

# The Safety of Cash and Debit Cards: A Study on the Perception and Behavior of Dutch Consumers\*

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This paper investigates the impact of the perceived payment safety on debit card and cash usage. It provides a conceptual framework of safety perception and payment behavior, which is empirically tested using 2008 consumer survey data. The results show that consumers' payment preferences are strongly influenced by their views on the safety of payment instruments. These views are determined mainly by consumers' perception of the likelihood that payment incidents may occur. The seriousness of possible incidents is also considered, though to a much lesser degree. Personal characteristics and experiences of payment incidents are shown to play a significant role here.

JEL Codes: C42, D12, E41.

## 1. Introduction

Debit cards have grown rapidly into widely used payment instruments at points of sale (POS) in the Netherlands since their introduction in the late 1980s. In 2010, around 58 percent of total sales and 32 percent of total transactions were paid by debit card versus 38 percent and 65 percent in cash (Jonker, Kosse, and Hernández 2012). The increasing acceptance and usage of the debit card has

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\*The views expressed in this paper are the author's and do not necessarily reflect those of De Nederlandsche Bank or the European System of Central Banks. All errors are the author's. The author would like to thank John Williams (the editor), an anonymous referee, Wilko Bolt, Hans Brits, Nicole Jonker, Maarten van Rooij, and Federica Teppa, as well as seminar and conference participants at various institutions for useful guidance, comments, and discussions, which greatly improved the paper. Author e-mail: j.c.m.kosse@dnb.nl.

made it progressively susceptible to fraud—in particular, skimming fraud.<sup>1</sup> Total skimming losses have increased materially over the past few years, from under EUR 4 million in 2005 to EUR 20 million in 2010 (Currence 2011). The scale of skimming fraud is still relatively small compared with the size of the Dutch debit card market,<sup>2</sup> yet the impact on society as a whole could be much larger. Incidents of fraud receive a fair amount of media attention, which is directed at not only the victims but also the entire population. This might affect overall payment behavior inasmuch as consumers may lose confidence in their debit card and shift to other means of payment. Kosse (2013), for example, shows that news about card fraud significantly depresses same-day card usage. Since earlier studies have shown that the debit card is often a fast and cheap payment method (Brits and Winder 2005; McKinsey & Company 2006; EIM 2011), this could eventually harm the efficiency of the entire retail payment system.

In light of this, it is important to have a clear understanding of how consumers assess the safety of payment instruments and of how this affects their payment choices. Understanding the mechanism of safety perception and payment behavior might help policymakers and central bankers preserve consumers' confidence in the safety of the payment system and in cost-efficient payment instruments in particular. A reasonable amount of research has already been carried out in the field of retail payments to better understand market participants' behavior and their underlying motivations.<sup>3</sup> Research into

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<sup>1</sup>Total card fraud is often grouped into four main categories: mail non-receipt fraud (the physical card sent by the bank through the mail is intercepted), lost-and-stolen-card fraud (cards being lost or stolen), card-not-present fraud (fraud related to remote payments such as Internet transactions), and skimming fraud (the data on the magnetic stripe of the card is copied and the personal identification number (PIN) is captured in order to produce a counterfeit card).

<sup>2</sup>In 2009, around 0.3 percent of all debit cards were copied, 0.4 percent of all automated teller machines (ATMs) and POS terminals were sabotaged, and total fraud losses amounted to 0.03 percent of total debit card sales (Currence 2011; De Nederlandsche Bank 2011).

<sup>3</sup>The many references include Baxter 1983; Stavins 2001; Rochet and Tirole 2003; Wright 2004; Bounie and Abel 2006; Keinonen 2007; Rysman 2007; Bolt, Humphrey, and Uittenbogaard 2008; Borzekowski and Kiser 2008; Klee 2008; Hyttinen and Takalo 2009; Zinman 2009; Ching and Hayashi 2010; and Kosse and Jansen 2013.

consumers' attitudes towards risks and the impact of safety perception on payment behavior, however, is scarce and does not provide a unanimous answer. Several theories and findings suggest that safety is one of the factors considered when choosing how to pay.<sup>4</sup> Others, however, find no evidence of safety playing a role.<sup>5</sup> Therefore, the aim of this paper is to analyze further consumers' payment behavior in relation to safety. More precisely, the objective is to assess the determinants of consumers' safety perception and to examine the impact of perceived safety on the usage of cash and debit cards.

To this end, 2008 consumer survey data is used for various empirical analyses. These analyses depart from the idea that consumers' safety perception of payment instruments is influenced by both their perception of the probability of incidents occurring when carrying or using a particular instrument and their perception of the severity of these incidents. Until now, this two-step approach of separating the probability of losses (PL) and the severity given losses (SGL) has not been considered in retail payments research. It is, however, commonly used in other research fields, such as in economics and finance and in food sciences.<sup>6</sup> The conceptual framework underlying the empirics in this paper further assumes that consumers' views on probabilities and consequences are heterogeneous, varying with personal characteristics and personal experiences.<sup>7</sup> People who have been involved in negative payments-related incidents are assumed to have different views on the likelihood and seriousness of incidents than those who have not. As a final step, the framework presupposes a negative relationship between consumers' safety perception and

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<sup>4</sup>See, e.g., Baumol 1952; Humphrey, Pully, and Vesala 1996; Cheney 2006; Benton et al. 2007; Jonker 2007; Bolt and Chakravorti 2008; Borzekowski, Kiser, and Ahmed 2008; He, Huang, and Wright 2008; Alvarez and Lippi 2009; Kahn and Roberds 2009; and Kosse 2013.

<sup>5</sup>See, e.g., Yin and DeVany 2001 and Schuh and Stavins 2010.

<sup>6</sup>In economics and finance, PD (probability of default) and LGD (loss given default) are often used when modeling credit risks (e.g., Bank for International Settlements 2005). The two-step approach is also found to be useful when modeling risk perception and behavior in fields such as food sciences, environmental sciences, and marketing (e.g., Royal Society 1992; UK Department of the Environment 1995; Rundmo 1996; and Yeung and Morris 2001).

<sup>7</sup>Wildavsky and Dake (1990) and Sapp (2003), for example, find that personal characteristics strongly affect risk perception when examining food technology adoption and risk perception.

their payment choices. Overall, the non-payments-related literature agrees that consumers' overall safety assessment negatively influences behavior; the higher the probability and impact of potential incidents, the higher the probability of consumers seeking risk relief (e.g., Huang 1993; Weinstein 1993; Eom 1994; Yeung and Morris 2001).

The empirical results presented in this paper first demonstrate that consumers' safety perception is influenced mainly by consumers' views on the likelihood that incidents may occur. Consumers who believe that the risk of falling victim to payment loss or fraud is high are more likely to believe that the corresponding means of payment are unsafe. As hypothesized by the conceptual framework, the seriousness of these incidents is also considered, though to a much lesser degree. Second, consumers' beliefs of the likelihood and impact of possible safety incidents are shown to be influenced strongly by experiences and personal characteristics. Generally, people who have been involved in negative payment incidents, women, people living in urbanized areas, and lower-educated and lower-income people think more seriously about the risks and consequences of payment incidents. Finally, this paper demonstrates that consumers' daily payment behavior is significantly influenced by how consumers assess the safety level of the different means of payment. People who perceive particular payment instruments to be unsafe are found to use them less often, reverting to alternative ways of paying. These findings are robust to the inclusion of a variety of consumer characteristics.

This paper proceeds as follows: Section 2 describes the survey methodology and data used for the empirical analyses. Section 3 analyzes the factors influencing consumers' safety perception, while section 4 reports the results on the role of safety in consumers' payment choices. Section 5 concludes and discusses policy implications.

## **2. Survey Methodology and Data Description**

In order to examine the determinants of consumers' safety perception and the role of safety in consumers' payment behavior, an extensive payments survey was conducted in April 2008 among more than 2,000 Dutch consumers. These consumers were drawn from

the CentERpanel, a representative panel of Dutch households, managed by the CentERdata research institute, which is closely affiliated with Tilburg University. The objective of the survey was to collect information about consumers' personal backgrounds, payment habits, and subjective judgments on the safety of POS payment instruments. The data were merged with data from the 2008 De Nederlandsche Bank (DNB) Household Survey (DHS) to construct a risk-aversion indicator for each respondent. The DHS is a yearly questionnaire collecting information on assets, liabilities, work, housing, mortgages, health, and income and many subjective measures such as expectations as well as investment and savings motives.

The payments survey was answered in full by 1,672 individuals, corresponding to a 65 percent response rate. Table 1 presents an overview of the key survey statistics. Because men, the elderly, and higher-educated people were slightly overrepresented in the sample, the data was weighted by age, gender, and education in order to represent the entire Dutch population. First, the survey data confirm that cash and debit cards are the major POS payment instruments used in the Netherlands, with the majority of the population paying with cash as well as a debit card at least once a week. The electronic purse (e-purse)<sup>8</sup> and credit cards are used less often. Second, the data indicates that, on average, Dutch consumers are positive about the safety of the various POS payment instruments. They were asked to rate the safety of cash, the debit card, the credit card, and the e-purse on a scale from 1 (very unsafe) to 7 (very safe). A distinction was made between using and carrying the payment instruments. Remarkably, the data shows small but significant differences between both aspects. Consumers feel less secure carrying any of the payment instruments than they do in using them for ATM withdrawals or POS payments. In general, they feel most secure carrying the e-purse or a debit card, while cash and the e-purse are perceived to be the

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<sup>8</sup>The Dutch national e-purse called Chipknip is a smartcard-based prepaid instrument that provides instant and irrevocable offline transactions at the POS. The chip on the card is loaded via a transfer from a bank account with a maximum of EUR 500 and can then be used at designated POS terminals. Since e-purse transactions do not require the cardholder to enter a PIN, the e-purse is mainly used for small-value payments at, for example, vending and parking machines.





safest instruments with which to pay. There is relatively considerable dissatisfaction with the safety of using and carrying credit cards, carrying cash, and making ATM withdrawals, with about 10 percent of respondents perceiving these payment aspects to be unsafe.

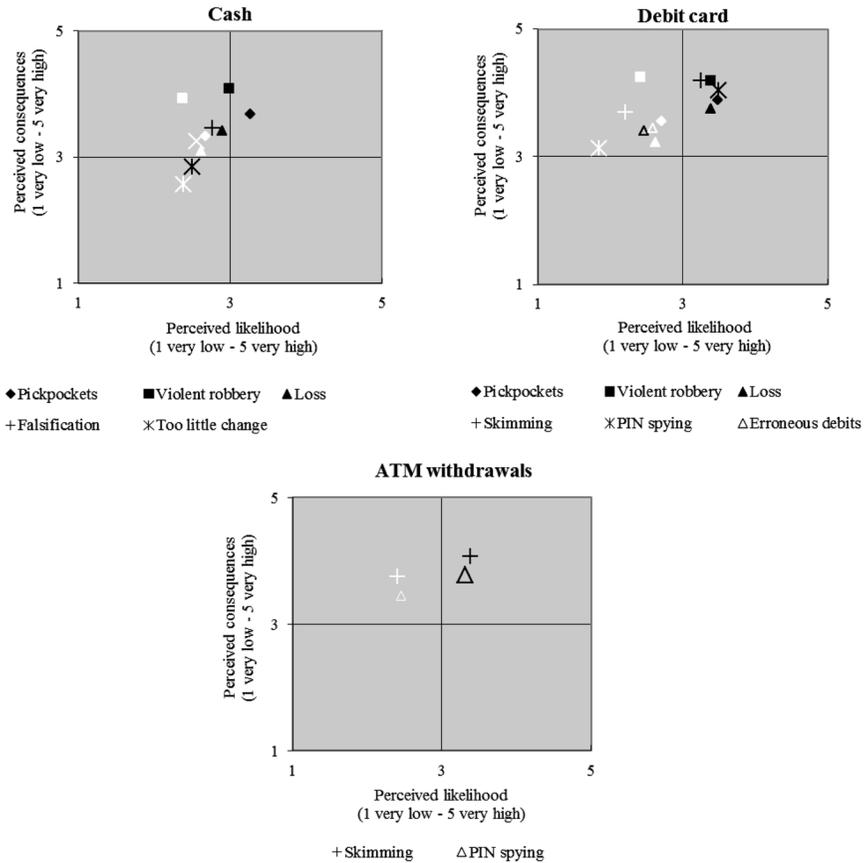
The respondents were also asked to rate the likelihood as well as the seriousness of possible payment incidents, on a scale from 1 (very low) to 5 (very high). The survey results presented in table 1 show that, on average, consumers believe that the chance of falling victim to payment incidents is relatively small. The consequences, however, are perceived to be rather serious. This also holds for the consequences of skimming fraud, which is generally compensated by banks. Another remarkable finding is that consumers have a certain perception of both the likelihood and the consequences of e-purse skimming fraud, whereas in fact this type of fraud does not exist. These findings hint at a certain lack of information and knowledge among consumers on the actual probabilities and consequences of payments-related safety incidents. Finally, table 1 shows that only a few respondents have ever been involved in a payments-related safety incident themselves. The incidents most experienced relate to carrying payment instruments (e.g., loss or theft). With the exception of receiving too little change, only a few respondents have ever been the victim of an incident resulting from an ATM withdrawal or a POS payment, such as of erroneous debits or skimming fraud.

### **3. Results: Factors Affecting Consumers' Safety Perception**

In order to examine the factors influencing consumers' safety perception, the 2008 survey data was employed for various empirical analyses, using the conceptual framework laid out in the introduction as a starting point. Given the limited usage of the e-purse and credit cards in the Netherlands, the focus is on cash and debit cards only.

First, to assess the relationship between overall feelings of payment (un)safety on the one hand and perceptions of probabilities and consequences on the other, figure 1 presents three scatter plots showing the average "likelihood" and "consequence" scores given by the respondents for various cash, debit card, and ATM incidents.

Figure 1. Perceived Likelihoods and Consequences



**Notes:** This figure presents the average “likelihood” and “consequence” scores given by the respondents for various cash, debit card, and ATM incidents. The black symbols refer to the average scores given by the respondents who rated the safety level of the corresponding payment instrument with a score of 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe). The white symbols refer to those who gave a score of 4 (neutral), 5 (a little safe), 6 (safe), or 7 (very safe). The black/white distinction in the cash graph for pickpockets, violent robbery, and loss is based on consumers’ overall safety assessment of carrying cash. For falsification and too little change, the distinction is based on the overall safety assessment of using cash. The black/white distinction in the debit card graph for pickpockets, violent robbery, and loss is based on the overall safety assessment of carrying a debit card. For skimming, PIN spying, and erroneous debits, the distinction is based on the overall safety assessment of using a debit card. The black/white distinction in the ATM graph is based on consumers’ overall safety assessment of ATM withdrawals.

Each plot makes a distinction between the average scores given by respondents who feel generally unsafe in either using or carrying (depending on the safety incident concerned) the corresponding payment instrument (the black symbols) and the average scores of those who felt safe (the white symbols).<sup>9</sup> A comparison of the black and white symbols shows that respondents feeling unsafe perceive not only the likelihood of the incidents as higher but also the consequences as more serious compared with those who felt safe. The largest difference, however, is in their probability assessment. This suggests that consumers' overall safety assessment is mainly influenced by their views on the likelihood of loss and fraud and, to a lesser extent, by their views on the possible consequences of it.

In order to examine this issue more formally, three ordered logit models were estimated, with the overall perceived safety level of cash (CASHSAFE), debit cards (DCSAFE), and ATM withdrawals (ATMSAFE) being the dependent variables. The perceived safety level of ATM withdrawals was taken directly from the survey. However, since the respondents were asked to provide two separate scores for cash and debit cards—one for using it and one for carrying it—the overall safety levels of cash and debit cards were calculated by averaging the usage and carrying scores and rounding that average up to the nearest integer. As a result, all three dependent variables take on a value ranging from 1 (very unsafe) to 7 (very safe). They are regressed upon a vector of two dummies, indicating whether consumers perceived the likelihood of related incidents to be high and whether they perceived the possible consequences to be serious. Both dummies take on a value of one when the average likelihood and consequences scores given by the respondents for related payment incidents, rounded up to the nearest integer, equal 4 (high) or 5 (very high). The model also includes an interaction term of both dummies to account for the possibility that perceived probabilities might only play a role when the consequences are thought to be serious and vice versa. In addition, an indicator of risk aversion

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<sup>9</sup>The black symbols refer to the respondents who rated the safety level of the respective payment aspect with a score of 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe). The white symbols refer to those who gave a score of 4 (neutral), 5 (a little safe), 6 (safe), or 7 (very safe).

**Table 2. Impact of Perceived Likelihood and Consequences on Overall Safety Assessment**

	CASHSAFE	DCSAFE	ATMSAFE
Perceived Likelihood (0 = low, 1 = high)	-0.782***	-0.646**	-1.362***
Perceived Consequences (0 = low, 1 = high)	-0.211*	-0.063	-0.028
Likelihood*Consequences	0.118	-0.670**	-0.038
Risk Aversion	0.013	-0.073	0.004
No. of Obs.	1,672	1,672	1,656
Pseudo R2	0.0129	0.0339	0.0333
Log-Likelihood	-2411.358	-2468.5358	-2476.1525

**Notes:** This table presents the parameter estimates of the three ordered logit regressions, with CASHSAFE, DCSAFE, and ATMSAFE being the dependent variables reflecting the overall perceived safety level of cash, debit cards, and ATM withdrawals, respectively, taking on a value ranging from 1 (very unsafe) to 7 (very safe). The dummy variables “Perceived Likelihood” and “Perceived Consequences” take on a value of one if the average of, respectively, the likelihood and consequences scores given by the respondents for related payment incidents, rounded up to the nearest integer, equal 4 (high) or 5 (very high), and zero otherwise. The interaction dummy “Likelihood\*Consequences” takes on a value of one if both the likelihood and consequences of related payment incidents are perceived to be high, and zero otherwise. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ .

is incorporated into the model to account for the fact that people might differ in their attitudes towards risks.<sup>10</sup>

Table 2 shows the parameter estimates of the ordered logit analyses. The results confirm the conclusion drawn from the scatter plots that consumers’ safety perception is influenced mainly by their views on the likelihood that incidents may occur. In the cash, the debit card, and the ATM model, the likelihood dummy has a significant negative sign, meaning that consumers who believe the chance of falling victim to cash, debit card, or ATM incidents is high are more

<sup>10</sup>This indicator was taken from the DHS questionnaire, in which respondents were presented with the following statement: “I would never consider investments in shares because I find this too risky.” The answers to this question were coded on a scale from 1 (totally disagree) to 7 (totally agree). For the purpose of this study, this variable is transformed into a dummy variable of one if respondents agreed to the statement.

likely to perceive these means of payment to be unsafe. The results demonstrate that the perceived consequences of possible incidents are also considered by consumers, though to a much lesser degree. The likelihood dummy has a significant negative effect in the cash model, but at the 10 percent significance level only. In the debit card model, it only appears through the significant interaction term, meaning that perceived consequences play a role only when the risks are perceived to be high. So, as long as consumers believe that the chance of falling victim to a debit card incident is small, the magnitude of the possible consequences is of no significant importance. Finally, the risk-aversion indicator has no significant impact in any of the three models. This shows that people who are less fond of taking risks in general are not more likely to believe that cash, debit cards, and ATM withdrawals are unsafe, irrespective of how they assess the likelihood of incidents occurring and the consequences.<sup>11</sup>

In the next step, three bivariate probit models were estimated to assess the role of personal experiences and personal characteristics in consumers' subjective assessment of probabilities and consequences. Each model contains two dependent variables: a dummy variable indicating whether consumers perceived the likelihood of related payment incidents to be high (i.e., LLHCASH, LLHDC, and LLHATM) and a dummy variable indicating whether they perceived the consequences of related incidents to be serious (i.e., IMPCASH, IMPDC, and IMPATM). In fact, these are the same dummies as the ones used as explanatory variables in the ordered logit analyses. In each model, the two dependent dummy variables are simultaneously regressed upon a vector of dummies indicating whether consumers had ever experienced similar payment incidents and various personal characteristics, such as gender, age, living environment, income, and education. The results presenting both parameter estimates and marginal effects are shown in table 3.

The findings support strongly the assumption laid out in the conceptual framework. That is, personal experiences of payments-related incidents influence one's beliefs about the likelihood of incidents occurring and the impact of these incidents. Negative cash

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<sup>11</sup>The correlation coefficients between risk aversion, perceived likelihood, and perceived consequences were small. Therefore, the three variables could be incorporated into the model simultaneously.

Table 3. Impact of Personal Experiences and Demographics

	Cash			Debit Card			ATM Withdrawals		
	LLHCASH	IMPCASH	dy/dx	LLHDC	IMPDC	dy/dx	LLHATM	IMPATM	dy/dx
	Constant	-0.261	0.318	0.054	-0.279	0.356	0.178***	-0.336	0.252
Exp. ATM Incident	0.325***	-0.153	0.054	0.587***	0.138	0.178***	0.824***	0.017***	0.013
Exp. Cash Incident	0.346***	0.260***	0.132***	-0.033	0.499	0.036	-0.107	0.479***	0.035
Exp. Debit Card Incident	-0.015	-0.024	0.007	0.279***	0.044***	0.067**	0.119	0.038	0.083
Gender	0.162**	0.312***	0.085	0.203***	0.326***	0.097***	0.204***	0.253***	0.083
Age:									
25-34 Years	-0.291	0.181	-0.059	-0.165	-0.102	-0.054	-0.038	0.167	0.008
35-44 Years	-0.195	0.378**	-0.018	-0.078	0.187	-0.002	-0.033	0.393**	0.030
45-54 Years	-0.323*	0.237	-0.064	-0.167	-0.058	-0.050	-0.037	0.154	0.007
55-64 Years	-0.269	0.358**	-0.041	-0.169	0.086	-0.037	0.083	0.158	0.041
65 Years and Over	-0.170	0.153	-0.029	-0.012	-0.007	-0.004	0.083	0.037	0.026
Living Environment:									
Enormously Urbanized	0.265**	0.104	0.086**	0.158	-0.064	0.033	0.067	-0.047	0.011
Strongly Urbanized	0.264**	0.105	0.085*	0.188*	0.019	0.053	0.154	0.087	0.051
Moderately Urbanized	0.279**	0.051	0.081**	0.249**	0.053	0.074**	0.162	0.145	0.061
Little Urbanized	0.185*	-0.047	0.040	0.208*	0.124	0.074**	0.093	-0.066	0.014
Income:									
EUR 1151-EUR 1800	-0.548***	-0.549***	-0.174***	-0.336**	-0.267	-0.110**	-0.602***	-0.116	-0.145***
EUR 1801-EUR 2600	-0.330**	-0.436***	-0.126***	-0.184	-0.206	-0.070	-0.425***	-0.002	-0.102**
More than EUR 2600	-0.415***	-0.521***	-0.150***	-0.331**	-0.292*	-0.112	-0.648***	-0.129	-0.154***

(continued)

Table 3. (Continued)

	Cash			Debit Card			ATM Withdrawals		
	LLHCASH	IMPCASH	dy/dx	LLHDC	IMPDC	dy/dx	LLHATM	IMPATM	dy/dx
	Education: Lower Sec. Higher General Intermediate Voc. Higher Voc. University	0.011 -0.221 -0.010 -0.313** -0.313*	-0.003 0.091 0.160 -0.060 -0.073	0.002 -0.048 0.015 -0.085* -0.086*	-0.080 -0.363** -0.164 -0.426*** -0.664***	0.162 0.143 0.322** 0.193 0.236	-0.005 -0.084* -0.017 -0.098** -0.153***	0.017 -0.352** -0.021 -0.164 -0.409**	-0.002 0.066 0.133 0.008 0.093
No. of Obs. Wald chi2 Prob. > chi2 Log-Likelihood Rho Test rho = 0 Prob. > chi2 Prob. (LLH = 1 & IMP = 1)	1,672 149.72 0.0000 -1984.17 0.3767 0.0000 0.3034			1,672 195.24 0.0000 -1772.74 0.4128 0.0000 0.3086			1,672 211.42 0.0000 -1635.01 0.4311 0.0000 0.2842		

**Notes:** This table presents the parameter estimates and marginal effects of the three bivariate probit regressions, with each model containing two dependent variables: a dummy indicating whether the likelihood of related incidents is perceived to be high (i.e., LLHCASH, LLHDC, and LLHATM) and a dummy indicating whether the consequences of related incidents are perceived to be serious (i.e., IMPCASH, IMPDC, and IMPATM). Both dummies are created by averaging the scores given by the respondents for the related payment incidents, rounded up to the nearest integer, and take on a value of one if this average equals 4 (high) or 5 (very high) and zero otherwise. The dummy variables “Exp. ATM Incident,” “Exp. Cash Incident,” and “Exp. Debit Card Incident” take on a value of one if the respondents have ever experienced a cash, debit card, or an ATM incident themselves, and zero otherwise. In all three models, the reference category is a man, younger than twenty-five years, living in a non-urbanized area, earning less than EUR 1150 per month, and only having primary education. Prob. (LLH = 1 & IMP = 1) reflects the predicted probability that a person from this reference category with no prior experiences with cash, debit, or ATM incidents perceives both the likelihood and the impact of possible incidents to be high. The marginal effects (dy/dx) reflect the change in this probability for a discrete change of the dummy variables from 0 to 1, holding all other variables constant at their reference points. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ .

experiences affect strongly and significantly consumers' views on the probability and impact of possible cash incidents, whereas negative debit card and ATM experiences have significant repercussions on consumers' perceptions about the likelihood and consequences of debit card and ATM incidents. People who have been involved in cash-related incidents are 13 percent more likely to perceive both the probability and consequences of cash incidents to be high compared with people having no such experiences. Similarly, those who have ever fallen victim to a debit card or an ATM incident are 7 percent and 19 percent more likely to think that the risks and consequences of these incidents are high. Interestingly, past experiences with cash incidents do not influence consumers' views about the safety of debit cards, and vice versa. Apparently, consumers see cash and debit cards as two distinct means of payment. With respect to ATM withdrawals, however, the results do point to a significant interaction with the other two payment instruments; those who have been involved in a cash incident are more likely to perceive the consequences of ATM incidents as severe. At the same time, those who have been involved in an ATM incident are more likely to perceive the probability of possible cash or debit card incidents as high. This might indicate that consumers perceive a strong association and overlap between ATM withdrawals on the one hand and both cash and debit cards on the other. This may be explained by the fact that ATM withdrawals are necessary for carrying and using cash and that, in order to withdraw money, a debit card is needed.<sup>12</sup>

Personal characteristics are shown to have a strong and significant impact on consumers' assessment of probabilities and consequences too. First, women are nearly 10 percent more likely than men to perceive as high and serious the likelihood and consequences of incidents relating to cash, debit cards, and ATMs. Second, people between the ages of 35 and 44 and between the ages of 55 and 64 are more likely than those younger than 25 years to believe that the consequences of cash and ATM incidents are more serious. The marginal effects, however, are insignificant. Third, compared with people from the lowest income category, higher-income people tend to think less

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<sup>12</sup>This is the case, at least, in the Netherlands, where most cash is withdrawn at ATMs and where consumers are able to use their debit card instead of a special ATM card for withdrawing money.

seriously about the likelihood and consequences of cash incidents and about the likelihood of debit card and ATM incidents. In addition, the perceived chance of being involved in a cash or debit card incident significantly increases with the urbanization degree of people's living environment, with marginal effects of around 8 percent. Last, education seems to play a role, with higher-educated people tending to rate the likelihood and impact of incidents significantly lower than less-educated people.

#### 4. Results: Impact of Safety on Payment Behavior

To assess the final step laid out in the conceptual framework—i.e., the impact of consumers' views on safety on their daily payment behavior—three types of consumers are identified: (i) frequent cash users who pay more frequently in cash than by debit card (CASH-PREF), (ii) frequent debit card users who pay more often by debit card than in cash (DCPREF), and (iii) consumers who have no particular preference and use cash and debit cards to the same extent (NOPREF). One-third of all respondents turn out to be frequent cash users, 30 percent prefer to pay by debit card, and 38 percent have no particular preference (NOPREF). Since there is no natural ordering between the different types of consumers, a multinomial logistic model was estimated with the type of consumer being the dependent variable taking on three outcomes: CASH-PREF, DCPREF, or NOPREF. As explanatory variables, dummy variables are used to indicate whether consumers perceived cash, debit cards, and ATM withdrawals to be unsafe,<sup>13</sup> and to account for personal characteristics, dummies are added for gender, age, education, income, and living environment. The results are summarized in table 4. As NOPREF is used as the base outcome, the coefficients of the CASH-PREF and DCPREF equations should be interpreted as changes relative to the NOPREF alternative.

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<sup>13</sup>The dummy variable "ATM Unsafe" takes on a value of one if the safety of ATM withdrawals was rated with a score of 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe), and zero otherwise. The dummies "Debit Card Unsafe" and "Cash Unsafe" both take on a value of one if the average of the safety scores given for using and carrying the instrument concerned rounded up to the nearest integer equals 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe), and zero otherwise.

**Table 4. Impact of Safety Perception on Cash and Debit Card Usage**

	CASHPREF		DCPREF	
	Coefficient	dy/dx	Coefficient	dy/dx
Constant	0.891**		-0.379	
ATM Unsafe (no = 0, yes = 1)	0.398*	0.038	0.510**	0.031
Debit Card Unsafe (no = 0, yes = 1)	-0.069	0.056	-1.049***	-0.098**
Cash Unsafe (no = 0, yes = 1)	-0.563**	-0.211***	0.611**	0.180***
Gender	0.115	0.039	-0.125	-0.027
Age:				
25-34 Years	-0.953***	-0.269***	0.353	0.168**
35-44 Years	-0.552*	-0.170**	0.302	0.112**
45-54 Years	-0.211	-0.044	-0.081	0.009
55-64 Years	-0.071	-0.035	0.169	0.033
65 Years and Over	0.223	0.037	0.156	-0.001
Living Environment:				
Enormously Urbanized	0.204	0.077*	-0.348	-0.058**
Strongly Urbanized	0.048	0.032	-0.231	-0.033
Moderately Urbanized	-0.049	0.014	-0.292	-0.033
Little Urbanized	-0.081	0.008	-0.306	-0.032
Income:				
EUR 1151-EUR 1800	-0.448*	-0.091	-0.205	0.013
EUR 1801-EUR 2600	-0.772***	-0.176***	-0.152	0.051
More than EUR 2600	-0.697***	-0.161***	-0.118	0.050

*(continued)*

The results show that consumers' daily payment behavior is strongly influenced by consumers' views on the safety level of the different means of payment. Changes in the perceived safety level of cash significantly affect consumers' preferences for cash. Those who believe that paying in cash is unsafe are 21 percent less likely to be frequent cash users. Similarly, people who believe that debit cards are unsafe are 10 percent less likely to be frequent debit card users. The results also point to a strong and highly significant substitution effect from cash to debit cards. People who think that cash is unsafe are more likely to prefer paying by debit card, with the probability of being a frequent debit card user increasing by 18 percent. These

**Table 4. (Continued)**

	CASHPREF		DCPREF	
	Coefficient	dy/dx	Coefficient	dy/dx
Education:				
Lower Sec.	-0.250	-0.108*	0.410	0.096*
Higher General	-0.223	-0.125*	0.590*	0.129**
Intermediate Voc.	-0.345	-0.127**	0.373	0.101*
Higher Voc.	-0.439	-0.147**	0.340	0.101**
University	-0.517*	-0.129*	-0.017	0.050
Prob. (CASHPREF = 1)		0.5914		
Prob. (DCPREF = 1)				0.166
No. of Obs.				1,672
LR chi2(46)				127.01
Prob. > chi2				0.0000
Log-Likelihood				-1763.3951

**Notes:** This table presents the parameter estimates and marginal effects of the multinomial logistic regression, with the dependent variable taking on three outcomes: CASHPREF, DCPREF, and NOPREF, with CASHPREF being one for frequent cash users, DCPREF being one for frequent debit card users, and NOPREF being one for those having no particular preference for either cash or debit. The results of the CASHPREF and DCPREF equations should be interpreted as changes relative to the NOPREF alternative. The reference category is a man, younger than twenty-five years, living in a non-urbanized area, earning less than EUR 1150 per month, and only having primary education. Prob. (CASHPREF = 1) and Prob. (DCPREF = 1) reflect the predicted probabilities that a person from this reference category that perceives neither cash nor debit cards nor ATM withdrawals to be unsafe is classified as being a frequent cash or debit card user. The marginal effects (dy/dx) reflect the change in this probability for a discrete change of the dummy variables from 0 to 1, holding all other variables constant at their reference points. The dummy variable “ATM Unsafe” takes on a value of one if the safety of ATM withdrawals was rated with a score of 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe), and zero otherwise. The dummies “Debit Card Unsafe” and “Cash Unsafe” both take on a value of one if the average of the safety scores given for using and carrying the instrument concerned rounded up to the nearest integer equals 1 (very unsafe), 2 (unsafe), or 3 (a little unsafe), and zero otherwise. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ .

findings are robust to the inclusion of various personal characteristics. Here, the estimation results confirm the conclusions drawn in earlier payment studies—that younger, more-educated consumers with higher incomes are more likely to pay by card instead of cash (see, for example, Kosse and Jansen 2013 and references therein).

## 5. Conclusions and Policy Implications

The key finding of this paper is that consumers' payment preferences are strongly affected by their perceptions of safety, which in turn are primarily influenced by views on the probability of possible safety incidents occurring when using or carrying a payment instrument. The economic significance of the role of consumers' safety perception, and of their views on risks in particular, provides several meaningful messages. First, it shows that the current levels of safety and efficiency of retail payment systems could be maintained or even improved by minimizing in particular the risks of safety incidents occurring. This underlines the importance of all stakeholders being constantly ready to reduce to a minimum fraud and safety risks in payments. Conversely, measures undertaken to reduce the severity of the consequences of safety incidents, such as fraud compensation, are likely to be of lesser value. Second, by demonstrating the importance of *perceptions* of safety, this paper emphasizes that it is essential to realize that perceptions may not always reflect *reality*. Consumers may wrongly perceive certain payment instruments to be unsafe and, therefore, wrongfully avoid them. Similarly, consumers may *underestimate* the risks of payments-related safety incidents and, consequently, inadequately protect themselves. Therefore, it is crucial that the public receive clear communication on the measures taken by the different actors and on the steps that consumers can take to minimize retail payment risks. This communication should not make the public feel insecure. However, done in a suitable way, it should improve the perceived level of retail payments safety, stimulating consumers to pay efficiently and safely in all circumstances.

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