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Understanding the economics of information sharing

Digital Economy Unit

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Creating Opportunities

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Key messages

The economics of information sharing

- Information is defined as what could be infer by data, and so the latter could be valuable (informative) or not (non-informative, noise).
- Conditional to context, information-sharing within markets can be welfare improver or welfare reducer, while can also show pro-competitive or anti-competitive features.
- Overall, expected effects in efficiency and competition will depend on the nature of competition and the type of uncertainty.
- In dynamic settings, information-sharing could facilitate collusion. Antitrust policy is aware and takes both soft and hard evidence to assess effects of data-sharing agreements among rival firms.
- Digital platforms could challenge conventional wisdom regarding competition effects of information-sharing, especially when trying to foster competition “for” the market and innovation efforts…
- …but privacy and data security costs need to be weighted when dealing with individuals personal data.
- Knowledge from the economics of information-sharing remains suitable to understand effects on competition “in” the market, but artificial intelligence and colluding algorithms rise further challenges to antitrust policy.

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01

Motivation

Motivation

Changes in the regulatory landscape

Two **bodies of regulation** already in place for **data protection** and **data sharing:**

01

GDPR and California Consumer Privacy Act (CCPA) aimed to protect personal data subjects (individuals) and how to comply with it by data controllers (firms)

02

PSD2 grants access to potential rivals -or alternative suppliers- of costumer transactional data and account information, with the aim to foster competition in some layers of financial services (payments)

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02

On the (private) value of information

On the value of information

A simple way to understand the value of data

Examples: loan **applicants screening,** a worker **searching for the most suitable employer,** going to the streets **with or without umbrella**

- Assume that information set $\boldsymbol{\Omega}$ is of common knowledge and we need to make a choice over uncertain prospects $\boldsymbol{a}$ and $\boldsymbol{b}$
- Information set $\boldsymbol{\Omega}$ are public odds for different states of nature and the preference of $\boldsymbol{a}$ over $\boldsymbol{b}$ implies that expected payoff from $\boldsymbol{a}$ is higher $\Leftrightarrow$ $U(a \mid \boldsymbol{\Omega}) \geq U(b \mid \boldsymbol{\Omega})^{\dagger}$
- Let's assume there is another –larger- set of verifiable information $\boldsymbol{\Omega'}$, privately known

† Bounded rationality and behavioral discipline show us that the way $\boldsymbol{\Omega}$ and options are presented, ordered and processed can modify preferences over options. We do not considering any sort of cognitive biases or environment-dependent preferences (internalities). For example, paradoxes of expected utility theory shown by Allais (1953), Ellsberg (1961) and others (Camerer, et. al 2002)

On the value of information

A simple way to understand the value of data

- The value of $\boldsymbol{\Omega'}$ is zero if our choice does not change, given this new information set. So, if $U(a \mid \boldsymbol{\Omega'}) \geq U(b \mid \boldsymbol{\Omega'})$ then $\boldsymbol{\Omega'}$ is non-informational or a noisy data set

- Alternatively, if our choice changes from $\boldsymbol{a}$ to $\boldsymbol{b}$, so that $U(a \mid \boldsymbol{\Omega'}) \leq U(b \mid \boldsymbol{\Omega'})$, implies $\boldsymbol{\Omega'}$ have valuable data

- We can define the private value of information as $U(b \mid \boldsymbol{\Omega'}) - U(a \mid \boldsymbol{\Omega})$, if generating or acquiring $\boldsymbol{\Omega'}$ do not entail costs

The private value of information can be understood as the benefits of making better choices

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03

A basic framework to asses effects of information sharing

Market competition, expected welfare and welfare distribution

A basic framework

Information sharing within imperfect markets

What are the **competition and welfare effects when firms share information** about cost or demand?

Overall effects in efficiency and competition will depend on:

A The nature of competition

- **Strategic substitutes** (usually Cournot): Marginal profitability of a firm's action is decreasing in the action of rivals
- **Strategic complements** (usually Bertrand): Marginal profitability of a firm's action is increasing in the action of rivals

B The type of uncertainty

- **Aggregate** (common value)
- **Firm specific** (private value)

A basic framework

Static competition with asymmetric information

- There are two firms i that compete simultaneously in a product market $Q = \sum_{i=1}^{2} q_i$, both with symmetric technology and cost function $C(q_i) = cq_i$

- Uncertainty over linear demand $P = \theta - \left(\frac{b}{2}\right) Q$. Two possible types for θ, high (θ^H) or low (θ^L) valuations, with probability distribution of (p^H, p^L). Information structure is of common knowledge

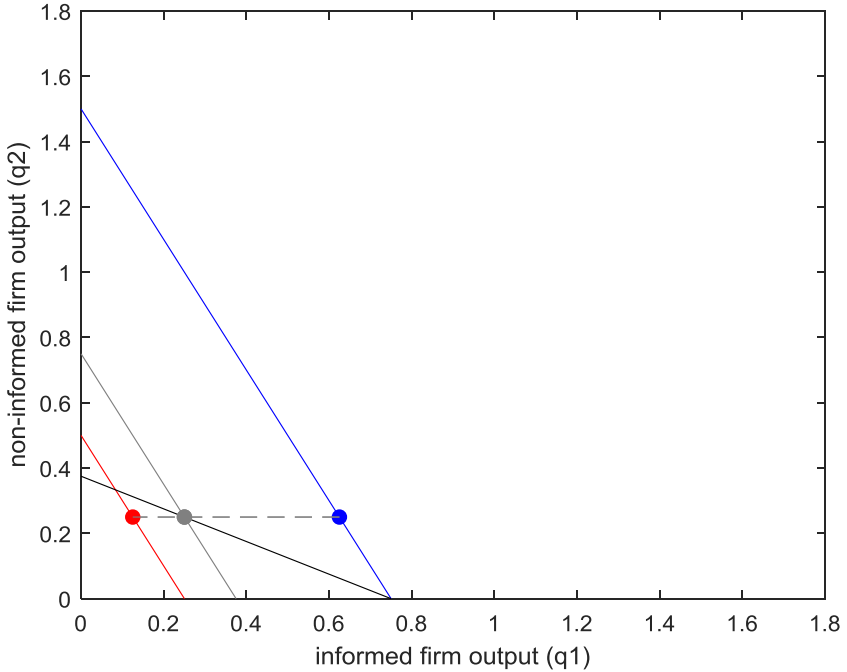
- Nature reveals type (θ^H/θ^L) to only one firm who privately knows demand characteristics in every state of nature

- Both firms chooses output strategy that maximize expected profits given its conjecture over rivals output strategy (Cournot Bayesian Nash Equilibrium)

A basic framework

Only one informed firm

FIRM STRATEGY SPACE



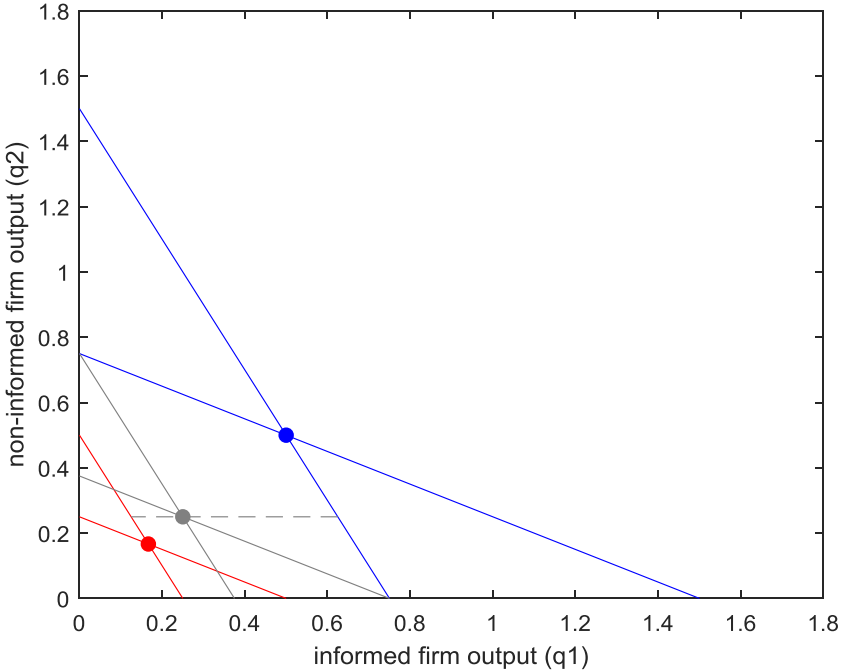
Asymmetric information equilibrium

- Blue(red) straight line is the best response of the informed firm in high(low) demand
- Black straight line is the best response of the non-informed firm …
- …who expects the grey line is the best response of the informed firm (conjecture)
- The dots over the dashed grey line characterize the equilibrium
- Figure assumptions

$$c = 0.5; b = 2; \theta = (2,1); p^H = 0.25$$

A basic framework
Both firms fully informed

FIRM STRATEGY SPACE



Symmetric information equilibrium

- Blue(red) straight lines are the best responses of firms in high(low) demand
- Blue and red dots characterize the equilibrium outputs at every state of nature; grey dot shows the expected supply of firms
- Figure assumptions

$$c = 0.5; b = 2; \theta = (2,1); p^H = 0.25$$

A basic framework

Competition effects of information sharing

Expected output and prices are the same, although with lower(higher) variance in prices(output)

IF ONLY ONE FIRM IS INFORMED

$Assumptions$: $c = 0.5; b = 2; \theta = (2,1); p^H = 0.25$

Demand type	Firm output		Market outcome		Firm profits		Welfare	
θ	q_1	q_2	Q	P	π_1	π_2	CS	W
High (θ^H)	0.625	0.250	**0.875**	**1.125**	0.391	0.156	0.383	0.930
Low (θ^L)	0.125	0.250	**0.375**	**0.625**	0.016	0.031	0.070	0.117
Expected	0.250	0.250	0.500	0.750	**0.109**	**0.063**	**0.148**	**0.320**

IF BOTH FIRMS ARE FULLY INFORMED

$Assumptions$: $c = 0.5; b = 2; \theta = (2,1); p^H = 0.25$

Demand type	Firm output		Market outcome		Firm profits		Welfare	
θ	q_1	q_2	Q	P	π_1	π_2	CS	W
High (θ^H)	0.500	0.500	**1.000**	**1.000**	0.250	0.250	0.500	1.000
Low (θ^L)	0.167	0.167	**0.333**	**0.667**	0.028	0.028	0.056	0.111
Expected	0.250	0.250	0.500	0.750	**0.083**	**0.083**	**0.167**	**0.333**

When information is asymmetric, there is less(more) intense competition in high(low) demand states, relative to the case when both firms are fully informed

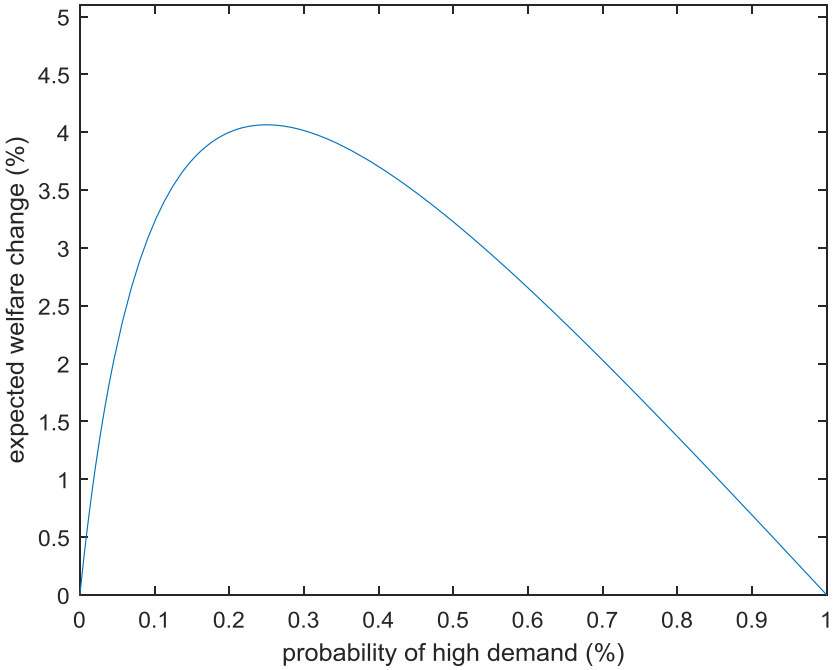
A basic framework

Welfare effects of information sharing

OVERALL WELFARE CHANGE

(%)

$Assumptions$: $c = 0.5; b = 2; \theta = (2,1)$



Why expected welfare is higher in Cournot?

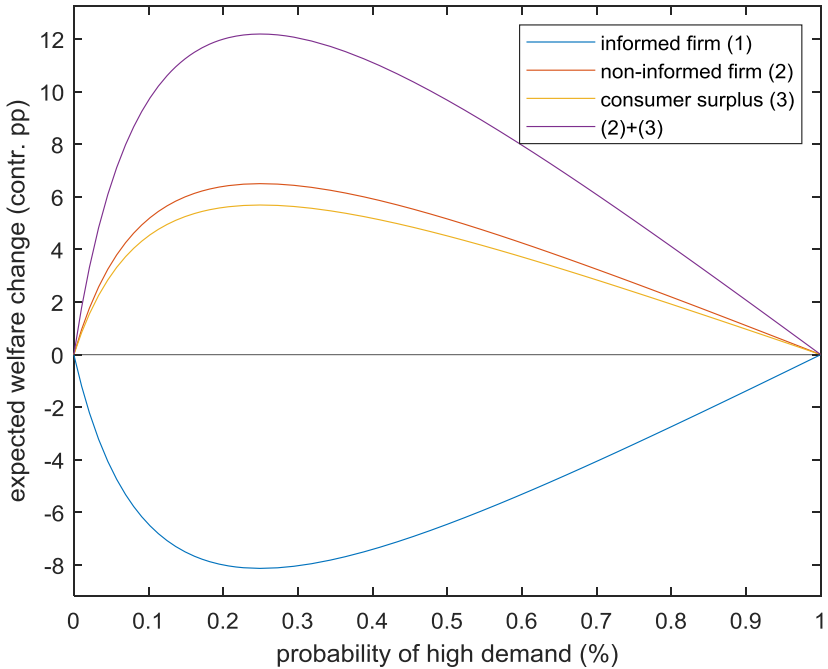
- There is a misallocation problem (allocative inefficiency of output across firms and state of nature)
- Output adjustments are distorted. The non-informed firm produce too little(much) in high(low) states of demand, relative to both informed rival and the full information case
- Welfare gains from sharing information are strictly positive, for any probability distribution of states…
- …and even higher when the asymmetry is too high that the informed firm do not supply in low demand (in a corner solution)

A basic framework

Welfare distribution effects of information sharing

DISTRIBUTION OF WELFARE CHANGES
(CONTR. PP)

$Assumptions$: $c = 0.5; b = 2; \theta = (2,1)$



Disentangling welfare effects

- The informational advantage allows the favored firm to exploit “informational rents” at the expenses of both non-informed firm and consumers welfare
- If demand information (at every state of nature) where fully disclosed to all firms, both non-informed firm and consumers would be better-off
- Nonetheless, the favored firm loses out the informational rent and is worse-off

A basic framework

Can we generalize the effects from different competition settings?

Information sharing, **expected competition and welfare:** A resume

TYPE OF UNCERTAINTY		THE NATURE OF COMPETITION			
		Strategic substitutes (Cournot)		**Strategic complements** (Bertrand)	
		Consumer surplus	Social welfare	Consumer surplus	Social welfare
Aggregate (common value)	Cost	POSITIVE	POSITIVE	?	POSITIVE
	Demand	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE (poor subs or lots of firms)
Firm specific (private value)	Cost	NEGATIVE (with few firms)	POSITIVE	NEGATIVE (with few firms)	NEGATIVE
	Demand	NEGATIVE (with few firms)	POSITIVE	NEGATIVE	NEGATIVE (monopolistic competition)

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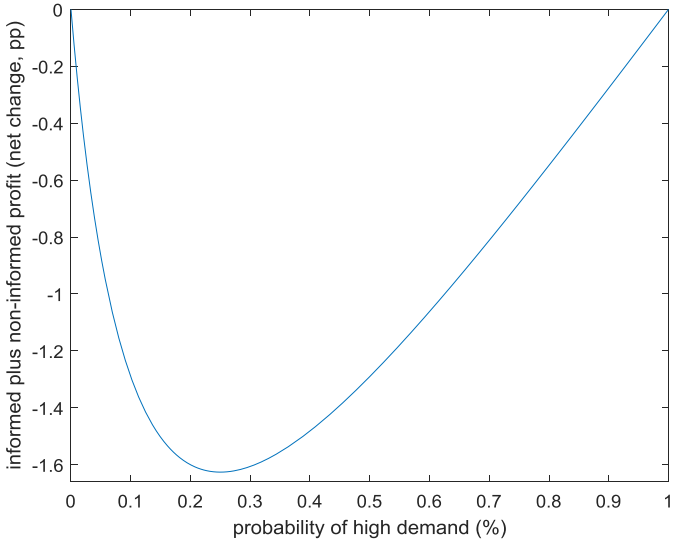
Unilateral incentives to share information

Unilateral incentives to share information

Incentives to disclose information to rivals

NET CHANGES IN FIRMS PROFITS
(CONTR. PP)

$Assumptions$: $c = 0.5; b = 2; \theta = (2,1)$



- In this Cournot setting, not sharing is a dominant strategy for the informed firm
- Profit losses for the informed firm cannot be fully offset by any feasible monetary transfer coming from the non-informed rival who leaves both firms better-off
- There is an incentive to demand but not to supply information. Profit gains of the non-informed firm falls short for information exchange to materialize
- Policy prescription: arguments for government intervention to force information sharing

Can we generalize a sort of market failure in information markets?

Unilateral incentives to share information

Firms unilaterally share verifiable information if it is profitable

Incentives will depended on **the nature of competition and type uncertainty**

TYPE OF UNCERTAINTY		THE NATURE OF COMPETITION: Strategic substitutes (Cournot)	THE NATURE OF COMPETITION: Strategic complements (Bertrand)
Aggregate (common value)	Cost	NO	?
	Demand	NO	YES
Firm specific (private value)	Cost	YES	NO (with few firms)
	Demand	YES	YES

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Competition policy and information sharing

Theory and practice

Competition policy and information sharing
Theory and practice

Antitrust theory

- In dynamic settings, information sharing can facilitate collusion
- A mechanism that helps to coordinate and monitor a non-competitive agreement
- Especially with few or patient players which communicate disaggregated firm level data

Antitrust practice

- *"Parallelism plus"* doctrine: both market (soft) and facilitating practices (hard) evidence that demonstrate collusion
- Communication of future actions through signals are not verifiable and mostly cheap talk
- Exemptions for efficiency gains but with proof burden on firms [Art. 81(3)]

Antitrust jurisprudence

- Airline Tariff Publishing: private price announcement discontinued, (DOJ 2004)
- Wood pulp: public price announcement, commitment value to consumers even with parallel pricing (ECJ 1993)
- UK Tractor [Art. 81(1)]: bidding ring by sharing detailed information of auctions (ECJ 1992,1994)
- Unilever and Henkel/Oleofina [Art. 81(1)]: firm's detailed data exchange agreement (ECJ 1986)

Competition policy and information sharing

Collusive potential of information exchange and desirable stance

High risk

Future actions (privately shared)

Firm level price/output data

Hard stance

Medium risk

Firm level demand data

Firm level cost data

Soft stance

Low risk

Aggregate market data

No concerns

Competition policy and information sharing

With no collusion fears or evidence of unconcentrated markets

LAX

on data sharing

if Cournot competition

HARD

on data sharing

if Bertrand competition

Authorities need to assess competition characteristics of the market (price or quantity) to allow (encourage or force) data sharing or not (forbid)

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General conclusions

General conclusions

What do we know about information sharing?

- An elusive topic and hard to grasp unambiguously in a unique framework. Collusion risks (tacit or not) and market dynamics make things more difficult in theory and practice (Asker, et. al 2016)
- Information sharing in Cournot competition tends to be welfare enhancer, but no unilateral incentives to share for the firm with informational advantages. A validation for PSD2 in banking and potentially in other sectors?
- Information sharing in Bertrand competition tends to be welfare reducing, while firms tend to have unilateral incentives to share data –Ex: auction markets
- Competition policy is aware, but *parallelism plus doctrine* sets the bar high to effectively pin-down false-negative informational agreements
- Could data-share agreements per-se be a presumption of Bertrand competition and bad for welfare? Yes, but not in practice: hard evidence and efficiency exemption
- Competition policy should be hard on private agreements of firm's detailed data sharing and of non-public future plan/price announcements. Alternative POV: price vs non-price information

General conclusions
Changing paradigms

Platforms

- Can be thought as price type of competition? Yes, most two-sided market models assume that
- We show that detailed data sharing (of proxies to individual's valuations) could be bad for welfare in some settings
- AI algorithms and collusion risks (Calvano E., et al 2018)
- How to face challenges of competition "in" and "for" the market?

Data interoperability

- Reproduction of consumers data footprint into rivals platform could allow higher competition "for" the market (and of innovation efforts)…
- …but could carry-on sins of competition "in" the market from a dominant incumbent
- Again, AI algorithms and collusion risks
- No convincing evidence that data portability facilitates market entry (Lam and Liu, 2018)
- Privacy concerns despite consumer consent (opt-in) regime

Antitrust guidelines and law

- Review presumption proof for dominance, merge control and damage theory (Soto, BBVA Research, 2019)
- Complete review of price discrimination stance
- List prices likely non-informative due to personal rebates. Evidence of uniform price setting (Cavallo, 2017)
- Hard on exclusionary and exclusivity contracts with suppliers
- Not all is antitrust: rules and user rights for non-personal data (common ownership in B2B data)

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