Contractual Data and Market Power

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Motivation

Work in progress!!...Comments valuable!

- Rise in online and digital economic transactions has led to a growing literature on the economics of data.
- A gap in the literature on the economics of data, a lot of control of consumer data, little on business to business data exchange (wholesale data exchange)

Research Issues

- Explore how the institutional and technical arrangements for data control impact level of competition, efficiency, pricing and market power
- Our focus is on contractual data as an input to production
- Explore the extent to which business should be competing in the provision of data-based services and collaborating on data standards

Contractual Data

- What are these contract based outputs that can be impacted by arrangements for data control?
- They are any form of economic output (where the consumers could be businesses or households) that depend on first creating agreements (contracts), whether for exchange of assets or for supply of goods or services, and then on co-operative fulfillment of those contracts by two or more firms.
- Examples of such contract-based outputs include: retail and wholesale payments (including card and bank payments, both domestically and internationally); securities trading and settlement; trade finance; logistics; construction supply chains; property ownership registration and transfer; and flight bookings
- The common feature is that ownership and contractual obligations are or can be represented in shared databases which are then used as input to production by the providers of the required goods and services.

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Technical innovation

- A novel model of vertical separation: upstream market for data control; downstream market for consumer goods/ services.
- Upstream market for data control, switching / connection costs, to reflect the nature of data operations with low variable costs of automated processing, but large fixed costs;
- Downstream Salop circle or ‘circular city’
- A baseline model and variations to capture different arrangements for ownership and governance of the data validators in the upstream market

Key findings

- Upstream competition generally leads to a fairly good outcome, if switching/ connection costs are low
- Upstream for profit monopoly – bad – results in downstream monopoly
- Upstream monopoly operated in general interest better, supports downstream competition (but not efficient pricing).
- Upstream monopoly owned by a subset of downstream firms, can substantially reduce competition (and may ultimately lead to monopoly)-proof yet to be formalized, LOL

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Literature

- Economics of Data: The issues addressed in this literature have included: property rights (Posner and Weyl 2019, Jones and Tonetti 2020, Acemoglu et al. 2019); privacy (Varian 2018, Acemoglu et al. 2019) and market failure (OECD 2016, Morton-Scott et al. 2019, Farboodi et al. 2019, Veldkamp and Chung 2019, Acemoglu et al. 2019, Jones and Tonetti 2020).
- Industrial Organisation: In developing our modelling approach, we build on research on utilities regulation (Armstrong and Sappington 2006, Armstrong, Cowan, and Vickers 1994), switching costs (Klemperer 1987a, Klemperer 1987b, Klemperer 1995 and Farrell and Klemperer 2007) and the 'circular city' spatial model of product differentiation formalised by Salop (Salop 1979).
- Other work on vertical integration also addresses imperfect competition in upstream and downstream markets Buehler and Schmutzler (2008), Reisinger and Schnitzer (2012) and Ordover, Saloner, and Salop (1990).

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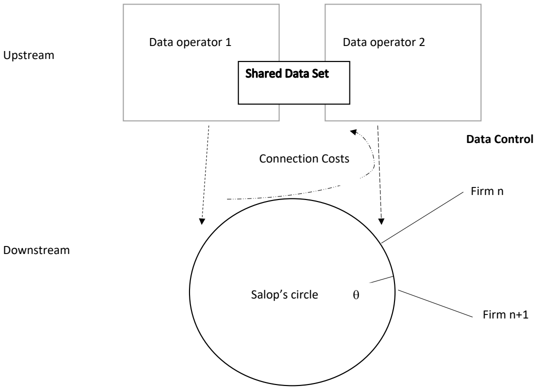
Data Control



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Economic Environment (1)

- data validators indexed by $j = [1, 2 \cdots J]$, compete in the upstream market; and N firms , indexed by $n = [1 \cdots N]$. Multiple data validators, profit maximizers
- Initially, before decisions on entry or exit are made, there are N_0 downstream firms connected to these data validators and an unlimited fringe of potentially new firms who can pay connection costs of S to connect to an existing operator.
- Firms can also switch data validators, paying the same cost S as a switching cost to move from their current operator to a new operator.

Economic Environment (2)

- Downstream firms have identical costs and so locate themselves at equidistantly around the circle. Firm n is located on this circle at position $\theta_n \in [0,1]$ given by:

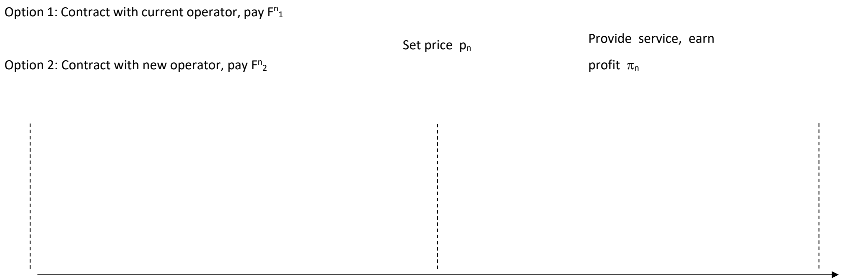
$$\theta_n = \frac{n-1}{N}$$

- Transport costs, paid by the consumers for purchasing from a firm n located at θ_n, depend on a parameter t and are a linear function of the distance moving around the diameter of the circle between the location of the consumer and the location of the firm $\theta - \frac{n-1}{N}$. The consumers purchase one unit from their preferred firm n at a price P_n. So total costs, price and transport, for purchase from n are given by

$$c(\theta) = P_n + t|\theta - \frac{n-1}{N}|$$

Timeline

Decisions on (i) on whether to enter the market (if they are initially outside) or exit the market (if they are initially inside), (ii) if they enter or stay in the market, which data operator they will then use for data control; and (iii) their location on the Salop circle characterising the downstream market and the price they charge to consumers.



Market Solution (1)

Fee charged for services by a data operator to an already connected downstream firm (in the case data operator $j = 1$ this to firms $n \leq \tilde{n}$, but the ordering is not material) be F^n and the fee charged to a new previously unconnected firm be $\bar{F}^n$ In equilibrium the following holds:

$$F^n = S$$
$$\bar{F}^n = 0$$

All downstream firms charge the same price (p) and earn the same profit (π) given by:

$$P = \frac{t}{N}$$
$$\pi = \frac{t}{N^2} - S$$

Market Solution (2)

With free entry and exit N is a function of t and S, the largest integer such that:

$$N \leq \sqrt{\frac{t}{S}}$$

and so can be expressed as

$$N\left(\frac{t}{S}\right) = \sup\left\{z \in \mathbb{Z} : z \leq \sqrt{\frac{t}{S}}\right\}$$

Social Planner Solution

In the model of this section the social welfare, the sum of consumer and producer surplus, is given by:

$$\Omega(N) = -S\max(0, N - N_0) - \frac{t}{4N}$$

. Socially optimal number of firms is an integer N^*, that depends upon N_0, t and S. Let $\hat{N} = \frac{1}{2}\sqrt{\frac{t}{S}}$ and $\tilde{N}$ be the largest integer such that $\tilde{N} \leq \hat{N}$ and so can be expressed as

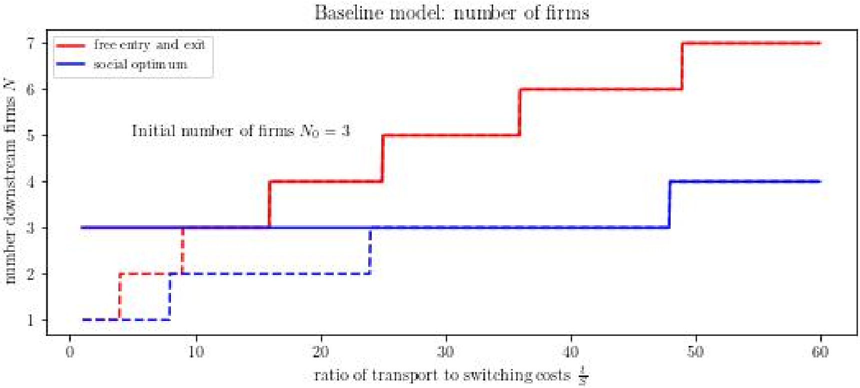
$$\tilde{N}\left(\frac{t}{S}\right) = \sup\left\{z \in \mathbb{Z} : z \leq \frac{1}{2}\sqrt{\frac{t}{S}}\right\}$$

.

and N^* is given by:

$$N^* = \begin{cases} N_0 & \text{if}\, N_0 \geq \hat{N} \\ \tilde{N} & \text{if}\, N_0 < \hat{N} \,\text{and}\, \tilde{N} \geq \frac{1}{2}\left(-1 + \sqrt{1 + \hat{N}^2}\right) \\ \tilde{N} + 1 & \text{otherwise} \end{cases}$$

Baseline



Baseline model: number of firms
free entry and exit
social optimum
Initial number of firms $N_0 = 3$
number downstream firms N
ratio of transport to switching costs $\frac{t}{s}$
0
10
20
30
40
50
60
1
2
3
4
5
6
7

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Price Elasticity of Demand (PED)

The price elasticity of demand is a function of P and can be expressed as:

$$\epsilon(P) = \frac{Q^{'}(P)P}{Q} = -q^{'}(p) \geq 0 \tag{1}$$

Assumption $\epsilon'(P) < 1$ and there level of price $P = \tilde{P}$ for which $\epsilon(\tilde{P}) = 1$ with $\epsilon(P) > 1 \iff P \leq \tilde{P}$. The role of this additional assumption is to ensure the existence of a unique equilibrium.

Social Planner Solution (PED)

The socially optimal price under the assumptions of this section is $P = P^* = 0$ (implying $p = p^* = -\infty$). While the socially optimal number of firms is given by N^* as stated above. This yields a total social surplus, the sum of consumer and producer surplus, of:

$$\Omega(N^*) = \int_{\Phi=0}^{1} Q(\Phi)\mathrm{d}\Phi - S \max\{N^* - N_0, 0\} - \frac{t}{4{N^*}^2}$$

Market Solution (PED) (1)

We now consider the market solution with elastic demand, employing the further monotonicelasticity our baseline results are changed:
N, a function of t, S, $\tilde{P}$, is the largest integer such that:

$$N \leq \sqrt{\frac{t}{S}(1-\epsilon(\tilde{P}))Q(\tilde{P})}$$

and so can be expressed as

$$N\left(\frac{t}{S}\right) = \sup\left\{z \in \mathbb{Z} : z \leq \sqrt{\frac{t}{S}(1-\epsilon(\tilde{P}))Q(\tilde{P})}\right\}$$

from which can be obtained the downstream price:
the downstream price P is the solution (implicit for $N \geq 2$) of:

$$P = \begin{cases} \frac{t}{N} 1-\epsilon(P) < \tilde{P} & \text{if } N \geq 2 \\ \tilde{P} & \text{otherwise} \end{cases}$$

and downstream profit:
downstream profit π is given by:

Market Solution (PED) (2)

from which can be obtained the downstream price. The downstream price P is the solution (implicit for $N \geq 2$) of:

$$P = \begin{cases} \frac{t}{N} 1 - \epsilon(P) < \tilde{P} & \text{if } N > 1 \\ \tilde{P} & \text{otherwise} \end{cases}$$

Downstream profit π is given by:

$$\pi = \begin{cases} \frac{t}{N} \frac{(1-\epsilon(P))Q(P)}{N} - S < \tilde{P}Q(\tilde{P}) - S & \text{if } N > 1 \\ \tilde{P}Q(\tilde{P}) - S & \text{otherwise} \end{cases}$$

Profit Making Monopoly Upstream

Suppose that the upstream data control is provided by profit-maximising monopoly data operator, and that the elasticity of demand is characterised by Assumption monotonicelasticity, then the outcome is

- Only one firm remains in the downstream market i.e., $N = 1$
- The downstream price is the monopoly price of Assumption monotonicelasticity, $P = \tilde{P}$
- The profit of the one downstream firm is $\pi = 0$
- the service fee F for the one remaining firm equals its revenue less connection charge, and so depends on the number of firms N_0 initially connected:

$$F = \begin{cases} \tilde{P}Q(\tilde{P}) & \text{if } N_0 \geq 1 \\ \tilde{P}Q(\tilde{P}) - S & \text{if } N_0 = 0 \end{cases}$$

The upstream monopolist is able to extracts all revenue, less any connection charge, from the downstream firms; and total revenue less any connection charge is maximised when there is also a downstream monopoly.

Downstream Owns One Upstream firm

- Let data operator 1 in the upstream market be a subsidiary of firm 1 in downstream market, if data operator 2 does not compete downstream the equilibrium conditions are unchanged.

The proposition can be best understood by a simple explanation. If there is no competition by the data operator in the downstream market firms can still enter and establish relationships with data operator 2.

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Finance

- Domestic retail payment (In bank retail payments the 'data operator' is a domestic payment scheme In US ACH network, the EU SEPA schemes, the UK BACS and Faster Payments. Key functions include arranging for settlement between participating payment institutions and co-ordination of operations, including agreement and adoption of the technical standards employed in payments)
- IO of international payments
- Securities clearing and settlement (the transfer of ownership in security accounts, is conducted by custodian banks on behalf asset managers and other investment intermediaries. Here the data validators are the custodian banks)
- Property ownership registration and ownership transfer (data control provided by local/national government)

Non Finance Related

- Passenger flight bookings (requires co-operation between airlines to deliver complete journey provided by multiple providers. The required data control is access to a global distribution systems (GDS) with three leading global competitors Amadeus, Sabre and Travelport)
- Supply chain logistics/international logistics (most data record systems in logistics are established on a proprietary basis. A downstream firm e.g. manufacturer, establishes contracts with individual firms in its supply chain with its own proprietary systems for monitoring the quality and timeliness of delivered goods and for invoice payments)
- Construction/manufacuturing supply chains (but requires extension due to fragmentation)
- BigTech e.g. e-commercie platforms (e.g Amazon, Alibaba)

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Key Takeaways

GOVERNANCE CRITICAL

- Data Standardisation key to reducing market power
- A for- profit monopoly can restrict entry (with elastic demand)
- A non-profit monopoly owned by firms, can restrict entry, but regulation/ independent ownership can improve welfare