FRAUD, INVESTMENTS AND LIABILITY REGIMES IN PAYMENT PLATFORMS

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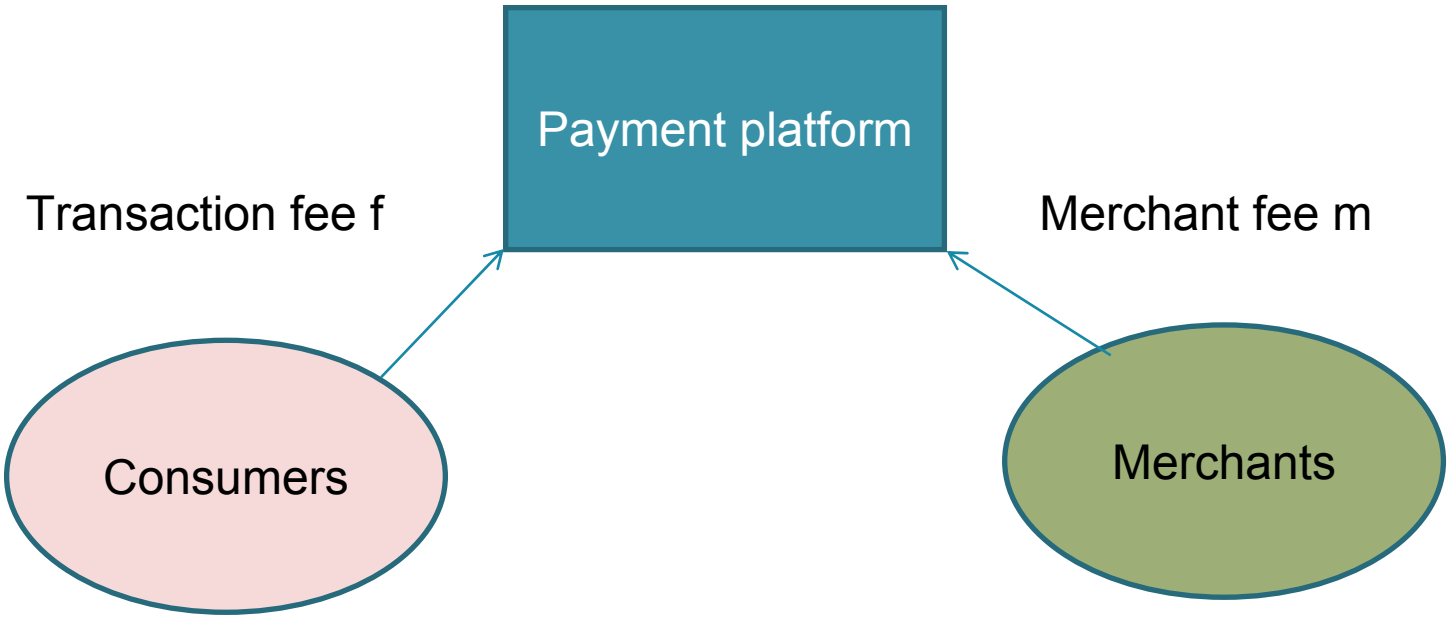
A SHORT INTRODUCTION TO PAYMENT PLATFORMS

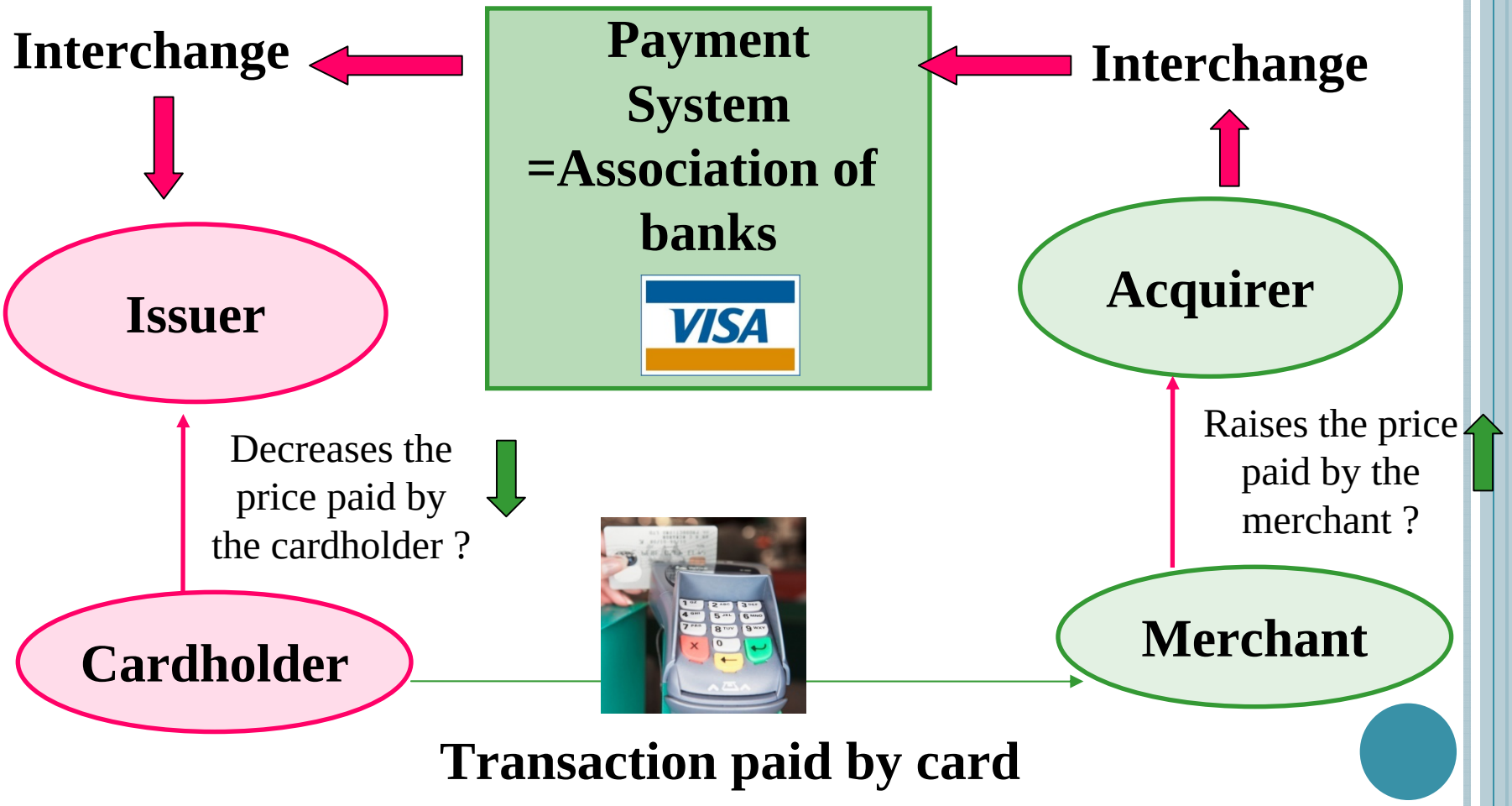
PAYMENT SYSTEMS AS TWO-SIDED MARKETS

- Payment platforms can be considered as ‘two-sided’ markets



- In such markets, the volume of transactions depends:
  - On the total price f+m
  - On the price structure f/m

FOUR-PARTY PAYMENT PLATFORMS



CONTEXT OF THE RESEARCH

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- 1- **Concern about the cost of fraud on payment cards:**
  - Cost of fraudulent transactions for banks (per $100 transaction)

Country	Spain	Australia	France	UK	US
Losses Rates	2.24¢	2.39¢	5¢	9.12¢	9.2¢

  - Opportunity cost in terms of lower use of electronic payment instruments – more efficient than cash except for low values.

- 2- **Regulation of payment systems/ Antitrust concerns:**
  - Dodd-Frank Act in the United-States,
  - Visa and MasterCard cases in the European Union,
  - Condamnation of French Banks by the Competition Authority in September 2010 for the check payment system.

CONTEXT OF THE RESEARCH

- **Liability rules to share the cost of fraud depend on:**
  - **Public laws:** limited consumer liability (e.g. TILA and regulation Z in the United-States)
  - **Private rules** (decided by payment networks):
    - Zero liability rule for consumers adopted by several payment associations,
    - Rules to share the cost of fraud between merchants and banks (or platforms)…
    - Liability of merchants higher for Internet transactions.

Country	% of loss for banks	% of loss for merchants
France	41.1%	53.5%
US	57%	43%

CONTEXT OF THE RESEARCH

- Investments to develop electronic payment instruments:
  - Payment cards, mobile payments
- Cost incurred by various participants:
  - Merchants: data-security costs, compliance, authentication tools.
  - Consumers: protection of personal information
  - Banks and networks (per transaction- US):

	Issuers	Acquirers	Networks
Signature-debit	2.2¢	0.7¢	0.4¢
PIN-debit	1.2¢	0.6¢	0.3¢

RESEARCH QUESTION & RELATED LITERATURE

RESEARCH QUESTIONS

- **Question 1:** what is the incidence of fraud liability regimes on the price structure that is charged by payment platforms?

- **Answer:** We extend Rochet and Tirole (2003) « two-sided market pricing formula » by taking into account the impact of the fraud liability regime on the expected fraud loss.

RESEARCH QUESTION

- **Question 2:** How do private liability regimes differ from the socially optimal regime that would be implemented by a social planner?

- **Answer:** Liability regimes can be used by monopolistic payment platforms to extract rents from merchants.

- **Not in the perimeter of our study:** compliance issues (e.g: EMV standard)

RELATED LITERATURE

- First paper to model fraud detection technologies & liability regimes in payment systems.
- **Paper related to three strands of literature:**
  - **1- Literature on platform pricing:**
    - **Rochet and Tirole (RAND 2002, EEA 2003, RAND 2006)**
    - Survey: Verdier (JES 2009)
  - **2- Literature on investment in two-sided markets:**
    - Verdier (IJIO 2010)
    - Belleflamme and Peitz (EER 2010)
  - **3- Literature on tort law**
    - Brown (1973)
    - Landes and Posner (1987)
    - Dari-Mattiacci, Parisi (2006)

THE MODEL

PAYMENT PLATFORM

- A three-party payment platform in the baseline model:
  - Focus on the incidence of the liability regime on the price structure.
  - The role of interchange fees is reintroduced in the next sections.
  - **Similar to Rochet and Tirole (2003) and Wright (2002)**
- Choice of transaction prices for the 'EPI':
  - Price paid by consumers: f
  - Price paid by merchants: m
- Marginal cost of processing the service: c

FRAUD AND LIABILITY REGIME

- Probability x (exogenous) of a fraudulent transaction.
- Probability q (endogenous) that the fraud is detected.
  - This probability is related to merchants' investments.
- Probability x(1-q) of a loss L, shared between:
  - Merchants (share α_S)
  - Consumers (share α_B),
  - And the platform (share $\alpha_P = 1 - \alpha_S - \alpha_B$).

- **<u>Assumptions about the liability regime:</u>**
  - Consumer liability regime determined by public laws (special case: zero liability rule),
  - Merchant liability privately chosen by the platform.

MERCHANTS

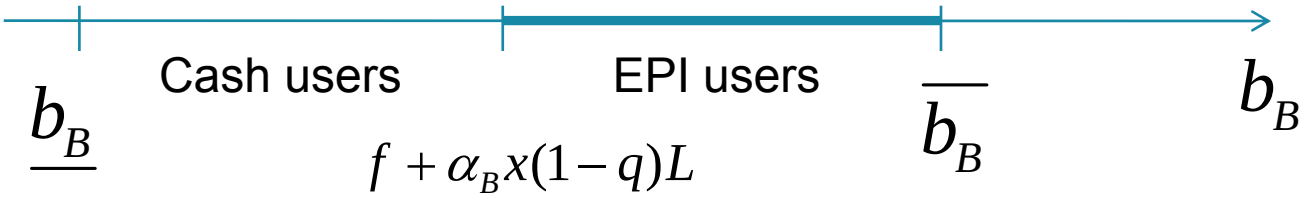
- **Local monopolist merchants:**
  - Marginal cost: d
  - Price of the good: p (endogenous) – and no discrimination according to the payment method.
  - Heterogenous on their EPI acceptance benefit b_s (wrt cash).
- **Merchants make two decisions:**
- 1- Whether or not to accept to accept the EPI:
  - Depends on the merchant fee m and the EPI acceptance benefit.
- 2- How much to invest in fraud detection technologies (Amount: e_s.Convex cost paid per transaction: $C_s(e_s)$)
  - The more the merchant invests, the higher the probability that fraud is detected: $dq / de_s \geq 0$

CONSUMERS

- **Consumers:**
  - Surplus of buying the good: v
  - Hold two payment instruments cash and the EPI
  - Heterogenous on their benefit of using the EPI with respect to cash: . b_B
  - Risk neutral and perfect information.

- If a merchant accepts the EPI, a consumer wishes to use the EPI if:

$$b_B - f - \alpha_B x(1-q)L \geq 0.$$



ADDITIONAL ASSUMPTIONS

- **A0-** Increasing density functions on the merchant side and the consumer side.

- **A1-** Increasing hazard rate for the distribution of the consumer's benefit of using the EPI.
  - Standard assumption in the literature (See Wright (2002)).

- **A2-** Consumers obtain a surplus from buying the good which is sufficiently high such that, in equilibrium:
  - It is not lower than the surplus of making a transaction,
  - The surplus of making a transaction is higher than the expected share of the fraud loss.

TIMING OF THE GAME

- **Stage 1:** the payment platform chooses the transaction prices and the level of liability that is borne by merchants.

- **Stage 2:** each merchant decides whether or not to accept the EPI and how much to invest in fraud detection technologies. They also choose the price of the good.

- **Stage 3:** each consumer is matched randomly to one merchant. Consumers decide on whether or not to buy the good and how to pay for the good.

THE RESULTS

STAGE 3: CONSUMER PAYMENT DECISION

- Consumer payment decision depends on:
  - The price of the good p that is set by a merchant
  - The price of an EPI transaction f
  - The expected loss in case of a fraudulent transaction

- If p≤v, the percentage of consumers who wish to buy the good and use the EPI is:

$$D_B = 1 - H_B(f + \alpha_B(1-q)xL)$$

- If p>v, the percentage of consumers who wish to buy the good and use the EPI is:

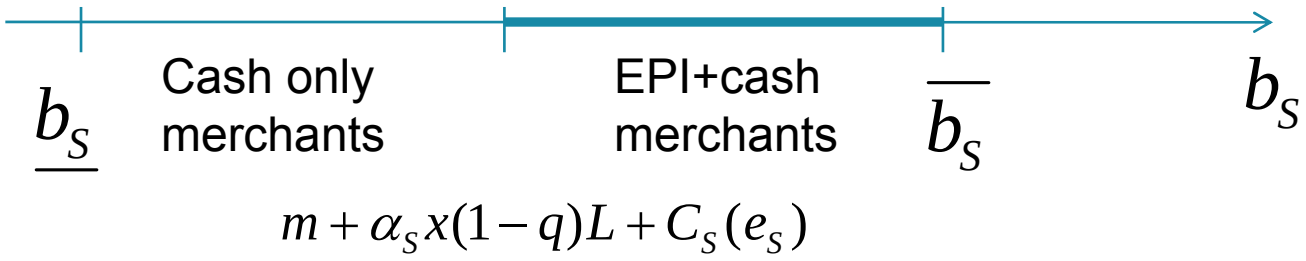
$$D_B = 1 - H_B(f + \alpha_B(1-q)xL + p - v)$$

STAGE 2: EPI ACCEPTANCE AND INVESTMENTS

- **Lemma 1:** each monopolistic merchant maximises its profit by setting p=v.
  - Merchant profit is maximized when cash-users are not excluded from the market (Similar to Wright (2002))

- The EPI acceptance condition:

$$b_S - m - \alpha_S x(1-q)L - C_S(e_S) \geq 0.$$



STAGE 2: EPI ACCEPTANCE AND INVESTMENTS

- **Lemma 2:** If the merchant fee is not to high, all merchants such that $b_S \geq \hat{b}_S(\alpha_B, e_B, \ldots)$ accept the EPI. The profit maximising investment for a merchant who accepts the EPI solves:

$$\alpha_S xL \frac{dq}{de_S} - C_S^{'}(e_S) = \left[b_S - \alpha_S xL(1-q) - m - C_S(e_S)\right]\frac{\xi_B}{e_S}$$

- **Interpretation:** drivers of merchants' investments.
  - 1- '*Expected loss effect*' (lower fraud losses)
  - 2- '*Transaction volume effect*' (higher consumer demand)

STAGE 2: EPI ACCEPTANCE AND INVESTMENTS

- Comparative statics: variation of merchants' investment with

Impact of…	… on merchant investment	… on the probability that a merchant accepts the EPI
Consumer liability	+	
Consumer transaction fee	+	–
Merchant transaction benefit	+	+
Merchant liability	+	–
Merchant fee	–	–

STAGE 1: PRICES AND LIABILITY LEVELS

- At stage one, the payment platform chooses the level of liability that maximises its profit,

$$\pi_P = (f + m - c)V_P - EL_P$$

- Where:

$$V_P = \int_{\hat{b}_S}^{\overline{b_S}} \int_{f+\alpha_B xL(1-q^*)}^{\overline{b_B}} h_S(b_S)h_B(b_B)db_B db_S$$

$$EL_P = \alpha_P xL \int_{\hat{b}_S}^{\overline{b_S}} \int_{f+\alpha_B xL(1-q^*)}^{\overline{b_B}} (1-q^*)h_S(b_S)h_B(b_B)db_S db_B$$

STAGE 1: PRICES AND LIABILITY LEVELS

- **Proposition 1:** the expected loss incurred by the payment platform (EL):
  - Decreases with the consumer fee
  - Decreases with the level of liability that is borne by merchants
  - Increases with the merchant fee only if the elasticity of the merchant's effort to the merchant fee is small or if the elasticity of the merchants' demand to the merchant fee is high.

THE PROFIT MAXIMISING PRICE STRUCTURE

- *We start by determining the profit maximising price structure with exogenous liability levels.*
- **Proposition 2:** the profit maximising price structure reflects the platform's trade-off between balancing profits on both sides of the market and minimizing the expected loss:
  - **THE TOTAL PRICE:**

$$\frac{f+m-c}{f} = \frac{1}{\varepsilon_V(f)} + \frac{\partial EL_P/\partial f}{f\partial V_P/\partial f}$$

  - **THE PRICE STRUCTURE:**

$$\frac{f}{m} = \frac{\frac{1}{\varepsilon_V(m)} + \frac{\partial EL_P/\partial m}{m\partial V_P/\partial m}}{\frac{1}{\varepsilon_V(f)} + \frac{\partial EL_P/\partial f}{f\partial V_P/\partial f}}$$

THE PROFIT MAXIMISING LEVEL OF LIABILITY

- **Proposition 3:** a profit-maximising payment platform chooses a level of liability for merchants that reflects a trade-off between minimizing the expected loss on fraud and maximizing the transaction volume.
  - Under the zero liability rule, the payment platform chooses the level of liability for merchants that maximises the probability of fraud detection.
  - If the transaction volume increases with the level of liability that is borne by merchants, there is a corner solution, such that the payment platform lets the merchant bear all the losses.

WELFARE MAXIMISING LEVEL OF LIABILITY

- **Proposition:** under the zero liability rule, if social welfare is a concave function of the level of liability, the profit maximising level of liability for merchants is lower than or equal to the welfare maximising level of liability.

- Payment platforms internalize imperfectly the impact of the liability regimes on consumer and merchant surplus.
- Liability regimes are a means for monopolistic payment platforms to extract rents from merchants.

THE ROLE OF INTERCHANGE FEES

- Modification of the model to take into account competition on banking retail markets:
  - Imperfect competition between issuers,
  - Perfect competition between acquirers.
- Zero liability rule for consumers.

- Proposition: If the issuers are imperfectly competitive and if the acquirers are perfectly competitive, the profit maximising interchange fee decreases with the level of liability that is borne by merchants.

CONCLUSION: NEXT STEPS & PERSPECTIVE

NEXT STEPS AND RESEARCH PERSPECTIVE

- **Next steps for the research program:**
  - Examine the welfare maximising level of liability if consumers bear some liability for fraud,
  - Compare the situation if we allow for platform investment,
  - Determine the role of competitive externalities between merchants.
  - In another paper, study compliance issues in two-sided markets.

- **Conclusion:** liability regimes should be taken into account by regulatory authorities in payment systems (antitrust concerns, adoption of payment instruments…).