Rebates and competition between payment card networks[1]

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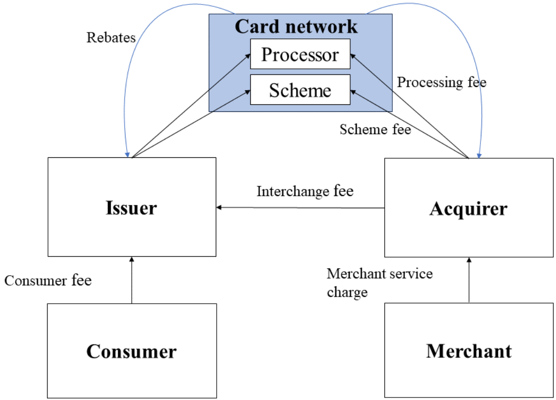
[1] The usual 'central bank' disclaimer applies.

Motivation: Why do card networks give rebates?

- VISA and Mastercard among most profitable companies in the world: net profit margin 45-55%
- Both spend 25-30% gross revenues, i.e. 10 billion per year, on rebates
- Existing literature focuses on the interchange fee (IF) - now regulated in many jurisdictions
- New model to analyse incentives and impact of rebates

Flows of payment fees



Overview

Two-sided platform competition model:

- Low (for some negative) heterogeneous (stand-alone) card benefits
- Analysing the impact of increasing homogeneous transaction benefits

Main finding: Card networks offer rebates to issuing/acquiring banks to maximise card issuance and card acceptance as profit margins increase with transaction benefits

- Card network competition reduces profit margins especially for networks with large transaction benefits

Literature

Starts with Baxter (1983): IF socially optimal if consumer fails to pay by card though joint benefit exceeds total resource cost.

Focus on IF pricing distortions:

- Market power (issuing) banks (Schmalensee, 2002; Wright, 2003, 2004; R&T, 2002, 2003)
- Heterogeneity of merchants/consumers (Wright, 2003, 2004; R&T, 2002, 2003)
- Competition between merchants (R&T, 2011)
- Card network competition (Guthrie & Wright, 2007)
- Usage decision made on one side (Bedre-Defolie & Calvano, 2013)

Another issue: difference between card and transaction benefits....

Model: basics

- Consumer and merchant side, indexed by $i = c, m$, populated by a unit-mass continuum of agents
- Each agent has a type ω_i and derives a gross payoff:

$$u_i(\omega_i, n_j) = B_i + \alpha_i n_j \tag{1}$$

  by joining the card network and from transacting with a mass of agents of size n_j from side j, $j \neq i$
- Heterogeneous (stand-alone) card benefit, B_i, is an independent draw from some distribution G_i and is the agent's private information
- Homogeneous transaction benefit, α_i, is the same for all side i agents and derived from transacting with agents from side j, $j \neq i$

Model: pricing

- The total payment P_i has two components: $P_i = f_i n_j - R_i$
- Transaction fee f_i is charged for every transaction with agents from side $j \neq i$
- Card fee F_i paid to or card rebate R_i received from the network per cardholder/merchant ($R_i = -F_i$)

Model: demand and profit

- Quasi linear preferences, i.e net payoff: $u_i(\omega_i, n_j) - P_i = B_i + \alpha_i n_j - f_i n_j + R_i = B_i + R_i$
- Demand function on side i:

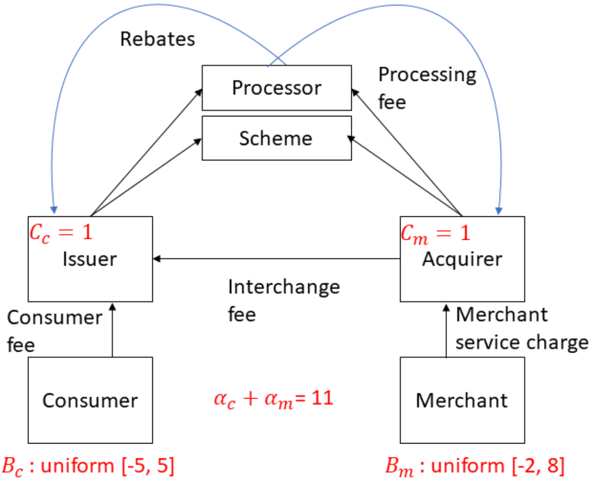
$$n_i = D_i(R_i) = 1 - G_i(R_i - \alpha_i n_j + f_i n_j) = 1 - G_i(R_i) \quad (2)$$

- Payment usage: $D(R_c, R_m) = D_c(R_c) \times D_m(R_m)$
- The card network's profits are specified by:

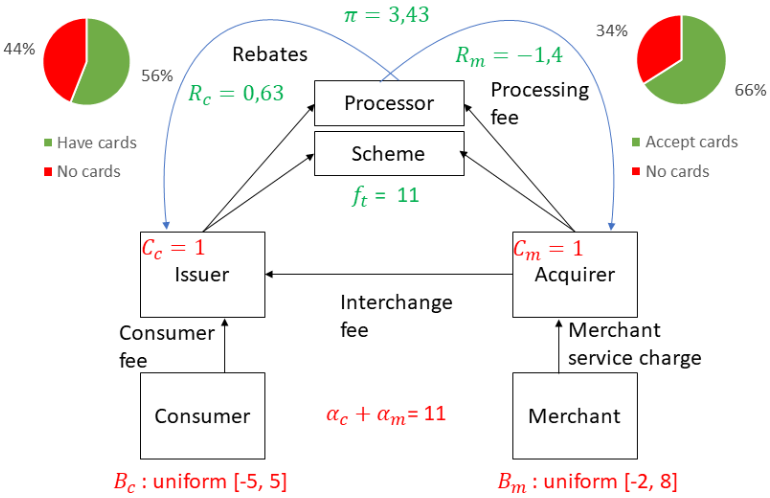
$$\begin{aligned}\Pi = (f_c D_m(R_m) - R_c - C_c) D_c(R_c) + \\ (f_m D_c(R_c) - R_m - C_m) D_m(R_m)\end{aligned} \quad (3)$$

  with cost C_i for each side-i agent it brings on board
- Equilibrium solution in the appendix on slide 25

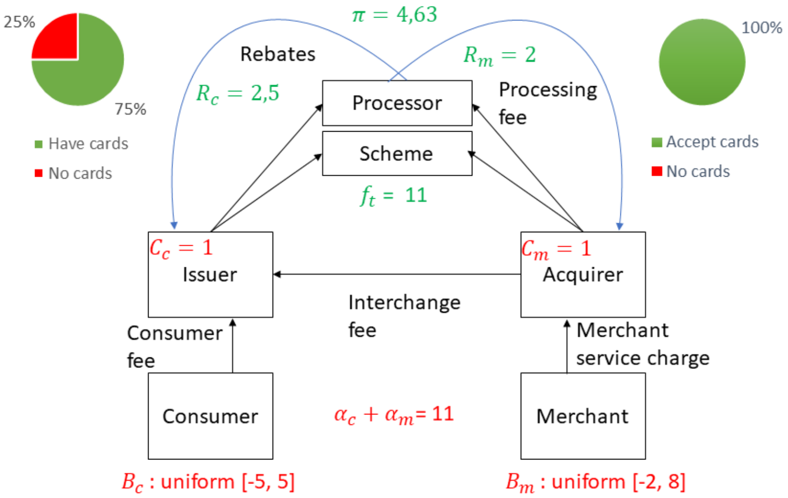
Numerical example



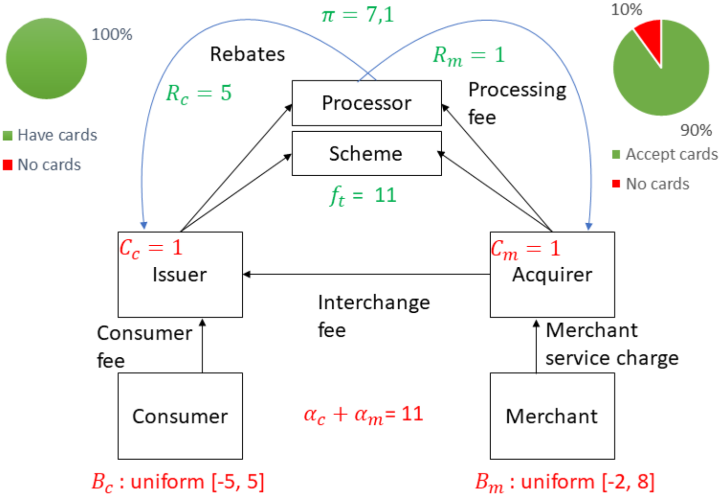
Interior solution



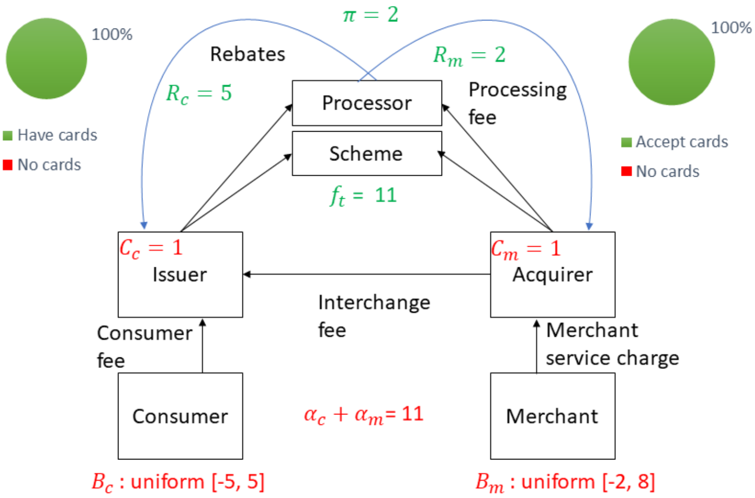
Boundary solution merchants



Boundary solution consumers



Full market coverage



Numerical example outcomes

- Interior solution: $R_c^* = 0.63$, $R_m^* = -1.40$, $n_c^* = 0.56$, $n_m^* = 0.66$ and profits $\Pi = 3.43$
- Boundary solution merchants: $R_m^* = 2$, $R_c^* = 2.5$, $n_c^* = 0.75$, $n_m^* = 1$ and profits $\Pi = 4.63$
- Boundary solution consumers: $R_c^* = 5$, $R_m^* = 1$, $n_c^* = 1$, $n_m^* = 0.9$ and profits $\Pi = 7.1$
- Full market coverage: $R_c^* = 5$, $R_m^* = 2$, $n_c^* = n_m^* = 1$ and $\Pi = 2$

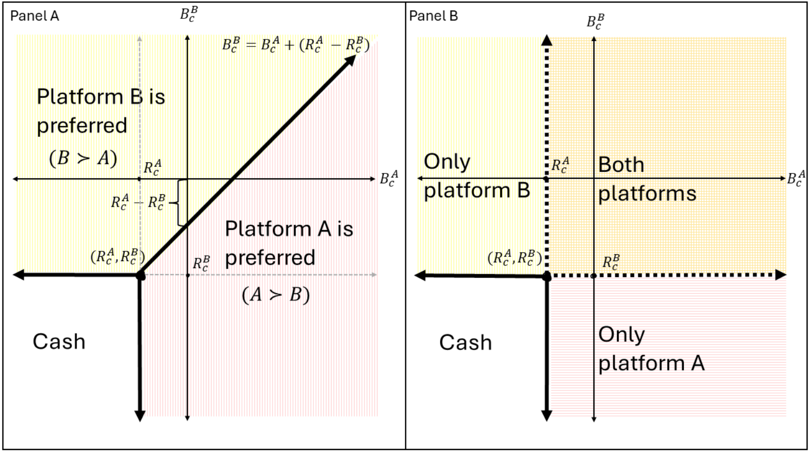
Findings

- Price structure of transaction fees is unimportant: $f_t = \alpha_c + \alpha_m$
- Rebates determined by the distribution of card benefits
- Suppose $\overline{B_m} > \overline{B_c}$ and the same variance of card benefits:
  - As total transaction benefits increase, rebates on the consumer side increase more than rebates on the merchant side
- Suppose $\overline{B_m} = \overline{B_c}$, but merchants more homogeneous than consumers:
  - As total transaction benefits increase, rebates on the merchant side are maximised earlier but lower than rebates on the consumer side

Duopoly model: basics

- Same assumptions as above, but two card networks, indexed by $k = A, B$
- Heterogeneous (stand-alone) card benefit, B_i^k, is an independent draw from some joint distribution G_i and is the agent's private information
- Platforms share the market and use so-called "insulated equilibrium" (IE) strategies: $T_i^k = f_i n_j^k - R_i^k$
- Competitive bottleneck structure: consumers singlehome, merchants multihome
- Consumer demand (4), cash demand (5), merchant demand (6) and profit (7) in appendix
- Equilibrium FOC's in the appendix on slide 31

Competitive bottleneck



Panel A: 'singlehoming' consumers

Panel B: 'multihoming' merchants

What about the boundary solutions?

- FOC's hard to solve - both analytically and numerically
- Consider each boundary solution where one or more constraints become binding, such as $D_c^A + D_c^B = 1$, $D_m^A = 1$ and $D_m^B = 1$, many mathematical constraints!
- Our solution: merchants are assumed homogeneous: $B_m = R_m = 0$
- One boundary solution where card networks share the consumer side: $B_c^k + R_c^k > 0$ for all consumers

Findings (1)

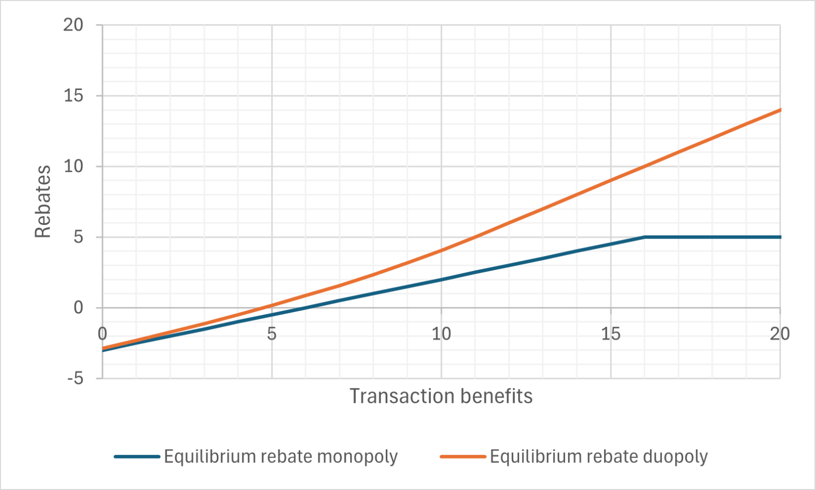


Figure set for: $\omega_c = (B_c^A, B_c^B)$ independently uniformly distributed $[-5, 5]$ on both card networks (or a single card network), $C_c^A = C_c^B = 1$, and $C_m^A = C_m^B = 0$

Findings (2)

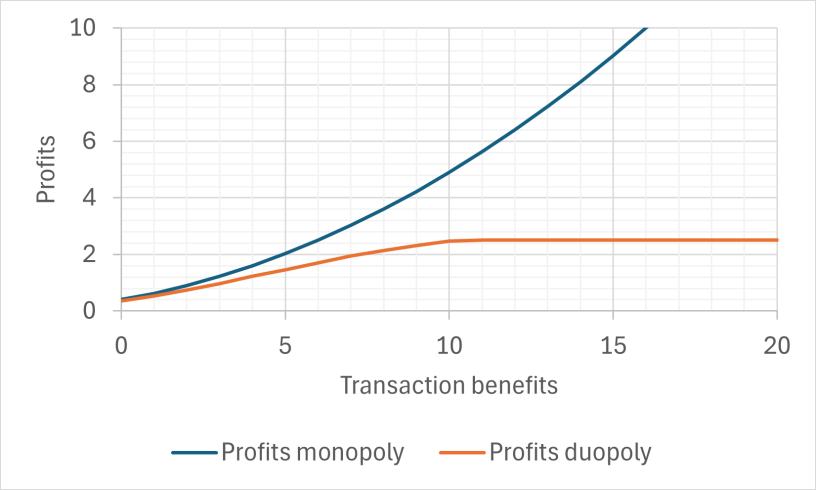


Figure set for: $\omega_c = (B_c^A, B_c^B)$ independently uniformly distributed $[-5, 5]$ on both card networks (or a single card network), $C_c^A = C_c^B = 1$, and $C_m^A = C_m^B = 0$

Discussion

- Homogeneous transaction benefits
- Fixed rebates
- Homogeneous merchants
- Consumer multihoming
- Inelastic demand on the product market
- No Surcharge Rule
- No competition between merchants
- What about market tipping???

Also: market tipping.. “Sneak Preview”

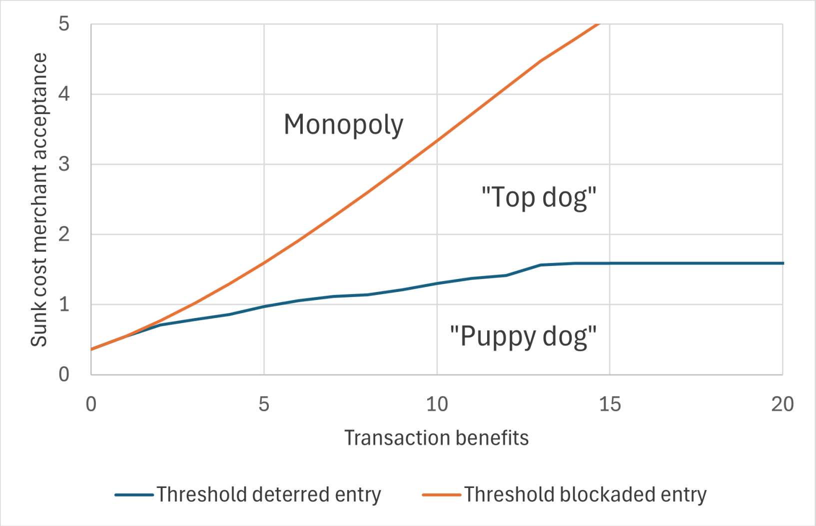


Figure set for: $\omega_c = (B_c^A, B_c^B)$ independently uniformly distributed $[-5, 5]$ on both card networks (or a single card network), $C_c^A = C_c^B = 1$

Conclusion

- New model: difference between card benefits and transaction benefits
- Rebates are important in analysing market power of payment card networks
- Rebates to the side with lowest average card benefit, more heterogeneity and/or more "singlehoming"
- Role of boundary solutions for four-party card networks
- Monopoly profits increase with transaction benefits, while duopoly profits stabilise
- Still many open questions: welfare analysis, market tipping, etc...

Appendix

Equilibrium outcome

- In the interior solution, i.e. $D_c(R_c) < 1$ and $D_m(R_m) < 1$:
  - $R_i^* = (f_i + f_j)n_j^*(R_j) - C_i - \eta_i(R_i)$
- In any of the two asymmetric boundary solutions, i.e. $D_i(R_i) = 1$ and $D_j(R_j) < 1$:
  - side i demand is maximized: $D_i(R_i^{Max}) = 1$.
  - side j: $R_j^* = f_i + f_j - C_j - \eta_j(R_j)$.
- Full market coverage, i.e. $D_c(R_c) = 1$ and $D_m(R_m) = 1$:
  - $D_c(R_c^{Max}) = 1$
  - $D_m(R_m^{Max}) = 1$

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Price elasticity

- Price elasticity of demand:

$$\eta_i(R_i) = -\frac{D_i(R_i)}{\partial D_i(R_i)/\partial R_i} = \frac{R_i}{\epsilon_i(R_i)} = \frac{1 - G_i(R_i)}{g_i(R_i)}$$

where $\epsilon_i(R_i)$ denotes the standard side-i price elasticity of quasi-demand as in R&T(2003).

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Duopoly model: consumer demand functions

Consumer demand for card network k is given by:

$$n_c^k = D_c^k(R_c^k, R_c^l) = Pr\{\omega_c \in \Omega_c : \; B_c^k \geq B_c^l - R_c^k + R_c^l \wedge B_c^k \geq -R_c^k\} = \int_{-R_c^k}^{\infty} \int_{-\infty}^{B_c^k + R_c^k - R_c^l} g_c(B_c^k, B_c^l) \, dB_c^l \, dB_c^k, \quad k \neq l, \quad k, l = A, B \tag{4}$$

and corresponding "residual card" demand n_c^l, where g_c is the joint probability density function of consumer card values over card networks A and B.

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Duopoly model: Cash demand function

Total cash use is given by:

$$n_c^C = 1 - n_c^A - n_c^B = Pr\{\omega_c \in \Omega_c : \; B_c^k \leq -R_c^k \wedge B_c^l \leq -R_c^l\}$$
$$\int_{-\infty}^{-R_c^A} \int_{-\infty}^{-R_c^B} g_c(B_c^A, B_c^B)\, dB_c^B\, dB_c^A \tag{5}$$

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Duopoly model: merchant demand function

Merchant demand for card network k is simply given by:

$$
\begin{aligned}
n_m^k &= D_m(R_m^k) = Pr\{\omega_m \in \Omega_m : \; B_m^k \geq -R_m^k\} \\
&= 1 - \int_{-\infty}^{-R_m^k} g_m(B_m^k)\, dB_m^k = 1 - G_m(-R_m^k), \quad k = A, B.
\end{aligned} \tag{6}
$$

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Duopoly Profit

- Card network's profits is specified by:

$$\Pi^k = (f_c^k D_m^k(R_m^k) - R_c^k - C_c^k) D_c^k(R_c^A, R_c^B) + (f_m D_c^k(R_c^A, R_c^B) - R_m^k - C_m^k) D_m^k(R_m^k) \quad (7)$$

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Equilibrium outcome duopoly (interior solution)

FOC consumer side:

$$R_c^k = (f_c^k + f_m^k) n_m^{k*}(R_m^k) - C_c^k - \mu_c^k(R_c^A, R_c^B), \tag{8}$$

where

$$\mu_c^k(R_c^A, R_c^B) = -\frac{D_c^k(R_c^A, R_c^B)}{\partial D_c^k(R_c^A, R_c^B))/\partial R_c^k} = \frac{1 - G_i(R_c^A, R_c^B)}{g_i(R_c^A, R_c^B)}$$

FOC merchant side:

$$R_m^k = (f_c^k + f_m^k) n_c^{k*}(R_c^A, R_c^B) - C_m^k - \eta_m^k(R_m^k), \tag{9}$$

where

$$\eta_m^k(R_m) = -\frac{D_m^k(R_m^k)}{\partial D_m^k(R_m^k)/\partial R_m^k} = \frac{1 - G_m(R_m^k)}{g_m(R_m^k)}$$

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