Do newspaper articles on card fraud affect debit card usage?

Anneke Kosse *

* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.
This paper investigates the impact of newspaper articles about skimming fraud on debit card usage in the Netherlands, using daily transaction data and daily newspaper announcements from January 1st 2005 to December 31st 2008. Key finding is that articles about skimming fraud significantly affect same day debit card usage. The direction and strength of the media effects strongly depend on the specific characteristics of the publications, such as type of fraud addressed and their position in the newspaper, but above all by the frequency with which they come out. The effects, however, are economically small compared to other factors, such as calendar and holiday effects, and do not sustain or accumulate in the long run. Yet, some first cost calculations demonstrate that the impact of media attention on total retail payments efficiency is not to be underestimated.

Keywords: debit card, fraud, safety, payment behaviour, media, newspaper

JEL-codes: C22, C23, D12, E21
1. INTRODUCTION

During the last three decennia, debit cards have rapidly grown into widely used payment instruments at points-of-sale (POS) in the Netherlands. The ongoing increase in its acceptance and usage, however, has made the debit card increasingly attractive for fraud, and in particular for skimming fraud, where the card data on the magnetic stripe is copied and the PIN is captured at the POS or an automated teller machine (ATM) in order to produce a counterfeit card. Total debit card skimming fraud in the Netherlands increased materially over the past few years, from less than EUR 4 million in 2005 to EUR 20 million in 2010. It reached its peak of EUR 36 million in 2009. Although the financial damages are relatively small in comparison with total debit card sales, the total consequences for society as a whole could be more widespread. Skimming incidents receive a fair amount of attention from the media in which not only the victims but the entire population is addressed.\(^2\) This might affect overall payment behaviour, as consumers may lose their confidence in the debit card and shift away to other means of payment. Since earlier studies have shown that the debit card is often a fast and cheap way of paying (Brits and Winder, 2005; McKinsey&Company, 2006; EIM, 2011), this could eventually harm the efficiency of the entire retail payment system.

Clear evidence of safety incidents affecting overall consumer confidence and payment behaviour, however, is lacking. The payments literature does not provide a unanimous answer. Some (e.g. Cheney, 2006; Jonker, 2007; Borzekowski et al., 2008; Kosse, 2010) find that safety is one of the factors considered when choosing a particular instrument. Others, however (such as Yin and DeVaney, 2001; Schuh and Stavins, 2010) find no evidence of safety playing an important role. Therefore, the aim of this paper is to further analyse consumers’ payment behaviour in relation to safety. More precisely, this paper will focus on the impact of newspaper publications about debit card skimming fraud on debit card usage. Thus far, the impact of media reporting has not been considered and tested for in payments research. Therefore, it will provide new insights into the extent to which

\(^2\) According to Statistics Netherlands (CBS), about half the Dutch population is subscribed to a daily newspaper (2008), 70% watches the news each day (2007) and 74% is regularly reading the news on the internet (2010).
consumer confidence and payment habits are affected by safety incidents and media communication, as well as into their implications for the overall cost efficiency of the payment system.

A rich set of daily transaction data and newspaper announcements is used from January 1st 2005 to December 31st 2008. The debit card data was provided by Equens, the Dutch Automated Clearing House (ACH) and covers all daily debit card transactions made by Dutch residents at POS terminals in the Netherlands. Daily newspaper announcements on debit card fraud were extracted from the LexisNexis database, covering both national and regional newspapers. Key finding is that debit card usage is significantly affected by newspaper reports on skimming fraud. The magnitude and size of the newspaper effects strongly vary with the specific features of the newspaper articles, such as the type of fraud addressed or whether it was published on the front page or not, but above all by the frequency with which they come out. Overall, skimming fraud news is found to depress same day debit card usage, with consumers’ reactions growing stronger in periods when more articles are published. A first calculation of the potential social cost implications shows that the influence of media attention is not to be neglected when assessing total fraud costs. However, although significant, the media effects are still economically small in comparison with other factors such as calendar and holiday effects and only last for one day, with consumers reverting back to their regular payment behaviour almost immediately.

The paper proceeds as follows: section 2 describes the development of debit card usage and skimming fraud in the Netherlands. Section 3 presents a selective review of the relevant literature, both in the context of payment choice and the effect of media communication in other research fields. Section 4 then describes the data and methodology. Section 5 reports the results illustrating the impact of newspaper publications on total debit card usage and section 6 sheds some light on their social cost implications. Section 7 summarises and concludes.

2. DEBIT CARD USAGE AND SKIMMING FRAUD IN THE NETHERLANDS

Since their introduction in the late 1980s, debit cards have rapidly gained popularity in the Netherlands. Whereas cash transactions still outnumber debit card transactions, the debit card has
gained the lead with respect to total value; in 2010, around 59% of total sales at the counter was paid by debit card versus 38% in cash. And the substitution is still ongoing: recent figures show that the yearly number and value of debit card transactions is still increasing, while the number of cash payments has decreased (Jonker et al., 2012). Several factors have contributed to the ongoing growth in debit card usage. First, the adoption of card terminals by retailers has strongly increased, enabling consumers to use their debit card at more and more places, whereas the number of ATMs has stabilised (DNB, 2011). Also, consumers’ payment preferences and habits are gradually changing due to changing population structures and external factors such as financial and non-financial incentives. Since 2007, for example, Dutch banks and retailers have launched various projects and campaigns to promote the usage of debit cards. Since then, consumers increasingly use their debit card, and in particular for low value purchases, which is reflected by the drop in the average debit card transaction amount from EUR 44.60 in 2005 to EUR 37.58 in 2010 (Currence, 2011a).

The ongoing increase in its acceptance and usage has made the debit card increasingly attractive for fraud. The most important type of debit card fraud in the Netherlands is skimming fraud, where the data on the magnetic stripe is copied and the PIN is captured in order to produce a counterfeit card. Total skimming fraud increased materially over the past few years, from less than EUR 4 million in 2005 to EUR 20 million in 2010, reaching its peak of EUR 36 million in 2009 (Currence, 2011b). Initially, debit cards were mainly copied at ATMs, but since 2008, the fraud has spread towards payment terminals in shops, petrol stations and ticket machines as well. Dutch banks entirely compensate for the financial damages incurred when the afflicted cardholders have taken reasonable safety measures. However, the total costs to cardholders are higher than solely the financial losses; by way of precaution, banks immediately block the underlying payment accounts if debit cards appear to be copied, leading to administrative and payment inconveniences for the cardholders concerned. Moreover, at a regional level, cardholders as well as retailers are confronted with the inconvenience of temporarily closedowns of stricken ATMs and payment terminals.

---

3 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 PIN is captured in order to produce a counterfeit card).
Compared to the size of the Dutch debit cards market, the scale of skimming fraud is still relatively small: in 2009, around 0.3% of all debit cards were copied, 0.4% of all ATMs and payment terminals were sabotaged and total financial damages amounted up to 0.03% of total debit card sales (Currence, 2011b; DNB, 2010). Yet, all stakeholders in the payment chain are giving high priority to its prevention and fight in order to preserve public confidence in the debit card. Banks and retailers try to minimise the risks and consequences through continued investment in anti-skimming devices and fraud detection systems and through informing and educating the public by means of public awareness campaigns. In particular the introduction of the more secure EMV technology is expected to significantly reduce the skimming threat and the usage of counterfeit cards in the Netherlands. The migration to EMV in the Netherlands will be fully completed in 2012, but the first results are already visible in the fraud decline between 2009 and 2010 and in the fact that attempted withdrawals with skimmed magnetic strips of EMV cards are no longer successful in countries that have adopted EMV.

3. RELATED LITERATURE

The role of safety in payment choice

The introduction of new electronic payment instruments has given rise to a stream of payment research examining consumer payment choice and retailer acceptance in response to incentives and payment characteristics. Theoretical papers more or less start from the idea that payment instruments differ from each other with respect to costs, safety, anonymity, speed, acceptance and other characteristics and that consumer’s and retailer’s choice of which payment instrument to use and which one to accept is based on their net benefits received (Bolt and Chakravorti, 2010). When studying consumer demand for cash, Alvarez and Lippi (2009) explicitly incorporate the probability of cash theft into their model and assume that consumers keep smaller cash balances and increase the number of cash withdrawals when the probability of theft increases. Bolt and Chakravorti (2008), He et al. (2008) and Kahn and Roberds (2009) too consider the probability of getting mugged as a proxy for the safety benefit of card payments over cash. None of these theoretical papers, however, take into account the safety costs of cards.
There is a substantial amount of self-reported survey data that suggest that debit card usage is influenced by relative prices, demographics such as age, education and income, transaction variables such as type of goods, spending place, transaction amount, and characteristics of the market infrastructure (e.g. Bounie and Abel, 2006; Rysman, 2007; Zinman, 2009). The survey-based literature, however, does not give a unanimous answer with regard to consumers’ attitudes towards risks and the impact of safety perception on card usage. Some find that safety is one of the factors considered when choosing a particular instrument (e.g. Jonker, 2007; Borzekowski et al., 2008) and that perceptions of risks negatively affect the usage of payment instruments (e.g. Arango and Taylor, 2009; Kahn and Linares-Zegarra, 2011). Cheney (2006) even expresses real concern for a possible erosion of consumer confidence in electronic payment instruments due to the increase of safety incidents. Kosse (2010) indeed shows that people who have ever fallen victim to debit card fraud in the past are more likely to perceive debit cards to be unsafe and to use cash more frequently. Others on the other hand (such as Yin and DeVaney, 2001; Ching and Hayashi, 2010; Schuh and Stavins, 2010) find no evidence of safety playing an important role.

In addition, there are some articles analysing payment usage over time using aggregate country data (e.g. Jonker and Kettenis, 2007; Amromin and Chakravorti, 2009; Bolt et al., 2008). Overall, they find that price and non-price variables have played an important role in the adoption of debit cards in many countries. No attention is paid to the role of safety and security, however, in either study. This makes the paper by Humphrey et al. (1996) a sole exception. They study the factors influencing the substitution between debit cards and other non-cash instruments in 13 developed countries from 1987 to 1993 and include a measure of crime into the model in order to explore the possible impact of safety and security. They find that debit card usage is negatively correlated with rates of violent crime.

**Contribution of this paper**

This paper contributes to the existing literature in several ways. First, the analysis is based on aggregate payments. The advantage of this so called macro-approach is that it is based on *actual* payment behaviour instead of individual perceptions and self-reported *stated* behaviour, as a result of
which measurement errors due to for example incomplete recall, telescoping or social desirability are
minimised (Jonker and Kosse, 2009). Second, payment behaviour is assessed using daily transaction
data. This unique high-frequency dataset is much richer than the annual transaction aggregates used in
previous studies. Third, instead of deriving a proxy for the level of safety, I use actual newspaper
announcements on debit card skimming fraud. Thus far, the impact of media reports has not been
considered and tested for in payment research. Therefore, new insights will be provided into the
extent to which overall consumers’ payment behaviour is affected by media announcements and into
the fragility of consumers’ confidence with respect to paying.

The current paper elaborates on the conceptual framework of safety perception and payment
behaviour presented in Kosse (2010). This framework (see figure 1) departs from the idea that
payment choices are affected by perceptions about safety, which in their turn are influenced by
consumers’ assessment of i) the likelihood of incidents to occur when carrying or using particular
means of payment, and ii) the severity of the consequences of these incidents. Following the intuition
from the food safety literature, opinions of friends, experts and the media are considered to play a role
as well. All the different steps in this framework are empirically tested for in Kosse (2010), except for
the impact of media communication, which will be the focus of this paper.

< FIGURE 1 ABOUT HERE >

*Impact of media communication in other research fields*

Although this is the first attempt to tackle with this issue in the field of payments, many papers have
already been written on the impact of media communication on consumer and private agent behaviour
in other research fields. In the 1990’s, for example, food safety concerns dramatically increased
worldwide as a result of contaminated meat products due to outbreaks such as of E. coli, Salmonella
or BSE. As a result, a new stream of literature was introduced, investigating the impact of food safety
information reported in the media on demand for food. Overall, public information pertaining to food
safety and health concerns through the media have shown to depress consumer food demand (e.g. Van
Ravenswaay and Hoehn, 1991; Smith et al.,1988; Dahlgran and Fairchild, 1987; Piggot and Marsh,
2004; Radwan et al., 2008). The effects, however, are small in comparison to other factors such as price and income effects, seasonal factors and time trends, and short-lived, with consumers soon forgetting the publicity and reverting back to previous consumption levels. In political science and economics too (e.g. Miller et al., 1979; Alsem et al., 2008; Campbell et al., 2003), consumer confidence and behaviour is found to be significantly affected by media publications, and also here, the effects are often found to last temporarily and to disappear in the longer run. Finally, central bank transparency, the extent to which central banks disclose information that is related to the monetary policymaking process, has attracted a significant amount of attention in the past two decades (e.g. Jansen and De Haan, 2007; Van der Cruijzen and Demertzis, 2007; Rosa and Verga, 2008). Overall, though small in some cases, evidence is found of a significant communication effect on private agents’ expectations and behaviour.

4. DATA DESCRIPTION AND METHODOLOGY

Data collection

In order to investigate the impact of fraud articles on debit card usage, I use daily debit card transaction data provided by Equens, the Automated Clearing House (ACH) responsible for the processing of domestic debit card transactions in the Netherlands. The data cover all daily debit card payments made by Dutch residents at POS terminals in the Netherlands from January 1st 2005 to December 31st 2008. The series is characterised by a positive trend and strong daily fluctuations, with relatively high peaks on Saturdays, in the fourth and first week of each month and in December (see figure 2).

Information on daily newspaper announcements on debit card fraud between January 1st 2005 to December 31st 2008 was extracted from the LexisNexis database, covering all articles published in both national and regional newspapers. Various keyword searches were performed to filter out the
articles in which somehow mention was made of skimming fraud with debit cards. In total, 1586
articles were extracted from 54 newspapers. The search results were manually checked and for each
article several characteristics were recorded, such as the name and distribution area of the newspaper,
the type of skimming fraud addressed (i.e. skimming fraud at ATMs, ticket machines or POS
terminals) and whether it was published on the front page or not. Since January 1st 2005, and in
particular from 2007 onwards, the frequency of skimming fraud publications has increased rapidly
(see figure 3), mainly due to a strong growth in publications on skimming fraud at ticket machines
and POS terminals (see figure 4). Moreover, a strong fluctuation in the daily number of publications
can be observed, with relatively high peaks around the summer of 2007. A closer look at the
distribution of the publications over the different months, weeks and days shows that they are fairly
randomly spread and not following a structural (seasonal) pattern, for example in relation to the
intensity of debit card usage.

< FIGURE 3 ABOUT HERE >
< FIGURE 4 ABOUT HERE >

All possible calendar and moving holiday effects will be taken into account when analysing the effect
of newspaper announcements. Esteves and Rodrigues (2010) do something similar when analysing the
daily evolution of ATM withdrawals and find evidence of significant calendar effects. The number of
ATM withdrawals is shown to not only differ per day of the week, it is also higher in the first and last
week of the month and during the summer holidays and the Christmas season. Jonker and Kosse
(2009) too find strong calendar effects when analysing transaction diaries of consumers. Following
the example of Esteves and Rodrigues (2010), I consider calendar effects to be anomalies related to
the calendar, such as the day-of-the-week, the month-of-the-year or fixed holidays such as Christmas
and Queen’s Day. Moving holidays are defined as holidays which are not fixed on a specific date,
such as Easter and Whitsun. Pre- and post-holidays are considered as well, to account for the
possibility that consumers’ purchasing and payment behaviour might deviate from regular behaviour
on days prior or subsequent to particular holidays.
Another factor that is often associated with consumers’ daily shopping and, in consequence, with their payment behaviour, is the weather. The effects, however, have never been empirically tested for. In order to account for any possible weather effects, I collected data on the daily rainfall and temperature\(^4\) in the Netherlands from the Royal Netherlands Meteorological Institute (KNMI).\(^5\)

**Empirical model and estimation method**

The daily number of debit card payments \((NRPOS)\) is assumed to be a function of a set of dummies controlling for potential calendar and holiday effects \((CALEND)\), a set of weather variables \((WEATHER)\), a time trend \((t)\) serving as a proxy for all not-observable variables that affect debit card usage and are highly correlated with time, and a set of dummies on the occurrence and characteristics of skimming fraud articles \((NEWS)\):\(^6\)

\[
NRPOS = NRPOS(CALEND, WEATHER, t, NEWS)
\]  

As Radwan et al. (2008) note, several types of information indices can be employed when analysing consumers’ responses to news publications, ranging from dummy variables (Tansel, 1993), news counts (Smith et al., 1998) or cumulative sums of news (Van Ravenswaay and Hoehn, 1991). In this paper I use dummy variables indicating, on a daily basis, whether any newspaper articles were published or not (see figure 4). The rationale behind this choice is that many consumers get their daily news from different media sources\(^7\), most of which are supplied with news from the same Netherlands national news agency. As a result, the same news items often appear simultaneously at different places and often reach the same consumers more than once a day. Therefore, using news counts might bias the results regarding the marginal impact of individual newspaper articles.

---

4 Daily precipitation amount in 0.1 mm and daily mean temperature in 0.1 degrees Celsius.
5 I acknowledge that there might be much more factors affecting daily debit card usage other than calendar, holiday and weather effects. However, since high frequency (i.e. daily) data are scarce, the analysis presented in this paper limits itself to these control variables only.
6 Since the majority of Dutch newspapers are edited, printed and distributed in the early morning before consumers start of their day, fraud publications are assumed to be exogenous and biases due to the possible endogenous nature of this variable are therefore concluded to be limited.
7 On average, Dutch consumers read 1.4 different newspapers a day (NOM Media, 2010) and 74% of the Dutch regularly read the news (also) on the Internet (CBS, 2010).
Before starting any time-series modelling, I investigated the time-series properties of the continuous variables using the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test and the DF-GLS test. All the three tests confirmed that there is a significant trend effect in the daily number of debit card payments. However, they all rejected the null hypothesis of unit root, also when the trend was excluded from the test equations (see table 1). Therefore, Ordinary Least Squares regression techniques are used and the trend is kept into the model. Since both the Breusch-Pagan test and the White test reject the null hypothesis of constant variance, and as the Durbin’s alternative test\(^8\) for autocorrelation points at a clear rejection of the null-hypothesis, heteroskedasticity-and-autocorrelation-consistent (HAC) standard errors or simply Newey-West standard errors are computed.

< TABLE 1 ABOUT HERE >

### 5. THE EFFECT OF FRAUD ARTICLES ON TOTAL DEBIT CARD USAGE

First I ran a benchmark regression without any publication dummies. For simplicity of estimation a log-linear model is used, with the log of the total number of daily debit card payments (logNRPOS) being the dependent variable. The benchmark regression includes a rich set of potential calendar and holiday effects including their appropriate number of lags and leads\(^9\). The reference day is a non-holiday Sunday in the first week of January. Moreover, the two weather variables daily rainfall and temperature are added, as well as the time trend.

Table 2 shows the parameter estimates and Newey-West standard errors (in italics) for the benchmark equation. Regarding the calendar effects, there are a number of intuitive results pointing at significant and strong day, week and month effects. On Mondays, debit card usage is more than twice as high as on Sundays, and it further increases as the week progresses. Moreover, it is highest in the

---

\(^8\) No conclusion could be drawn from the traditional Durbin-Watson test (Durbin and Watson, 1950), as the lower and upper bounds for 5% critical values (reported in Savin and White (1977)) are not appropriate for sample sizes higher than 200 and for models including more than 21 regressors.

\(^9\) As the appropriate number of lags and leads is unknown in advance, the starting point is to include two lags and two leads for each particular holiday and then to econometrically test alternative combinations.
first and last week of the month, when most salaries are paid out, and lowest in February, the shortest month in the year. From March onwards, the number of payments increases until July when the summer holidays start. From September onwards, however, debit card usage rises again, reaching its peak in December. Regarding fixed and moving holidays, the results are as expected. In general, the number of debit card payments is higher on days prior to a particular holiday, reflecting people’s tradition of buying gifts and cloths and preparing special dinners. The holidays themselves are characterised by a decrease in payments. On Christmas Day and New Year’s Day, for example, the total number of debit card payments is 85% and 80% lower than on a regular day. Regarding post-holiday effects, I find strong negative effects for the days after Easter Day, Whitsun Day and Christmas Day, which are traditionally celebrated as national work-free holidays as well in the Netherlands. The results further confirm a significant weather effect; the total number of card payments decreases with the amount of rainfall. This demonstrates that on rainy days consumers rather stay at home and consequently make fewer transactions. The positive temperature parameter suggests that card usage increases with the average daily temperature, however the effect is not significantly different from zero. Finally, the strong significance of the time trend shows that debit card usage is continuously increasing over time due to variables other than those included in the model. For example, it would pick up the effect of gradually changing consumer payment habits, caused by slowly changing preferences or population composition. On average, total debit card payments increases with 0.03% a day\textsuperscript{10}, holding all other variables fixed.

\textless TABLE 2 ABOUT HERE \textgreater

In the next step, I include various fraud publication dummies into the benchmark regression, as well as their lagged values in order to assess how long any newspaper effect persists. I do this in two parts. First, I add a binary dummy indicating on a daily basis whether any skimming fraud articles are published or not and further refine the analysis by making a distinction between ‘regular’ articles and

\textsuperscript{10} This corresponds to the actual debit card figures that show a total transaction growth of 40% and an average yearly growth of 10% between January 2005 and January 2009.
articles published on the front page, and by assessing to what extent newspaper effects accumulate over time. Second, I will have a closer look at the specific nature of the fraud articles by separating total skimming fraud news into two categories: i) news about skimming fraud at ticket machines and other POSs, and ii) articles dealing with skimming fraud at ATMs.\textsuperscript{11} The results of the first exercise are presented in table 3, while the results of the second analysis are summarised in table 4.

First of all, I find that newspaper publications about skimming fraud depress same day debit card usage. The total number of card payments is 0.8\% lower on days when fraud articles are published than what it would have been without these publications (see table 3, column 1). Interestingly, the insignificance of all tested lagged values indicates that the effect only lasts for one day with consumers reverting back to their normal payment behaviour almost immediately. When I extend the model by adding a ‘front page’ dummy for days on which articles were published at the front page, there is an indication of an additional depressing effect of 0.5\% (column 2). This effect, though, is not significantly different from zero. However, since the models presented in column 1 and 2 assume a constant publication effect over the entire sample period, the real effects may be underestimated. Therefore, in order to assess if consumers’ reaction to newspaper publications has accumulated over time, I split the data into two different periods and distinguish between articles published before mid 2007 and articles published thereafter. There are three reasons for choosing this particular structural breakpoint. First, as observed earlier from figures 3 and 4, the frequency with which skimming fraud publications have come out has rapidly increased since mid 2007. Second, the summer of 2007 is characterised by relatively high peaks in the daily number of fraud publications. Finally, from mid 2007 onwards, the focus of the newspaper articles has changed from ATM fraud to POS fraud as well. As a result, consumers’ awareness, attitudes and reactions might have changed too. The results indeed confirm a structural break around mid 2007 (column 3). Its insignificant parameter shows that up to July 2007, skimming fraud articles have had no effect on debit card usage. For the period after July 2007, however, I find a strong significant negative effect of 2.4\%. Regarding any possible additional front page effects, again no significant differences are found. A further break-

\textsuperscript{11} No discrimination between positive and negative messages is made, since the majority of articles was negative in nature. Moreover, such discrimination can be highly subjective and highly correlated (Smith et al., 1988)
down of the period after July 2007, though, seems to be useful (column 4). Overall, consumers’
reaction seems to grow stronger the more frequently articles are published. Whereas, media attention
before mid 2007 had no single effect on debit card usage, it did depress total debit card payments with
2.8% in the second half of 2007, when newspapers were full of skimming fraud articles and when the
focus of the articles had started to shift from ATM fraud to POS fraud as well. Between January 2008
and July 2008, the effect was somewhat smaller (-1.4%), but it grew stronger again to -2.6% in the
second half of 2008, which was characterised by a new wave of POS fraud announcements.
Moreover, I find a clear additional front page effect of -5.4% in the second half of 2008, with the total
number of debit card payments being 8.1% lower on days when articles were published on the front
page of a newspaper. In all cases, however, the lagged publication dummies remain insignificant,
showing that the effects only last for one day.

< TABLE 3 ABOUT HERE >

Overall, the results in table 3 suggest that newspaper publications about skimming fraud have a
depressing effect on debit card usage. The size of the effects, however, fluctuates over time, with
consumers’ reaction growing stronger in periods when more articles are published. Table 4 further
expands the analysis by looking at the specific content of the publications by breaking them down by
type of skimming fraud addressed. First, there are indications that consumers react differently to
articles dealing with skimming fraud at POSs than to news about ATM skimming fraud (column 2).
Total debit card payments seem to be lower on days when POS fraud articles are published, whereas,
though insignificant, for ATM fraud articles a positive effect is reported. However, once again,
allowing newspaper effects to change over time appears to be relevant. Overall, POS skimming fraud
articles have only started to affect consumers’ payment behaviour since January 2008, with an
average depressing effect of 2.7% (column 4). For the period before 2008, when hardly any POS
skimming fraud announcements were published, no significant effects are found. Newspaper reports
on ATM fraud on the contrary, have affected payment behaviour already from 2005 onwards.
Interestingly, the magnitude of the effect has changed over time. Initially, the estimation results point
at a significant positive effect, with total debit card payments being 1.6% higher on days with ATM skimming fraud publications (column 4). Apparently, using the debit card for paying at the POS was perceived as a safer alternative than using it to withdraw cash from an ATM. The significant and increasing negative parameters for the periods after July 2007, though, show that over the course of time, the positive effect has gradually turned into a negative effect as well. This might indicate that the strong increase of publications after mid 2007, and in particular the growing media attention for POS skimming fraud, has increased consumers’ awareness of the risk of skimming fraud and has changed their attitudes towards using their debit card in general, without making any difference anymore between using it for withdrawing cash or as a means of payment at the POS. In none of the regressions, again, the lagged publication dummies turned out to be significantly different from zero, suggesting that the publication effects only lasted for one day.

As a final check, I re-ran the regressions using the total number of daily articles published as an explanatory variable. The results, however, did not point at any significant individual newspaper effects, supporting the earlier decision of using newspaper dummies in stead of news counts.

6. SOCIAL COST IMPLICATIONS OF DEBIT CARD FRAUD ANNOUNCEMENTS

This paper demonstrates that newspaper publications about debit card skimming fraud do affect the way consumers pay for their POS purchases. Publications reporting about fraud at ATMs are found to have lead to a temporary increase in debit card usage between January 2005 and July 2007. On average, the daily number of debit card payments increased with 1.6% on days with ATM fraud articles being published. From July 2007 onwards, however, both ATM and POS fraud articles have started to depress debit card usage. Since then, on average, the total number of debit card payments was 2.1% lower on days when POS fraud articles came out and 3.2% lower on days with publications about ATM fraud. Various studies have shown that the way consumers pay significantly affects the
overall cost efficiency of the payment system. In general, electronic means of payment are found to be cheaper for both banks and businesses compared to their paper-based alternatives. With respect to transactions at the point-of-sale, the total social costs of a debit card transaction are generally shown to be lower than those of a transaction paid by cash. Therefore, due to their impact on payment behaviour, newspaper publications about card fraud have a potential to harm the overall cost efficiency of the payment system.

In order to put the potential social costs of fraud announcement in perspective, I estimated the costs associated with the temporary shifts in card usage between 1st January 2005 and 31st December 2008. First, using the parameter estimates from the most extended model presented in table 4 (column 4) and controlling for the calendar, holiday, weather and trend effects reported in table 2, I estimated how many debit card payments would have been made in the fictive scenario when no single articles were published. Given the insignificance of the lagged publication dummies, I assume that consumers did not compensate for their change in debit card usage at a later moment in time and, thus, that the short-lived changes in debit card usage were made up by changes in cash usage. For the calculation of the social costs of this substitution, I combined the cost estimates presented in Brits and Winder (2005), McKinsey& Company (2006) and EIM (2007) and assumed the substituted payments to have had the average debit card transaction values as reported by Currence (2011a).

Table 5 shows the estimated changes in debit card payments, as well as the social costs involved. Overall, between 2005 and 2009, newspaper publications about skimming fraud have lead to a net substitution of 13 million debit card transactions and, consequently, to a cost increase of EUR 5 million. However, looking at the individual periods, large differences are found. During the second half of 2008, when newspapers were full of fraud publications, total social costs amounted up to EUR 4.5 million. Although this is still a modest sum given the total yearly social costs of POS payments in 

---

12 See for example Brits and Winder (2005), EIM (2011) and Bolt and Chakravorti (2010).
13 Possible benefits of newspaper publications are not taken into account here. Media attention, for example, might lead to banks and other stakeholders increasing their fraud-reducing efforts and activities even further. These possible positive effects of media attention may in the medium or long-run outweigh the costs associated with the temporary changes in payment behaviour.
14 Following Brits and Winder (2005), I only consider variable costs and distinguish between costs varying with the number of transactions and costs varying with the value of the transactions. Further details of this social cost calculation are available upon request.
the Netherlands\textsuperscript{15}, these first calculations demonstrate that the total costs of debit card skimming fraud are significantly higher than just the sum of the direct fraud losses and the indirect costs of inconveniences and preventative measures to afflicted cardholders, retailers and banks. Therefore, and not in the least because consumers’ reactions are found to grow even stronger the more articles are published, the influence of media attention and its share in the total costs of fraud incidents are not be underestimated.

< TABLE 5 ABOUT HERE >

7. CONCLUSIONS

This paper investigates the impact of newspaper publications about debit card skimming fraud on aggregate debit card usage in the Netherlands using a rich set of daily transaction data and newspaper announcements from January 1\textsuperscript{st} 2005 to December 31\textsuperscript{st} 2008. A first key finding is that newspaper articles about skimming fraud significantly affect same day debit card usage. This finding is robust to controlling for a wide range of calendar, holiday and weather variables and a time trend. Moreover, I find that the direction and the size of the effects strongly vary with the specific characteristics of the publications, such as the type of fraud addressed and the position of the article in the paper, but above all by the frequency with which consumers are confronted with it. Overall, consumers are found to use their debit card less on days when newspapers report about debit card skimming fraud. The temporary substitution away from the debit card towards cash is strongest in periods with a high frequency of publication days, but weakens again as soon as the media attention decreases.

The economic significance of consumers’ response to skimming fraud publications provides several meaningful messages. First, it shows that sustained media attention for card fraud does have the potential to affect consumers’ confidence in the debit card and, through the induced shift in payment behaviour, to harm the overall cost efficiency of the retail payment system. First cost

\textsuperscript{15} In 2002, the total costs of all POS payments in the Netherlands added up to EUR 2.9 billion (Brits and Winder, 2005).
calculations show that during the second half of 2008, for example, the total social costs caused by the
behavioural change amounted up to EUR 4.5 million. This is still small in relative terms, but
demonstrates that the impact of media attention should not be neglected when assessing the total costs
of fraud incidents. Whereas this paper focuses on skimming fraud only, the results are likely to prevail
for other payments-related fraud and safety incidents as well, and underline the importance of all
stakeholders being constantly ready to reducing fraud and safety risks to a minimum.

Second, similar to the results found in other research fields, the impact of skimming fraud
publications only last for one single day, with consumers reverting back to their regular behaviour
almost immediately. Furthermore, also the finding that the strength of consumers’ reactions weakens
again after periods of radio silence indicates that newspaper effects do not sustain or accumulate in
the long run. This might suggest that consumers’ confidence in the debit card is relatively sturdy and
not easily affected. However, it may also be an indication of limited consumer attention. There is a
growing body of literature pointing to an important role for limited or inattention regarding financial
behaviour (Stango and Zinman, 2011; DellaVigna, 2009; Scholnick et al., 2008; Clerides and Courty,
2010). It suggests that consumers have a limited stock of attention and therefore do not always use all
information available when making decisions. Attention can be triggered by repeatedly providing
information, leading to behavioural changes that, however, depreciate over time. Applying this theory
to this paper would suggest that consumers may make irrational payment choices, due to too little
attention for the safety of paying. The payment choices induced by the fraud reports, however, are
then to be considered the rational ones. The question rises to what extent this is true. The fraud reports
refer to specific fraud incidents at single places and single points in time, and do not fully reflect the
actual safety level of debit cards. In fact, the media attention may actually lead to an overestimation of
their unsafety and induce irrational payment decisions instead. Therefore, the findings of this paper
are more likely to be an indication of consumers having a short memory when it comes to newspaper
articles. They may therefore better be explained using a memory-based model, which departs from the
idea that behaviour is affected by information as long at it remains salient in the memory, which may
only be a very short time (Hill et al., 2007). After all, like stated by Alsem et al. (2008); “Nothing is
as old as yesterday’s news”.

18
REFERENCES


Arango, C. and V. Taylor (2009), The role of convenience and risk in consumers’ means of payment, Discussion Paper 2009-8, Bank of Canada

Bhargava, Franzini and Narendrananathan (1983), Serial correlation and the fixed effects model, Review of Economic Studies, 49, pp. 533-549


Brits, J.H. and C.C.A. Winder (2005), Payments are no free lunch, DNB Occasional Studies, 3 (2), De Nederlandsche Bank


CBS (2010), Statistics Netherlands, see database on statline.cbs.nl


Cubeco (2010), Dagblad Academie, May 2010, see www.dagbladacademie.nl

Currence (2011a), Currence, Key figures, see statistics on www.currence.nl


Dahlgran, R.A. and D.G. Fairchild (1987), The demand impacts of chicken contamination publicity – a case study, Agribusiness, 18, pp. 459-474


DNB (2011), Retail Payments Statistics, De Nederlandsche Bank, see database on www.dnb.nl


EIM (2007), The POS payment system in the Netherlands: an estimation of the costs and revenues (Het toonbankbetalingsverkeer in Nederland: kosten en opbrengsten van toonbankinstellingen in kaart gebracht), Zoetermeer

EIM (2011), Toonbankbetalingsverkeer in 2009 (POS payments in the Netherlands), May 2011, Zoetermeer


Fuller, W.A. (1976), Introduction to statistical time-series, John Wiley & Sons, New York


He, P., L. Huang and R. Wright (2008), Money, banking and monetary policy, Journal of Monetary Economics, 55, pp. 1013-1024


Jansen, D. and J. de Haan (2007), The importance of being vigilant: has ECB communication influenced euro area inflation expectations?, DNB Working Paper, 148, De Nederlandsche Bank


Jonker, N. and A. Kosse (2009), The impact of survey design on research outcomes: a case study of seven pilots measuring cash usage in the Netherlands, DNB Working Paper, 221, De Nederlandsche Bank


NOM Media (2010), NOM Print Monitor: NPM 2010-I/2010-II, see www.nommedia.nl


Scholnick, B., N. Massou and A. Saunders (2008), The impact of wealth on inattention: evidence from credit card repayments, Working Paper, University of Alberta, Edmonton

Schuh, S. and J. Stavins (2010), Why are (some) consumers (finally) writing fewer checks? The role of payment characteristics, Journal of Banking and Finance, 34(8), 1745-1758

Smith, M.E, E.O. van Ravenswaay and S.R. Thompson (1988), Sales loss determination in food contamination incidents: an application to milk bans in Hawaii, American Journal of Agricultural Economics, 70, pp. 513-520


Yin, W. and S. DeVaney (2001), Determinants of consumers’ use of debit cards instead of cash and checks, Consumer Interests Annual, 47

Figure 1: Conceptual framework of safety perception and payment behaviour

Source: Kosse (2010)
Figure 2: Daily number of POS debit card transactions in the Netherlands

Source: Equens
Figure 3: Daily number of newspaper articles about debit card skimming fraud

Source: LexisNexis Database
Figure 4: Days with at least one debit card skimming fraud announcement

This figure highlights the days on which at least one newspaper article was published about debit card skimming fraud. A distinction is made between publication of articles about fraud at ATMs (upper graph) and publication of articles about fraud at ticket machines or other points-of-sale in the Netherlands (bottom graph).
Table 1: Overview of time-series properties of dependent and explanatory variables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LogNRPOS</td>
<td>I(0)</td>
<td>7</td>
<td>Yes</td>
<td>I(0)</td>
<td>21</td>
<td>Yes</td>
<td>I(0)</td>
<td>I(0)</td>
<td>I(0)</td>
</tr>
<tr>
<td>RAIN</td>
<td>I(0)</td>
<td>1</td>
<td>No</td>
<td>I(0)</td>
<td>1</td>
<td>No</td>
<td>I(0)</td>
<td>I(0)</td>
<td>I(0)</td>
</tr>
<tr>
<td>TEMP</td>
<td>I(0)</td>
<td>4</td>
<td>No</td>
<td>I(0)</td>
<td>7</td>
<td>No</td>
<td>I(0)</td>
<td>I(0)</td>
<td>I(0)</td>
</tr>
</tbody>
</table>

1 Order of integration, 2 Number of significant lags in test equation, 3 Significant trend in test equation?
Table 2: Daily debit card usage: the role of calendar, holiday and weather effects

<table>
<thead>
<tr>
<th>Calendar effects</th>
<th>Fixed holiday effects</th>
<th>Moving holiday effects</th>
<th>Other effects</th>
<th>Trend</th>
<th>Rain</th>
<th>Temperature</th>
<th>Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of the week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Monday</td>
<td>1.131***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tuesday</td>
<td>1.231***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Wednesday</td>
<td>1.332***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Thursday</td>
<td>1.386***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Friday</td>
<td>1.574***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Saturday</td>
<td>1.608***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sunday</td>
<td>1.626***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week of the month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Week1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Week2</td>
<td>-0.065***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Week3</td>
<td>-0.054***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Week4</td>
<td>0.027***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Week5</td>
<td>0.094</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month of the year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- February</td>
<td>-0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- March</td>
<td>0.035***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- April</td>
<td>0.087</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- May</td>
<td>0.012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- June</td>
<td>0.112***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- July</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- August</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- September</td>
<td>0.013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- October</td>
<td>0.055***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- November</td>
<td>0.089***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- December</td>
<td>0.164***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- New Year</td>
<td>0.906</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Valentine</td>
<td>0.065***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Queen's Day</td>
<td>0.037***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mother's Day</td>
<td>0.065***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Father's Day</td>
<td>0.058***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Easter Day</td>
<td>0.047***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ascension Day</td>
<td>0.014***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Whitsun</td>
<td>0.031***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OLS parameter estimates and Newey – West Standard Errors (in italics). The dependent variable is the total number of daily debit card payments in the Netherlands (in logs). The calendar and holiday effects should be interpreted as the percentage changes relatively to a non-holiday Sunday of the first week of January. Alternative combinations of lag and lead lengths have been investigated using separate t-tests and joint-F tests. This table only presents the results of the covariates that turned out to have a significant effect. *** p<0.01, ** p<0.05, * p<0.10.
Table 3: Daily debit card usage: the role of newspaper publications

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>News on skimming fraud</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-front page news on skimming fraud</td>
<td>-0.008*</td>
<td>0.005</td>
<td>-0.000</td>
<td>0.005</td>
</tr>
<tr>
<td>Front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-front page news on skimming fraud</td>
<td>-0.008*</td>
<td>0.005</td>
<td>-0.001</td>
<td>0.006</td>
</tr>
<tr>
<td>Front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before mid 2007</td>
<td>0.006</td>
<td>0.006</td>
<td>-0.002</td>
<td></td>
</tr>
<tr>
<td>After mid 2007</td>
<td>-0.024***</td>
<td>0.008</td>
<td>0.001</td>
<td>0.012</td>
</tr>
<tr>
<td>Non-front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before mid 2007</td>
<td>0.017</td>
<td>0.015</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>After mid 2007</td>
<td>-0.032</td>
<td>0.024</td>
<td>-0.016</td>
<td>0.026</td>
</tr>
<tr>
<td>Front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before mid 2007</td>
<td>0.016</td>
<td>0.018</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>After mid 2007</td>
<td>-0.028***</td>
<td>0.009</td>
<td>-0.011</td>
<td>0.013</td>
</tr>
<tr>
<td>Non-front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before mid 2007</td>
<td>0.017</td>
<td>0.015</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>After mid 2007</td>
<td>-0.032</td>
<td>0.024</td>
<td>-0.016</td>
<td>0.026</td>
</tr>
<tr>
<td>Front page news on skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>t=0</td>
<td>t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before mid 2007</td>
<td>0.016</td>
<td>0.018</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>After mid 2007</td>
<td>-0.028***</td>
<td>0.009</td>
<td>-0.011</td>
<td>0.013</td>
</tr>
</tbody>
</table>

OLS parameter estimates and Newey–West Standard Errors (in italics). The dependent variable is the total number of daily debit card payments in the Netherlands (in logs). The regressions include the full set of control variables described in the main text and presented in table 2. The results should be interpreted as percentage changes relatively to the effects of non-front page articles published before mid 2007 (between January 2005 and July 2007). Alternative combinations of lag lengths have been investigated using separate t-tests and joint-F tests, but they all turned out to be insignificant as well. *** p<0.01, ** p<0.05, * p<0.10.
### Table 4: The role of newspaper publications by type of skimming fraud addressed

<table>
<thead>
<tr>
<th>Type of Skimming Fraud</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>News on skimming fraud</td>
<td>-0.008*</td>
<td>0.005</td>
<td>-0.000</td>
<td>0.005</td>
</tr>
<tr>
<td>- T=0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- T-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- POS fraud</td>
<td>-0.014***</td>
<td>0.005</td>
<td>-0.002</td>
<td>0.006</td>
</tr>
<tr>
<td>- Before mid 2007</td>
<td>0.005</td>
<td>0.010</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>- After mid 2007</td>
<td>-0.021*</td>
<td>0.008</td>
<td>0.007</td>
<td>0.011</td>
</tr>
<tr>
<td>- ATM fraud</td>
<td>0.008</td>
<td>0.005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Before mid 2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- After mid 2007</td>
<td>-0.021*</td>
<td>0.008</td>
<td>0.007</td>
<td>0.011</td>
</tr>
<tr>
<td>News on POS skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Jan 05 - Jul 07</td>
<td>0.005</td>
<td>0.010</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>- Jul 07 - Jan 08</td>
<td>-0.026***</td>
<td>0.005</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>- Jan 08 - Jul 08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Jul 08 - Dec 08</td>
<td>-0.027**</td>
<td>0.005</td>
<td>0.016</td>
<td>0.016</td>
</tr>
<tr>
<td>News on ATM skimming fraud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Jan 05 - Jul 07</td>
<td>0.016***</td>
<td>0.005</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>- Jul 07 - Jan 08</td>
<td>-0.027**</td>
<td>0.013</td>
<td>0.014</td>
<td>0.016</td>
</tr>
<tr>
<td>- Jan 08 - Jul 08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Jul 08 - Dec 08</td>
<td>-0.044***</td>
<td>0.005</td>
<td>0.010</td>
<td></td>
</tr>
</tbody>
</table>

OLS parameter estimates and Newey – West Standard Errors (in italics). The dependent variable is the total number of daily debit card payments in the Netherlands (in logs). The regressions include the full set of control variables described in the main text and presented in table 2. The individual period effects should be interpreted as percentage changes relatively to the effects of articles published before mid 2007 (between January 2005 and July 2007). Alternative combinations of lag lengths have been investigated using separate t-tests and joint-F tests, but they all turned out to be insignificant as well. *** p<0.01, ** p<0.05, * p<0.10.

31
### Table 5: Estimated social costs of temporary shift in debit card usage due to fraud publications

<table>
<thead>
<tr>
<th>Period</th>
<th>Debit card usage</th>
<th>Social costs</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual (million trx.)</td>
<td>In case of no pubs. (million trx.)</td>
<td>Induced shift (million trx.)</td>
<td>Total (EUR million)</td>
<td>Total no. of publication days</td>
<td>Avg. social costs per pub. day (EUR)</td>
<td></td>
</tr>
<tr>
<td>Jan. 05 - Jul. 07</td>
<td>3,629</td>
<td>3,623</td>
<td>5.4</td>
<td>-2.2</td>
<td>82</td>
<td>-26,682</td>
<td></td>
</tr>
<tr>
<td>Jul. 07 - Jan. 08</td>
<td>846</td>
<td>850</td>
<td>-4.8</td>
<td>1.9</td>
<td>75</td>
<td>25,509</td>
<td></td>
</tr>
<tr>
<td>Jan. 08 - Jul. 08</td>
<td>868</td>
<td>870</td>
<td>-2.2</td>
<td>0.8</td>
<td>48</td>
<td>17,464</td>
<td></td>
</tr>
<tr>
<td>Jul. 08 - Dec. 08</td>
<td>880</td>
<td>911</td>
<td>-11.5</td>
<td>4.5</td>
<td>92</td>
<td>48,730</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,223</td>
<td>6,254</td>
<td>-13.1</td>
<td>5.0</td>
<td>297</td>
<td>16,992</td>
<td></td>
</tr>
</tbody>
</table>

Actual debit card usage as predicted by the estimates shown in table 2 and table 4 (column 4). Second column contains predictions generated using the same estimates, but assumes no publication of skimming fraud articles between January 2005 and January 2009. Social costs are estimated assuming a full substitution of debit card payments by cash payments using the cost estimates reported in Brits and Winder (2005), McKinsey&Company (2006) and EIM (2007) and the yearly average debit card transaction values from Currence (2011a).
Previous DNB Working Papers in 2012

No. 335  **Mark Mink and Jakob de Haan**, Contagion during the Greek Sovereign Debt Crisis
No. 336  **Paul Cavelaars en Joost Passenier**, Follow the money: what does the literature on banking tell prudential supervisors on bank business models?
No. 337  **Michael Ehrmann and David-Jan Jansen**, The pitch rather than the pit: investor inattention during FIFA World Cup matches
No. 338  **Janko Gorter and Paul Schilp**, Risk preferences over small stakes: Evidence from deductible choice
Financial acceleration of booms and busts