0.00877 (1.95)	0.00894* (1.99)	0.00777 (1.64)	0.00873 (1.92)	0.00809 (1.84)	0.00841* (2.21)
cons	0.00247 (0.47)	0.00338 (0.57)	0.00394 (0.93)	0.00340 (0.54)	0.00488 (0.81)	0.00245 (0.41)
logGDP	-0.0518 (-0.33)	-0.0354 (-0.22)	0.0956 (0.47)	-0.0419 (-0.26)	0.0547 (0.34)	
credreg2		-0.000376 (-0.65)	-0.0000435 (-0.07)	-0.000468 (-0.85)	-0.000429 (-0.76)	
secondary			-0.0000109 (-0.01)			
tertiary			-0.000602 (-0.36)			
adr				0.00684 (0.70)		
urban					0.0137 (1.15)	
logGNI						-0.0320 (-0.17)
N	215	215	186	215	215	211

Table A.6 Number of cards per 1 thousand inhabitants (Kiviet non-logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.card_pop	0.914***	0.913***	0.927***	0.860***	0.889***	0.877***
	(18.23)	(18.12)	(17.53)	(15.76)	(16.50)	(16.81)
nopos_pop	0.00201	0.00211	0.00215	0.000728	0.00143	0.00132
	(0.59)	(0.62)	(0.74)	(0.21)	(0.40)	(0.39)
noatm_pop	-0.0138	0.0101	-0.118	-0.0345	0.00475	-0.0319
	(-0.12)	(0.09)	(-0.97)	(-0.31)	(0.04)	(-0.30)
nonperform	-5.783	-4.900	-4.028	-6.908	-5.712	-6.262
	(-1.60)	(-1.27)	(-0.82)	(-1.79)	(-1.48)	(-1.64)
trustindex	-8.721	-7.395	-9.247	-5.307	-7.066	-5.498
	(-1.56)	(-1.15)	(-1.83)	(-0.81)	(-1.08)	(-0.84)
inflation	8.446	8.555	5.090	7.123	8.037	7.468
	(1.55)	(1.56)	(0.73)	(1.33)	(1.47)	(1.40)
cons	0.526	1.486	2.049	3.597	1.652	3.628
	(0.07)	(0.20)	(0.26)	(0.48)	(0.22)	(0.49)
GDP	0.00732	0.00838	0.0176	0.00919	0.00671	0.0109
	(0.83)	(0.92)	(1.57)	(0.99)	(0.72)	(1.21)
credreg2		-0.449	0.166	-0.649	-0.626	-0.497
		(-0.65)	(0.18)	(-0.92)	(-0.89)	(-0.71)
secondary			0.388			
			(0.31)			
tertiary			-1.614			
			(-0.89)			
urban				18.47		19.76
				(1.24)		(1.33)
adr				13.22	15.03	
				(1.41)	(1.60)	
N	211	211	182	211	211	211

Table A.7 Card transactions as a fraction of total noncash transactions (Kiviet logarithmized).

	(1)	(2)	(3)	(4)
L.s_cards	0.832***	0.821***	0.789***	0.829***
	(15.41)	(15.16)	(18.15)	(15.00)
logATM	-2.259	-2.331	-2.676	-2.232
	(-1.07)	(-1.08)	(-1.66)	(-1.05)
logcardno	1.954	1.973	2.163	2.181
	(0.96)	(1.16)	(1.33)	(1.06)
logeftpos	0.780	0.963	0.0941	0.548
	(0.51)	(0.46)	(0.07)	(0.35)
trustindex	0.0839	0.0796	0.124	0.105
	(0.90)	(0.72)	(1.06)	(1.11)
adr	-0.00887	0.0270	0.0674	-0.142
	(-0.04)	(0.08)	(0.21)	(-0.61)
urban	0.0501	0.0464	0.00719	-0.0516
	(0.16)	(0.19)	(0.02)	(-0.16)
secondary	0.0842	0.0813*	0.0701	0.0873
	(1.75)	(2.12)	(1.85)	(1.80)
GNI	-0.0000315	-0.0000736	-0.000105	-0.000140
	(-0.19)	(-0.32)	(-0.51)	(-0.79)
cons	-0.216	-0.241	-0.358*	-0.171
	(-1.47)	(-1.37)	(-2.45)	(-1.18)
ec_time		-0.000359		
		(-0.06)		
DC			0.0189	
			(1.47)	
openess				0.0561*
				(2.02)
N	201	197	198	201

Table A.8 Card transactions as a fraction of total noncash transactions (Kiviet non-logarithmized).

	(1)	(2)	(3)	(4)
L.s_cards	0.846***	0.844***	0.800***	0.838***
	(15.66)	(18.84)	(16.53)	(15.15)
noatm_pop	-0.00147	-0.00138	-0.00270	-0.00104
	(-0.56)	(-0.49)	(-1.11)	(-0.40)
card_pop	0.00180	0.00187	0.00177	0.00203
	(1.17)	(1.57)	(1.40)	(1.33)
eftpos_pop	-0.0000154	-0.0000129	-0.0000583	0.00000416
	(-0.13)	(-0.10)	(-0.55)	(0.04)
trustindex	0.0705	0.0751	0.107	0.0892
	(0.65)	(0.68)	(0.96)	(0.81)
adr	-0.00898	0.0231	0.0906	-0.197
	(-0.04)	(0.06)	(0.31)	(-0.87)
urban	0.0522	0.0221	0.0509	-0.110
	(0.16)	(0.07)	(0.15)	(-0.34)
secondary	0.0867	0.0847*	0.0679	0.0905
	(1.71)	(2.30)	(1.73)	(1.77)
GNI	-0.0000538	-0.0000913	-0.000138	-0.000193
	(-0.39)	(-0.42)	(-0.74)	(-1.26)
cons	-0.194	-0.226	-0.309*	-0.157
	(-1.25)	(-1.17)	(-2.06)	(-1.01)
ec_time		0.00129		
		(0.23)		
DC			0.0199	
			(1.51)	
openess				0.0583*
				(2.11)
N	201	197	198	201

Table A9 Determinants of card transactions value per capita (Blundell-Bond non-logarithmized).

	(1)	(2)	(3)	(5)	(6)	(7)
L.valuetot	0.661***	0.566***	0.483***	0.453***	0.671***	0.933***
	(15.12)	(11.53)	(8.91)	(8.00)	(15.33)	(24.43)
noatm_pop	0.182	-0.479	0.743	0.607	0.238	0.467
	(0.38)	(-1.00)	(1.56)	(1.27)	(0.45)	(1.74)
trustindex	77.91***	31.29	48.46**	39.03*	71.07***	24.16**
	(7.79)	(1.90)	(2.84)	(2.19)	(5.19)	(2.75)
eftpos_pop	0.0679***	0.0782***	0.0440**	0.0538***	0.0730***	-0.0106
	(6.11)	(6.11)	(2.96)	(3.40)	(4.91)	(-1.00)
GNI		0.136***				
		(4.48)				
cons		144.0***				
		(4.86)				
McapGDP		7.213***				
		(4.27)				
adr			50.84	62.76		
			(1.01)	(1.24)		
urban			102.8***	81.16**		
			(4.16)	(2.94)		
secondary			-13.30*	-14.54*		
			(-2.01)	(-2.20)		
GDP				0.0405		
				(1.76)		
Inflation					-4.166	
					(-0.58)	
Interestlend						-51.62**
						(-2.89)
Const	-7415***	-14540***	-11485***	-10255***	-6471***	-1758*
	(-7.05)	(-5.85)	(-6.84)	(-5.66)	(-3.90)	(-2.08)
N	219	212	198	198	219	117

Table A10. Determinants of EFTOPOS number per 1 million inhabitants (Blundell-Bond non-logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.eftpos_pop	0.766***	0.748***	0.766***	0.777***	0.793***	0.743***
	(19.03)	(18.92)	(18.70)	(15.67)	(16.89)	(19.20)
noatm_pop	1.064	0.814	1.503	1.832	3.808**	1.805
	(1.01)	(0.76)	(1.26)	(1.40)	(2.89)	(1.70)
trustindex	104.0*	141.2**	112.2*	141.9*	97.39	56.20
	(1.99)	(2.60)	(1.99)	(2.52)	(1.44)	(1.06)
Adr	508.4***	589.4***	607.9***	401.6**	417.4**	589.2***
	(3.75)	(4.25)	(4.33)	(2.58)	(2.64)	(4.39)
Urban	47.99	78.56	122.3*	-110.5	147.4*	60.39
	(0.94)	(1.49)	(2.00)	(-1.34)	(2.02)	(1.20)
secondary	-32.01	-32.89	-40.55*	-10.04	-12.14	-42.62*
	(-1.72)	(-1.77)	(-2.08)	(-0.52)	(-0.22)	(-2.32)
GNI	-0.0903	-0.111	-0.0998	0.0359	-0.353***	-0.142*
	(-1.31)	(-1.62)	(-1.44)	(0.42)	(-3.61)	(-2.09)
Cons	153.5*	139.0*	106.6	169.2	-14.22	57.64
	(2.17)	(1.97)	(1.43)	(1.94)	(-0.16)	(0.78)
McapGDP	1.861					
	(0.41)					
Inflation		145.0*	145.5*			
		(2.48)	(2.48)			
card_pop			-0.972			
			(-1.45)			
Services				101.2		
				(1.07)		
Travel					-21.61	
					(-0.72)	
ec_cost						-283.5***
						(-3.70)
Const	-24842.5**	-30870***	-28714***	-28619.**	-16592	-9298.8
	(-3.18)	(-3.81)	(-3.48)	(-3.27)	(-1.94)	(-1.06)
N	202	202	202	173	139	202

Table A11 Number of cards per 1 thousand inhabitants (Blundell-Bond non-logarithmized).

	(1)	(2)	(3)	(4)	(5)	(6)
L.card_pop	0.666***	0.639***	0.607***	0.623***	0.649***	0.657***
	(15.73)	(14.55)	(11.78)	(14.05)	(14.84)	(15.02)
Eftpos_pop	0.00585*	0.00747*	0.0103**	0.00418	0.00473	0.00630*
	(2.07)	(2.56)	(2.90)	(1.30)	(1.44)	(2.22)
noatm_pop	0.136	0.0470	0.0426	0.0815	0.141	0.155
	(1.50)	(0.47)	(0.37)	(0.81)	(1.25)	(1.67)
nonperform	-2.068	-6.375	-3.804	-7.420	-5.278	-2.439
	(-0.60)	(-1.59)	(-0.83)	(-1.86)	(-1.32)	(-0.65)
trustindex	-2.828	-7.507	-9.473*	-7.906*	-10.48*	-4.163
	(-0.86)	(-1.87)	(-2.11)	(-1.99)	(-2.37)	(-1.21)
inflation	13.31**	9.792*	8.720	9.170	11.09*	12.81**
	(2.89)	(2.01)	(1.71)	(1.89)	(2.25)	(2.71)
cons	-9.690	-12.85*	-19.80**	-13.83*	-11.78*	-9.334
	(-1.68)	(-2.18)	(-2.75)	(-2.35)	(-2.00)	(-1.58)
GDP	0.0104**	0.0128**	0.0120**	0.0120**	0.0122**	
	(2.75)	(3.26)	(2.81)	(3.06)	(3.12)	
credreg2		1.348*	1.346	1.017	1.231	
		(2.02)	(1.90)	(1.50)	(1.85)	
secondary			-1.892			
			(-1.31)			
tertiary			-0.775			
			(-0.43)			
adr				24.98*		
				(2.33)		
urban					7.044	
					(1.70)	
GNI						0.0119**
						(2.65)
Const	849.9	1433.0*	2266.6**	1026.5	1122.7	918.1
	(1.58)	(2.36)	(3.15)	(1.65)	(1.81)	(1.65)
N	211	211	182	211	211	207

Table A12 Card transactions as a fraction of total noncash transactions (Blundell-Bond non-logarithmized).

	(1)	(2)	(3)	(4)
L.s_cards	0.846***	0.844***	0.800***	0.838***
	(15.66)	(18.84)	(16.53)	(15.15)
noatm_pop	-0.00147	-0.00138	-0.00270	-0.00104
	(-0.56)	(-0.49)	(-1.11)	(-0.40)
card_pop	0.00180	0.00187	0.00177	0.00203
	(1.17)	(1.57)	(1.40)	(1.33)
eftpos_pop	-0.0000154	-0.0000129	-0.0000583	0.00000416
	(-0.13)	(-0.10)	(-0.55)	(0.04)
trustindex	0.0705	0.0751	0.107	0.0892
	(0.65)	(0.68)	(0.96)	(0.81)
adr	-0.00898	0.0231	0.0906	-0.197
	(-0.04)	(0.06)	(0.31)	(-0.87)
urban	0.0522	0.0221	0.0509	-0.110
	(0.16)	(0.07)	(0.15)	(-0.34)
secondary	0.0867	0.0847*	0.0679	0.0905
	(1.71)	(2.30)	(1.73)	(1.77)
GNI	-0.0000538	-0.0000913	-0.000138	-0.000193
	(-0.39)	(-0.42)	(-0.74)	(-1.26)
cons	-0.194	-0.226	-0.309*	-0.157
	(-1.25)	(-1.17)	(-2.06)	(-1.01)
ec_time		0.00129		
		(0.23)		
DC			0.0199	
			(1.51)	
openess				0.0583*
				(2.11)
N	201	197	198	201

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