Innovation in customer authentication methods, card-based internet payments and User Experience: empirical evidence from Italy

Guerino Ardizzi (*)

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(*) Bank of Italy, Market and Payment System Oversight. The views expressed are those of the author and do not involve the responsibility of the Bank.
Motivation of this paper

Digital payment innovation:

- right balance between security and positive user-experience
- lack of empirical analysis

PSD2 introduces ad hoc obligations for payment services providers to apply strong customer authentication (SCA) for remote electronic payments

This paper is a first attempt to assess the impact of a security innovation on (card-based) internet payments

Research questions:

- the massive adoption of multi-factor authentication methods may have negative impacts on the user experience?
- policy implications?
Agenda

- Literature
- Model
- Results
- Conclusion & policy issues
Key findings from the literature (*):

- Security concerns may be an impediment to the confidence of the adoption of digital services.
- User experience can suffer as digital products become more complicated because of security innovations. Empirical results are limited.

(*)

Consumers’ payment and perception of safety
Hayashi et al. (2015); Schu and Stavins (2015); Kosse (2013)

Digital products, security and usability
Svilar and Zupancic (2016); Krol et al. (2015); Braz and Robert (2006)

Consumer experience and multi-factor safety technology
De Cristofaro et al. (2016); Adyen (2014).
Model: strategy

Card-based internet payments

Cards are still the payment instrument most frequently used for e-commerce, also due to mobile technologies.

“3D-Secure” protocol

It’s a two-factor authentication method for online card transactions linking the e-merchant, the acquiring PSP and the issuing PSP, adopted by the industry in the past already, with different penetration rate among countries.

Dataset (source: Bank of Italy, banking statistics)

Bank panel data over the period 2011H1 – 2016H2, representative of 80 percent of the card-based Internet payments sector (from 200 up to 376 observations); information about: number of cards, percentage of cards used over the Internet, total volume and value of card transaction (of which Internet transactions), percentage of “3-D secure” based transactions, other control variables (such as bank size and type).

Focus on credit cards over the Internet
Pattern of the 3D Secure rate and credit card turnover over the Internet in Italy

Source: Bank of Italy, banking statistics
Assessing the user experience: one can assume a relationship between the Internet card turnover (transaction per card), the 3D Secure adoption (percentage of 3DS transactions) and other control variables $Z$:

$$\text{TURNOVER}_{it} = \alpha_0 + \alpha_1 3DS_{it} + \sum_h \alpha_h Z_{it} + u_{it}$$ [1]

An alternative specification considers as a dependent variable the share of credit cards on total cards which has been activated online:

$$\text{CARDONL}_{it} = \alpha_0 + \alpha_1 3DS_{it} + \sum_h \alpha_h Z_{it} + u_{it}$$ [2]

H0: 3D-Secure authentication methods introduce additional steps in the payment workflows which can impact the user experience (turnover or card adoption as a proxy).
Results support the hypothesis of negative effects of the two-factor authentication method (such as the 3-D-Secure protocol) on the user-experience (expressed in term of card turnover or card online adoption). Such outcomes are robust both in static panel data specifications (FE models) and the dynamic ones (GMM estimator à la Arellano-Bond).

Among the regressors time dummies and a set of environmental variables \((Z)\) which can influence the use of card-based internet payments are included. See appendix
Predicted turnover ("usability") with upward shifts over time: "learning by doing", consumer awareness, technology improvements
Conclusion & policy issues

- Potential trade-off between security technologies and usability:
  - empirical evidence

- The issue is acknowledged by the regulator (EBA GLs, PSD2-EBA RTS):
  - SCA combined with:
    - low value transactions
    - transaction risk analysis

- The issue must be addressed by the payment industry:
  - «education» (consumer awareness)
  - SCA with different usabilities
...examples of SCA with different usability
Thanks!
Coefficients and p-values in parentheses. FE = fixed effect estimator; GMM-Style = Arellano-Bond two-step system GMM estimator (all covariates – with the exception of dummies - are treated as endogenous and instrumented through their lagged values). Among the regressors, time dummies and a set of environmental variables (Z), which can influence the provision of card-based internet services (type of PSP, internet market share, cross-border penetration, share of alternative payment methods, network dimension, etc.), are included. See Model: results

### Estimates Equation 1 "TURNOVER": unbalanced bank panel data, 2011-2016; results

<table>
<thead>
<tr>
<th>Regressors *</th>
<th>FE</th>
<th>GMM-Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D-S</td>
<td>-0.345**</td>
<td>-0.457**</td>
</tr>
<tr>
<td>(1.433)</td>
<td>(1.906)</td>
<td></td>
</tr>
<tr>
<td>$\sum_k Z$</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Time dummy</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Constant</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

| Observations | 375       | 397       |
| Groups       | 58        | 38        |
| R²           | 0.20      | 0.012     |
| ARE (p-value) | 0.775    | 0.973     |
| Hansen test (p-value) |       |           |

* Dependent variable: TURNOVER = log-value of credit card based Internet transaction divided number of issued credit card; robust standard errors in round brackets.

### Estimates Equation 2 "CARDONL": unbalanced bank panel data, 2011-2016; results

<table>
<thead>
<tr>
<th>Regressors *</th>
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<th>GMM-Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D-S</td>
<td>-0.097**</td>
<td>-0.075*</td>
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<tr>
<td>(0.47)</td>
<td>(0.047)</td>
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<td>$\sum_k Z$</td>
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<td>yes</td>
</tr>
<tr>
<td>Time dummy</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Constant</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

| Observations | 222       | 193       |
| Groups       | 42        | 37        |
| R²           | 0.48      | 0.70      |
| ARE (p-value) | 0.13     | 0.06     |
| ARE2 (p-value) | 0.01    | 0.63     |
| Hansen test (p-value) |       |           |

Dependent variable: CARD ONLINE = percentage share of credit cards active at least once for Internet payments during the reference period.