Do newspaper articles on card fraud affect debit card usage?

A study on the impact of skimming fraud in the Netherlands

Anneke Kosse
De Nederlandsche Bank

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Outline

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Rapid growth of debit card usage

- Introduced in late 1980s
- 2009:
  - ± 28% of total transactions
  - ± 54% of total sales
- More and more small transactions:
  - EUR 44.60 (2005) → EUR 39.07 (2009)

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Growth debit card skimming fraud

- Debit card skimming fraud NL
  - EUR 4 mln (2005) → EUR 36 mln (2009)
  - 0.03% debit card sales
  - 0.3% debit cards
  - 0.4% ATM & POS terminals

- Indirect costs of skimming fraud
  - For accountholders
  - For banks and retailers

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Debit card skimming fraud

- Social impact may be larger!
  - Erosion of consumer confidence
  - Shift towards less efficient payment instruments

Clear evidence is lacking!


Loss skimming 36 million euro

AMSTERDAM - Banken hebben nog steeds geen goede oplossing voor skimmen, het illegaal kopiëren van bankpassen. Intussen loopt de schade voor banken steeds verder op. In 2009 werd er door criminelen voor 36 miljoen


Ticket machines still not secure

ERMELO - De Nederlandse Spoorwegen gaan voorlopig alleen de treinkaartjesautomaten op de stations in Ermelo en Veenendaal beveiligen tegen het zogeheten skimmen - het stiekem kopiëren van pinpassen.
Nadat vorig jaar was geknoeid met de pingleuf van de automaat in Veenendaal en een maand geleden op


Substantial increase in debit card fraud

RIJSWIJK - Criminelen kopiëren (skimmen) steeds vaker pinpasgegevens bij de kaartjesapparaten op


Increase skimming fraud at railway stations

AMSTERDAM- Het aantal gevallen van het illegaal kopiëren van pinpasgegevens via kaartjesautomaten op NS-stations is in oktober en november sterk gestegen.
Kwamen bij de Spoorwegpolitie dit jaar tot oktober nog driehonderd meldingen van 'skimmen' bij kaartjesautomaten op NS-stations binnen, in oktober en


...tailers face skimming fraud increase

Criminelen houden zich al jaren op grote schaal bezig met het zogenaamde skimmen. Door speciale apparatuur op een geld- of betaalautomaat te plaatsen kunnen skimmers de gegevens van uw bankpas kopiëren om vervolgens met een

Research objective & question

- **Objective:**

  To further analyse consumers' payment behaviour in relation to safety

- **Question:**

  Impact of newspaper articles about debit card skimming fraud on aggregate debit card payments?

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Payments literature

- Theoretical papers:
  - *Alvarez & Lippi (2009), Bolt & Chakravorti (2008), He et al. (2008), Kahn & Roberds (2009)*
  - **No attention for safety costs of debit cards**
- Survey-based papers:
  - *Cheney (2006), Jonker (2007), Borzekowski et al. (2008), Kosse (2010), Yin & DeVaney (2001), Schuh & Stavins (2010)*
  - **Provide no unanimous answer**
- Macro analyses:
  - *Humphrey et al. (1996)*
  - **Annual data & crime rates as proxy of safety**

Intuition from other research fields

- Food science, political science, economics:
  - *Van Ravenswaay & Hoehn (1991), Smith et al. (1988), Dahlgran & Fairchild (1987), Piggot & Marsh (2004), Radwan et al. (2008), Miller et al. (1979), Alsem et al. (2008), Campbell et al. (2003)*
  - **The effects of newspaper reports are small and short-lived**

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Data collection: daily debit card usage

- Source: Equens
- Daily data
- From 01/01/2005 to 31/12/2008
- All Dutch debit card payments
- All Dutch points-of-sale
- Broken down by zip-code

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Data collection: newspaper articles

- Source: LexisNexis
- National & regional newspapers
- Daily data
- From 01/01/2005 to 31/12/2008
- Keywords: skimming / debit card fraud
- 1586 articles from 54 papers

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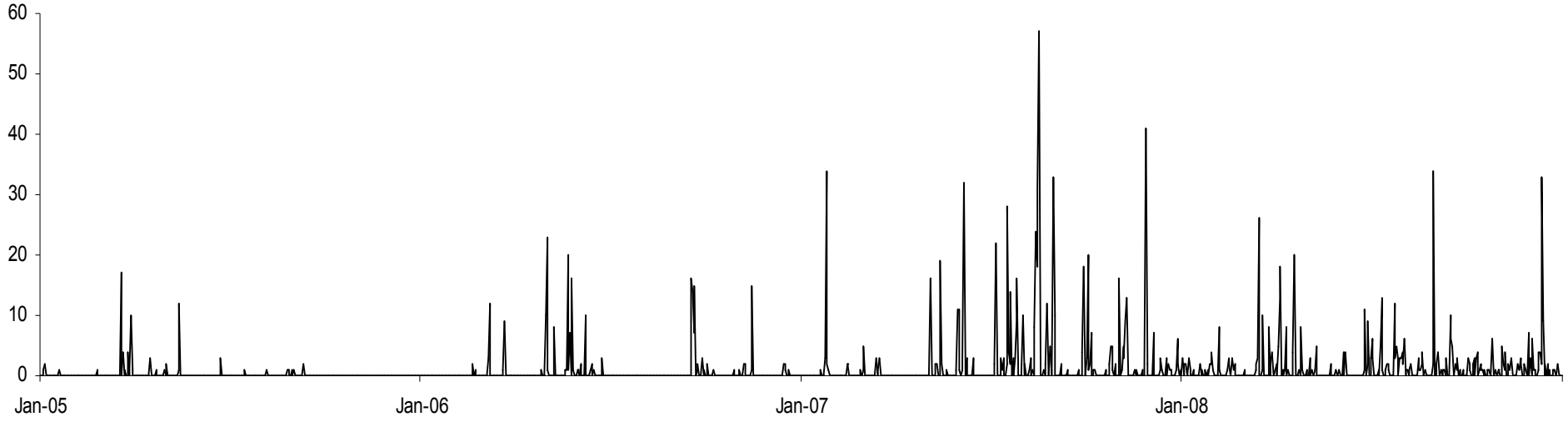
Data collection: newspaper articles



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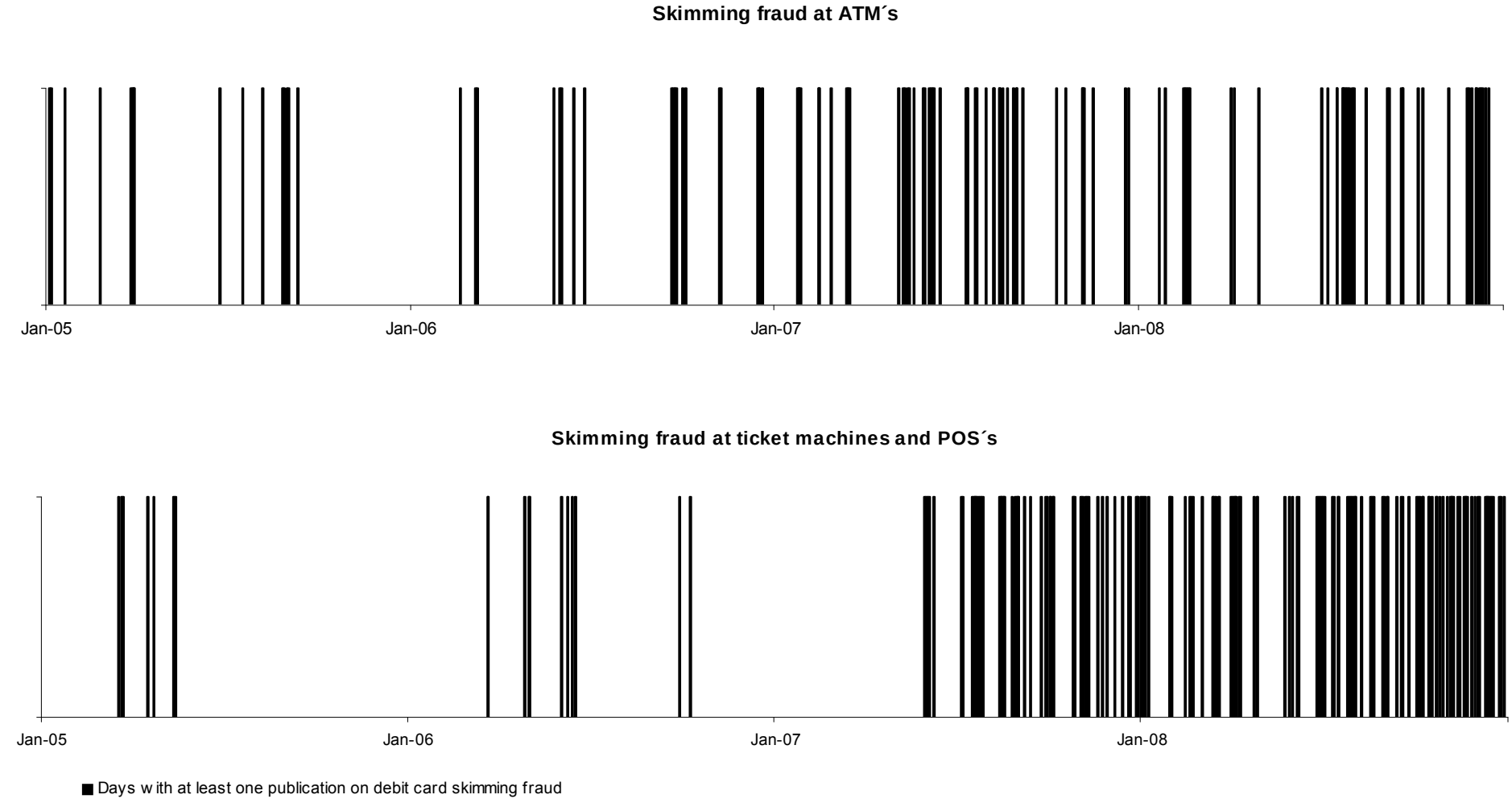
Data collection: newspaper articles



Data collection: control variables

- Calendar and holiday effects
  - Day-of-the-week
  - Week-of-the-month
  - Month-of-the-year
  - Fixed holidays
  - Moving holidays
  - Pre- & post-holidays
- Daily rainfall
  - Source: KNMI
  - From 01/01/2005 to 31/12/2008
  - Daily precipitation (in 0.1 mm)
  - At different weather stations
- Trend variable

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Time-series analysis

1. Tests for unit root
2. Cointegration Equation:

$$\log NRPOS_t = \alpha_0 + \sum_{k=1}^{K} \beta_k CALEND_t + \phi RAIN_t + \delta t + \sum_{l=0}^{L} \chi_l PUBPOS_{t-l} + \sum_{l=0}^{L} \varphi_l PUBATM_{t-l} + \varepsilon_t$$

3. Test for unit root in ε_t
4. Error Correction Model:

$$\Delta \log NRPOS_t = \sum_{k=1}^{K} \gamma_k \Delta CALEND_t + \eta \Delta RAIN_t + \kappa \Delta t + \sum_{l=0}^{L} \lambda_l \Delta PUBPOS_{t-l} + \sum_{l=0}^{L} \mu_l \Delta PUBATM_{t-l}$$
$$-(1-\theta)[error_{t-1}] + \varepsilon_t$$

5. OLS with Newey-West standard errors

Results: control variables

- Calendar effects
  - Lowest on Sundays, peak on Saturdays
  - Highest in 1st and 4th week of the month
  - Lowest in January, February & August, peak in December
- Holiday effects
  - Higher on days prior to holidays
  - Decrease on the holidays themselves
  - Decrease on some post-holidays
- Rain
  - Significant negative impact (-0.02% / 0.1 mm)
- Trend
  - Significant positive impact: +0.027% a day

Results: newspaper effects

COINTEGRATION EQUATION		ERROR CORRECTION MODEL	
Regressors	**logNRPOS**	**Regressors**	**Δ logNRPOS**
PUBPOS $_{t=0}$	-.01216*** (.005)	Δ PUBPOS $_{t=0}$	-.01319**** (.005)
PUBPOS $_{t-1}$	.00290 (.006)	Δ PUBPOS $_{t-1}$	.00283 (.007)
PUBPOS $_{t-2}$	-.00100 (.008)	Δ PUBPOS $_{t-2}$	-.00126 (.004)
PUBATM $_{t=0}$	-.00156 (.007)	Δ PUBATM $_{t=0}$	-.00105 (.006)
PUBATM $_{t-1}$	.01075* (.007)	Δ PUBATM $_{t-1}$	.01168** (.006)
PUBATM $_{t-2}$	-.00311 (.008)	Δ PUBATM $_{t-2}$	-.00111 (.006)
Constant	13.7393**** (.018)	Constant	.00012 (.001)
		Error correction term	-.92089**** (.047)
No. Observations	1454	No. Observations	1454
R-squared	.980	R-squared	.485
F-Statistic	56289.55	F-Statistic	143105.33
Prob(F-statistic)	.0000	Prob(F-statistic)	.0000
Durbin-Watson stat.	1.84148		

Nr. debit card trx. 1.2 % lower on days with pubs on POS skimming

Nr. debit card trx. 1.1 % higher the day after pubs on ATM skimming

* Significant at 15% level *** Significant at 5% level
** Significant at 10% level **** Significant at 1% level

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Panel analysis

- 10 individual Dutch cities
- From 01/01/2005 to 31/12/2008
- Local daily debit card usage
- Local daily rainfall
- Publication about local POS skimming incidents
- Publication about local ATM skimming incidents

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Panel analysis

- Fixed-effects model:

$$\log NRPOS_{it} = \sum_{j=1}^{10} \alpha_j CITY_{ij} + \sum_{k=1}^{K} \beta_k CALEND_{it} + \phi RAIN_{it} + \delta t_i + \sum_{l=0}^{L} \chi_l PUBPOS_{it-l} + \sum_{l=0}^{L} \lambda_l PUBPOSLOCAL_{it-l}$$

$$+ \sum_{l=0}^{L} \varphi_l PUBATM_{it-l} + \sum_{l=0}^{L} \theta_l PUBATMLOCAL_{it-l} + \varepsilon_{It}$$

- Heteroskedasticity & autocorrelation:
  - OLS with Newey-West standard errors
  - OLS with panel-corrected standard errors
  - FGLS

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Results: control variables

- Individual city effects
  - Differ significantly
- Calendar effects
  - Lowest on Sundays, peak o…
  - Highest in 1st and 4th …
  - Lowest in Januar… …k in December
- Holiday …
  - …idays
  - …days themselves
  - …e post-holidays
- …
  - Significant negative impact (-0.02% / 0.1 mm)
- Trend
  - Significant positive impact: +0.022% a day

The same as national analysis

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Results: newspaper effects

	NEWEY-WEST	PCSE	FGLS
$PUBPOS_{t=0}$	-.00777	-.00777	-.00777*
	(.007)	(.009)	(.005)
$PUBPOS_{t-1}$	.00397	.00397	.00397
	(.006)	(.010)	(.005)
$PUBPOS_{t-2}$	-.00275	-.00275	-.00275
	(.005)	(.010)	(.005)
$PUBPOSLOCAL_{t=0}$	-.00676	-.00676	-.00676
	(.019)	(.030)	(.031)
$PUBPOSLOCAL_{t-1}$	.02889	.02889	.02889
	(.044)	(.032)	(.032)
$PUBPOSLOCAL_{t-2}$	-.01811	-.01811	-.01811
	(.027)	(.030)	(.031)
$PUBATM_{t=0}$	.00645	.00645	.00645
	(.005)	(.010)	(.006)
$PUBATM_{t-1}$	.01118***	.01118	.01118**
	(.005)	(.011)	(.006)
$PUBATM_{t-2}$	-.00837*	-.00837	-.00837*
	(.005)	(.010)	(.006)
$PUBATMLOCAL_{t=0}$	-.01166	-.01166	-.01166
	(.027)	(.040)	(.040)
$PUBATMLOCAL_{t-1}$	.02417	.02417	.02417
	(.043)	(.041)	(.041)
$PUBATMLOCAL_{t-2}$	-.00499	-.00499	-.00499
	(.022)	(.040)	(.040)
Constant	8.83367****	8.83367****	8.83367****
	(.033)	(.014)	(.008)

Nr. debit card trx. 0.8 % lower on days with pubs on POS skimming

No extra/other effect of local POS skimming incidents

Nr. debit card trx. 1.1 % higher the day after pubs on ATM skimming

No extra/other effect of local ATM skimming incidents

Conclusions

- Newspaper articles about skimming fraud do affect debit card usage
- Impact depends on type of skimming fraud addressed
  - ATM skimming fraud → debit card payments ↑
  - POS skimming fraud → debit card payments ↓
- No difference between local and national incidents
- Effects are economically small
- Effects are short-lived

Follow-up

- For this paper:
  - Structural breaks
  - Theory of consumer inattention
  - Social cost estimation

- For future work?
  - ATM withdrawals
  - Transaction values
  - Impact on an entrepreneurial level

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Thank you for your attention

Questions?

Anneke Kosse
+ 31 (0)20-524 2827
j.c.m.kosse@dnb.nl

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