« Forthcoming, American Economic Review and Les Prix Nobel »

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Market Failures and Public Policy

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I. Introduction

Economists have long extolled the virtues of markets. Unfettered competition protects consumers from the political influence of lobbies, and forces producers to deliver products and services at cost. Alas, competition is rarely perfect, markets fail, and market power -the firms' ability to raise price substantially above cost or to offer low quality[2]- must be kept in check.

Industrial organization studies the exercise and control of market power. To this purpose, it builds models that capture the essence of the situation. The predictions of the model can then be tested econometrically and possibly in the lab or the field. In the end, the reasonableness of, and robustness to modelling assumptions and the quality of empirical fit determine how confident economists are in making recommendations to public decision-makers for intervention, and to companies for the design of their business model.

Industrial organization has a long tradition: first theoretical, with the work of French "engineer-economists" Antoine Augustin Cournot (1838) and Jules Dupuit (1844); then policy-oriented with the enactment of the Sherman Act (1890) and subsequent legislation; then descriptive with the studies of the Harvard school ("Structure-Conduct-Performance") comforting and refining the antitrust drive; and finally sceptical with the Chicago school. The Chicago school correctly pointed out the lack of underlying theoretical doctrine and went on to cast doubt on the whole edifice. It however did not develop an alternative antitrust doctrine, perhaps because it was broadly suspicious of regulation.

[1] This lecture is dedicated to the memory of Jean-Jacques Laffont. It is of course unlike any lecture I had ever given. It is filled with emotion, intellectual indebtedness and very fond memories.
The lecture is also very unfair to the community of researchers who have developed industrial organization economics in its modern form. The lecture indeed is in no way a survey, even on its very limited subset of topics, and does not attempt to recognize contributions. Its purpose rather is to use examples drawn from my own research to illustrate the approach and use of theoretical industrial organization. This should however not obscure the fact that modern industrial organization is the outcome of a collective undertaking by a (still vibrant) community of talented researchers.

[2] Industrial organization economists have studied a variety of other market failures, involving information problems and a range of externalities (such as environmental damages or banking failures) which arise even in the absence of market power; small banks (such as the Cajas and the Landesbanken recently in Europe) often fail, leaving the slack for the deposit insurance fund/taxpayer to pay, and firms without market power often pollute. This lecture will focus on market power, which limits the diffusion of a product, service or technology to downstream firms and end-users.

By the late seventies and early eighties, the antitrust and regulation doctrine was in shambles and had to be rebuilt. The modern intellectual corpus that then emerged has been very much a collective effort, involving not only me, but also my closest collaborators on the topic[3] and the many scholars whose own work and discussions with me have deeply influenced my thinking. My being under the spotlight owes more to their contribution than to my own talent. But I claim credit for having been in the right places at the right times and in having learnt from fabulous colleagues and students, in the area for which the prize was awarded and in other fields as well.

With sometimes a bit of luck, as when my MIT fellow classmate, and like me Eric Maskin advisee, Drew Fudenberg told me about an interesting field (I actually did not know what “industrial organization” meant…). Having already taken my generals, I then sat in fascinating lectures given by Paul Joskow and Dick Schmalensee, and started fruitful collaboration with Drew.

A stroke of good fortune indeed, as the required tools, game theory and information economics, were witnessing a series of breakthroughs.

On the policy front, there was widespread recognition that old-style public utility regulation, which by and large insured public utilities against poor cost performance, led to inflated cost and poor customer satisfaction, and so reforms were called for.

To crown it all, institutional change favoured the use of economic reasoning. Where disputes were settled and regulations designed opaquely in the minister’s office, transparent processes run by independent agencies were put in place. For instance, competition authorities and regulatory agencies sprung up in Europe, which used economic reasoning.

This most fortunate conjunction of circumstances led to a new paradigm. As was emphasized in the committee’s scientific background report, this paradigm is rich and complex. First, counting the number of firms or their market shares provides only a rough indication as to whether the market is competitive. Second, industries have their specificities. Competition in IT, payment cards, innovation, railroads or cement is different.

Economists accordingly have advocated a case-by-case or “rule of reason” approach to antitrust, away from rigid “per se” rules (which mechanically either allow or prohibit certain behaviors, ranging from price-fixing agreements to resale price maintenance). The economists’ pragmatic message however comes with a double social responsibility. First, economists must offer a rigorous analysis of how markets work, taking into account both the specificities of particular industries and what regulators do and do not know[4]; this latter

[3] Chronologically, and very unfairly to the many others with whom I have had the chance to interact, Drew Fudenberg, Eric Maskin, Jean-Jacques Laffont, to whose memory this lecture is dedicated, Patrick Rey, Jean-Charles Rochet, Paul Joskow, and Josh Lerner.

[4] They must also account for enforcement costs.

point calls for "information light" policies, that is, policies that do not require information that is unlikely to be available to regulators.

Second, economists must participate in the policy debate. The financial crisis, whose main ingredients could be found in academic journals, is a case in point. But of course, the responsibility here goes both ways. Policymakers and the media must also be willing to listen to economists.

II. Restraining market power to the benefit of consumers

Regulators affect industries in multiple ways:

- Sectoral regulators in telecoms, electricity, railroads or postal services regulate incumbent operators' rate of return and monitor the conditions under which they give rivals access to the bottlenecks that they control.
- Antitrust authorities allow or invalidate horizontal as well as vertical mergers and agreements, and decide whether certain behaviors and contractual covenants constitute an abuse of a dominant position.
- Patent and trademark offices and courts grant, uphold or reject a patent, and determine its scope, its breadth, whether the grantee can seek injunctions and so forth.

Ultimately, these various forms of regulation have in common that regulators face a trade-off between lowering the price for the users, thereby ensuring wider diffusion, and granting a fair return to the firm.

Consider for example the foreclosure doctrine in its modern form[5]. In Figure 1, an upstream firm *U* has a unique access to an "essential facility", "infrastructure" or "bottleneck input", some input that cannot be reproduced or bypassed by others at a low cost: a railroad tracks & stations network, a power transmission grid, a key patent[6]...

[5] The discussion here follows Hart-Tirole (1990) and Rey-Tirole (2007), to which we refer for the "loose ends" left over by this intuitive discussion. See also Segal (1999) for a broader treatment, which covers applications beyond industrial organization.

[6] Antitrust practitioners are often reluctant to call a key patent an "essential facility"; for, an essential facility is usually associated with an obligation to share. I nonetheless include key patents in the essential facility category as it fits the criterion "some input that cannot be reproduced or bypassed by others at a low cost". We will later discuss the obligation to share.

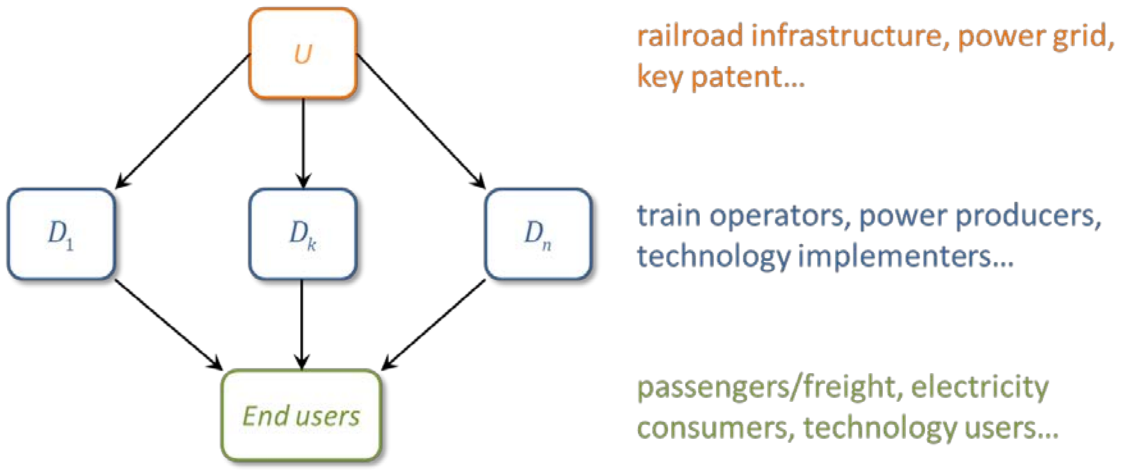

Figure 1

The competition-policy issue is whether the upstream firm should give "equal" or "fair" access to all downstream suppliers (alternative train operators, power producers, technology implementers, $D_1, \ldots, D_n$ in the figure) or whether it should be allowed to "foreclose" access to the bottleneck to all downstream firms but one or a couple of affiliated entities or allies. Such a fair access, so goes the argument, allows downstream firms to compete for the end users on a level playing field. Yet, as we will see, what constitutes "fair access" and "enabling of downstream competition" requires some thinking.

Provided that *bilateral negotiations* between the upstream supplier and individual downstream firms are not precluded, downstream competition dissipates the profit that can be extracted from end-users. To see this intuitively, suppose that downstream competitors sell a homogeneous product with demand curve $Q = D\ (p)$ or $p = P\ (Q)$, that production upstream and downstream is costless, and that downstream firms transform 1 unit of input into 1 unit of output. The question is whether, by controlling the bottleneck, the upstream firm is able to capture the monopoly profit $\pi^m = \max\{Q\,P(Q)\} = Q^m P(Q^m)$, where Q^m and P^m are the monopoly quantity and price respectively.

Let U and D_i negotiate a quantity q_i to be delivered by U and then put on the market by D_i. Suppose that D_i anticipates that the other downstream firms will bring $Q_{-i} = q_1 + \ldots + q_{i-1} + q_{i+1} + \ldots + q_n$ to the market. Then the quantity q_i that maximizes the sum of U and D_i's profits[7] is the best Cournot reaction $R^C(Q_{-i})$ to Q_{-i}:

$$q_i = R^C(Q_{-i}) = \arg\max \{q_i P(q_i + Q_{-i})\}.$$

In this example, the outcome of bilateral, private negotiations is therefore the *Cournot equilibrium* with n firms. The upstream firm behaves opportunistically and does not

[7] This quantity maximizes the "cake" to be divided between the two parties; the sharing of this cake will involve a monetary transfer between them.

internalize the negative externality on other downstream firms when negotiating an increase in supply with downstream firm D_i.

Because the upstream profit is capped by the downstream profit, equal to the Cournot industry profit, fair access jeopardizes the ability of the upstream firm to profit from the essential facility: the upstream bottleneck owner is victim of its inability to commit not to flood the downstream market. The more competitive the downstream industry (the larger *n* is), the more the profit is destroyed and the more eager the upstream firm is to regain its market power (the upstream monopolist makes zero profit in the limit of large *n*, and this even if it enjoys full bargaining power- i.e. appropriates the joint surplus- in bilateral negotiations). The more general message is clear: under unfettered bilateral negotiations, downstream competition erodes the upstream firm's market power.

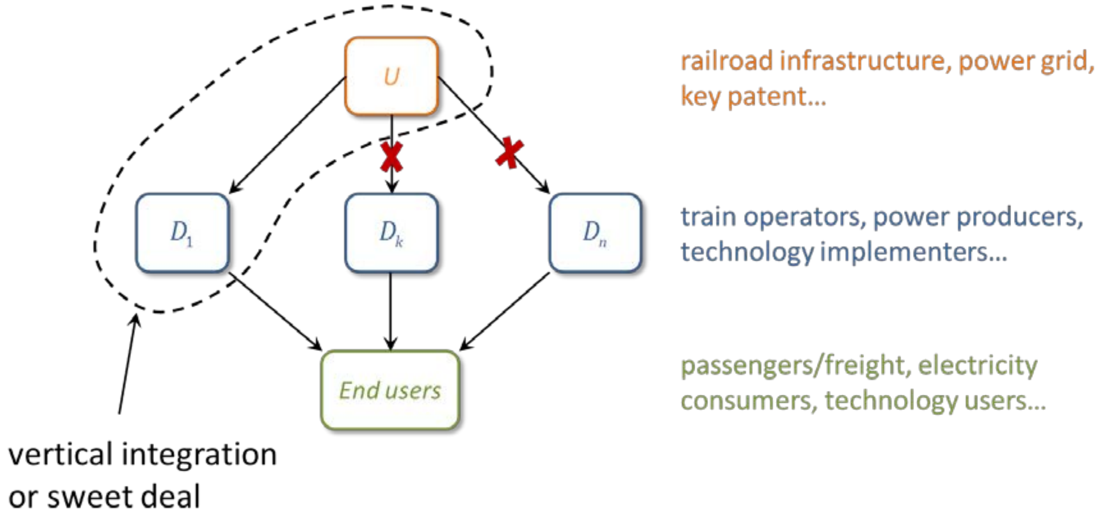

Figure 2

In practice therefore, the upstream firm often favors its downstream subsidiary (D_1 in Figure 2) in a myriad of ways, for example by refusing to deal with rivals or to grant them a license, by charging prohibitive access prices, or by making its technology incompatible with the rivals'. If not vertically integrated, it may enter a "sweet deal" with a downstream firm to the same effect. In short, the upstream firm uses exclusivity to restore its market power. For example, a biotech company with a patent on a new drug will grant exclusive rights for the product approval, production and marketing stage to a single pharmaceutical company, either in-house (Sanofi for Genzyme) or external.

A well-meaning antitrust authority might want to promote competition by requiring that the upstream firm give equal treatment to all downstream firms. This policy requires some transparency in contracting, i.e. all contracts must be made public. The equal access requirement however involuntarily will lead to monopoly pricing! The upstream firm can do so for example by offering Q^m / n against payment π^m / n to all downstream firms. Alternatively, it can offer to give free access to the bottleneck resource to whoever will pay lump-sum payment π^m; at most one downstream firm would accept the deal, as entry by a second firm would destroy downstream profit and not allow it to recoup the lump-sum payment to the bottleneck owner.[8] Thus, "equal treatment" by no means guarantees low prices for the end-users; if anything, it helps the upstream firm to secure its monopoly profit.

Summing up, whether the antitrust authority tolerates such exclusionary behavior or not, de facto regulates the rate of return on the upstream infrastructure. Should the authority clampdown on exclusionary behaviors? The (common sense) answer summarized in Figure 3 hinges on that to the following question: Does the bottleneck result from an investment, an innovation? Or is it associated with political connections, wrong market design or sheer luck? Simply, is there an investment worth of a reward or not? For instance,

- the beneficiary of a highway, harbour or airport concession deserves its monopoly power if the monopoly position was acquired through a competitive, well-designed auction, but not if it was acquired free of charge or through a biased auction design.
- An inventor should be allowed to exploit the innovation himself or grant an exclusive license if the innovation is major, but not if the innovation lacks novelty or is obvious, but nonetheless is protected by intellectual property law.
- A public utility should earn reasonable profit on investment, but not benefit from lucky cost and demand conditions. For example, it should not be able to benefit from a fall in the market price of a key input, while being able to renegotiate the regulatory contract if that price shoots up.

Market power is

	deserved	undeserved
concession	competitive, well-designed auction	unpaid-for legal monopoly
intellectual property	major innovation	obvious, not novel innovation
utility regulation	investment/effort	lucky cost and demand conditions

Figure 3

[8] Still another way of obtaining the monopoly profit is to offer the same following two-part tariff to all downstream firms: $T(q) = A + w\,q$, where w, the wholesale price, satisfies: $n\,q^C(w) = Q^m$, the monopoly quantity, and $q^C(w)$ is the Cournot quantity given unit cost w. The fixed fee A is then set so as to capture the resulting Cournot profit of each downstream firm.
None of the schemes allowing the upstream firm to reap monopoly profit is robust to additional, private contracting: for, there is always money to be made by the upstream firm by contracting for a higher quantity with an individual downstream firm as long as the latter's quantity lies below the Cournot reaction curve (for zero marginal cost) . Thus, to sustain individual quantities below $q^C(0)$, contracts must indeed be public.

The same reasoning underlies much of antitrust doctrine, which, following Schumpeter, does not view monopoly power as illegal, but frowns upon the further acquisition of market power through merger or abuse of dominant position[9].

To be certain, finer information may be needed to assess the substantive merit of market power. Software markets are often dominated at any given point of time by a large firm benefitting from network externalities among users. Such network externalities may result from chance (users have just coordinated on the platform) or may have been created through investment. Similarly, it is often not obvious to tell if a public utility's profit comes from its cost-reducing or demand-expanding effort or sheer luck. This brings me to the issue of regulatory information.

Handling the firm's informational superiority

Regulators face a double asymmetry of information, called adverse selection and moral hazard respectively.

- First, regulated firms have superior knowledge about their environment: their technology, the cost of their inputs, the demand for their products and services.
- Second, they take actions that affect cost and demand: human resource management, strategic choices of plant capacity, R&D and brand image, quality control, risk management and so forth.

In its simplest version, the firm's cost function can be written as:

$$C = f(\beta, e, \boldsymbol{q}) + \varepsilon,$$

where β is an efficiency parameter known only to the firm, *e* (possibly multidimensional) is a cost-reducing effort, $\boldsymbol{q} = (q_1,\dots,q_n)$ is the vector of outputs, and ε stands for exogenous uncertainty about the final realization of the cost. The effort *e* is also unobserved by the regulator and is costly to the firm.

Unsurprisingly, authorities that neglect the asymmetry of information fail to deliver effective, cost-efficient regulation. To take two examples unrelated to market power, command-and-control in environmental regulation all over the world and judicial control of the business justification for layoffs in France have backfired by imposing high costs on the industry and thereby casting doubts on the reasonableness or sustainability of these policies. The same principle holds for industrial organization.

[9]For example, the antitrust authority may disapprove the handicapping of horizontal rivals, say, by making one's technology incompatible when no protection of intellectual property is at stake, by locking in customers through long-term contracts that have limited efficiency justification (as in e.g. Aghion-Bolton 1987), or by committing to tough behavior through irremediable tying (as in e.g. the model of horizontal foreclosure of Whinston 1990).

With regard to market power, there are two broad principles. The first is obvious. Authorities should attempt at reducing the asymmetry of information: by collecting data of course; but also by benchmarking the firm's performance to that of similar firms operating in different markets; and finally by auctioning off the monopoly rights (as firms reveal information about industry cost when competing with each other).

The second principle is that one size does not fit all: one should let the regulated firm make use of its information. Before we get to this, imagine that you are in charge of dealing with a contractor. Two familiar contracts will probably come to your mind:

- you can offer to fully reimburse the contractor's cost, plus some set payment over this cost; such a contract is called a "cost plus" contract if the taxpayer foots the bill or a "rate-of-return" contract if the cost and reward are derived from revenue from the users;
- or you can fix the total payment and tell the firm that this payment will cover its return as well as its cost, whatever the latter turns out to be; such a contract is called a "fixed price" (taxpayer-financed project) or "price cap" (used-financed good) contract.

The two contracts differ in the strength of incentives provided to the contractor: The cost-plus contract shelters the firm from fluctuations in its cost performance, while the fixed price contract makes the firm fully accountable for its cost performance. For example, in the case of a non-marketed good, the *net* return t for the firm is:

$$t = a - b\,C,$$

with $b = 0$ for a cost-plus contract[10], = 1 for a fixed-price contract, and between 0 and 1 more generally. The slope b is called the "power of the incentive scheme" or "cost-sharing parameter".

The fixed price contract obviously elicits more cost-reducing effort from the firm. It however has the drawback of leaving substantial profit to the firm in lucky circumstances in which costs turn out to be particularly low or demand high, independently of any effort made by the firm. In the example above, the fixed fee a must be set sufficiently high so as to induce the firm to produce if its cost is high

Returning to the "one size does not fit all" idea, one can show that regulated firms should be confronted with a menu of options; to over-simplify, this menu might take the form of a choice between a fixed-price and a cost-plus contracts. The firm then self-selects: an

[10] Define "effort" as being costly for the firm (what is done beyond intrinsic motivation or career concerns), and $e = 0$ as the minimum effort. Then the cost-plus contract elicits $e = 0$ and yields a β- independent rent for the firm. Hence, the rent can be made arbitrarily small without jeopardizing the firm's participation.

efficient firm will opt for being accountable for its cost, while an inefficient firm will opt for the protection of cost-plus[11].

Raising the power of incentives has been key to remedy the dismal cost performance of traditional regulation. However, theory and practice indicate some caveats regarding high-powered incentives[12]:

First, making the firm accountable for its cost performance also provides the firm with an incentive to skimp quality; so powerful incentives must go together with a more thorough monitoring of quality.

Second, the observation that powerful incentives generate both high effort and high profit (or rent) implies that regulators cannot have their cake and eat it too. The firm will be rewarded both for its effort to reduce cost (as it should) and for lucky circumstances (as it should not: this is an underserved rent); but asymmetric information means that there is no way to tell the two apart. While the regulators under the pressure of public opinion may be tempted to take back this rent ex post, such policy reversal destroys the firm's incentive to reduce cost[13]. A wider knowledge of this principle would have prevented some wishful thinking when powerful incentives were introduced.

Thus, powerful incentives require commitment; this commitment in turn requires an independent regulatory agency, protected from the pressure of public opinion.

Third, the possibility of high rents increases the benefit for the firm of capturing its regulator. So, if you cannot guarantee the regulator's independence from industry (and if you do not have enough competition), don't go for powerful incentives.

Be careful when tinkering with the price structure

The essence of regulation is often to ensure that undeserved market power does not translate into high overall prices. Traditionally, though, regulators have gone way beyond price-*level* regulation; they also have mingled with the ratio of prices, that is, with the price *structure*. There, too, they face a substantial informational handicap. Moreover the need for intervention is much less obvious than in the case of the price level: While it is clear that a monopoly has incentives to charge high prices, it is a priori less clear that it is biased in its choice of letting Bob rather than Anna bear the brunt of market power.

In 1956, Marcel Boiteux, building on earlier work by Franck Ramsey, asked, how should the fixed infrastructure cost of a regulated firm be covered by markups on the various goods

[11] See e.g. Laffont-Tirole (1986). Precursors to my work with Jean-Jacques Laffont include Loeb-Magat (1979), Baron-Myerson (1982) and Sappington (1982). Under some conditions, the optimal regulatory scheme lets the firm pick within a menu of linear incentive contracts $t = a - b\,C$, each characterized by a pair of fixed-payment and cost-sharing parameters (a, b).

[12] A broader list of caveats of high-powered incentives and their theoretical modelling can be found in Laffont-Tirole (1993).

[13] This is the so-called "ratchet effect" (see, e.g., Freixas et al. (1985) and Laffont-Tirole (1988)).

sold by the firm? This fixed cost is presumably large as the motivation for regulating the firm is its monopoly power, protected by the reluctance of entrants to duplicate the fixed cost. Boiteux showed that regulated firms should exhibit a price structure similar to that of ordinary, unregulated ones: in equation (1), the price p_i in segment i should be low if the segment is cheap to serve (the cost c_i is low), and has a high elasticity of demand η_i (that is, if a price increase implies a substantial reduction in demand)[14]. As the fixed production cost to be covered through markups increases, these markups also increase (i.e. θ increases). Thus, regulated prices should be “business oriented”, similar to, but overall lower than those set by an unregulated monopoly (for whom the coefficient θ would be equal to 1.

$$\frac{p_i - c_i}{p_i} = \frac{\theta}{\eta_i} \tag{1}$$

Furthermore, and under some conditions[15], the regulatory problem decomposes: the trade-off between rents and cost-reducing effort should be addressed through the cost- or profit-sharing rule, and pricing should obey the Ramsey-Boiteux principle. This dichotomy result has practical implications, as we will see shortly.

Yet, regulators used to force regulated firms to set an economically very inefficient price structure. Typically, utilities charged low prices on inelastic segments such as monthly subscription fees to be connected to the power or telephone network, and high prices on elastic consumptions (e.g. long distance phone calls). They charged also high prices to business and low prices to residential consumers, while the former had more bypass opportunities. One justification for this was redistributive concerns; but these cross-subsidies also benefitted the rich, and furthermore whether redistribution could not be achieved by other, more efficient means (say, the income tax) was not discussed.

This price tinkering away from Ramsey-Boiteux principles was also sometimes motivated by the (correct) premise that regulators do not possess the information about cost and demand to fine-tune prices in a business-oriented fashion.

This however ignored the possibility of making use of decentralized information. The above-mentioned dichotomy between incentives and pricing opens the way for the use of business-oriented pricing. A price cap regulation, in which the firm must only comply with some cap on its weighted[16] average price, not only creates powerful incentives by making the firm

[14] We here consider the case of independent demands; formulas must be adjusted to account for “cross-elasticities” in case of substitutes or complements.

[15] See Laffont-Tirole (1990). The dichotomy does not hold in the absence of cost or profit measurement (Baron-Myerson 1982) as then a single instrument (the vector of prices) must accomplish two goals: capture the firm’s rent and limit the departure from Ramsey-Boiteux principles.

[16] This of course is very much of an idealization. In theory, the weights should be equal to the anticipated quantities at the Ramsey-Boiteux prices (not those that result from the firm’s choice so as not to let it manipulate the weights); intuitively, an increase in price p_i generates a reduction of consumer surplus equal to the quantity of good i; a price cap based on the anticipated quantities therefore creates just the right “internalization” of consumer surplus. The caveat is of course asymmetric information: the regulator does not

accountable for its cost, but also lets the firm free to choose a business-oriented price structure.

A special case of this idea arises when one of the "products" supplied by the monopoly is an intermediate input, that is, the provision of access for rivals to an essential facility. By imposing access prices at marginal cost (assuming they can measure it), regulators de facto bias the price structure and focus markups on those final segments for which the essential facility owner faces no competition[17]. This is bound to be inefficient in general.

III. Two-sided markets

A particularly interesting choice of price structure arises in so-called two-sided markets. Two-sided "platforms" bring together multiple user-communities that want to interact with each other: gamers and game developers for videogames; users of operating systems and app developers for operating systems; "eyeballs" and advertisers for search and media platforms; cardholders and merchants for payment card transactions (Figure 4). The challenge for two-sided platforms is to find a viable business model that gets both sides on board.

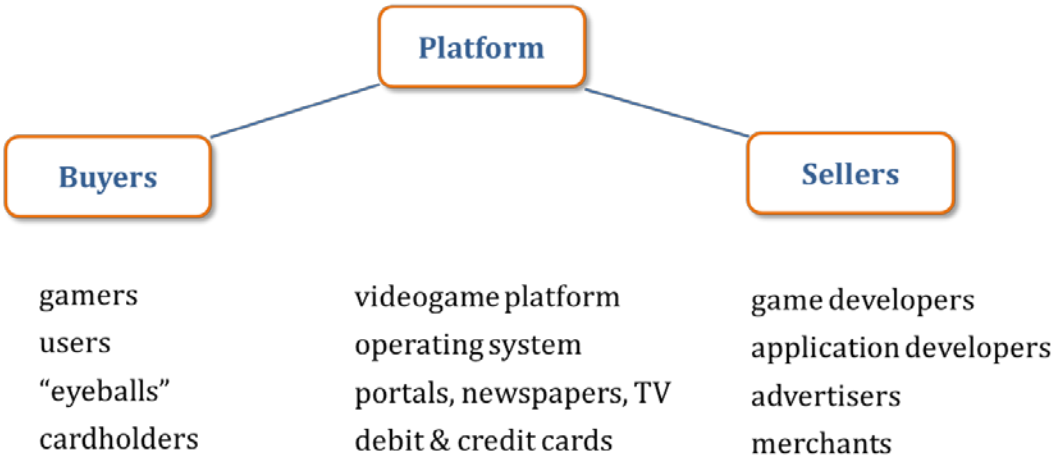

Figure 4

know the Ramsey-Boiteux quantities. More research is needed on this front (see Armstrong-Vickers 2000 for a contribution in this direction). Empirically, though, the use of price caps has had a substantial rebalancing effect toward a Ramsey-Boiteux-oriented price structure.

[17] To see this, suppose that good i is supplied by a competitive downstream fringe at marginal cost c_D. The regulated firm owns the bottleneck input that allows the downstream fringe to operate. The upstream marginal cost is c_U. Let $c_i = c_D + c_U$. If access is given at access price $a = c_D$, then $p_i = c_i$ is lower than in the Ramsey-Boiteux formula. The fixed cost must then be recouped entirely through (very high) prices on goods for which the regulated firm faces no competition. For more on such "one-way" access pricing, see Laffont-Tirole (1994). I here will not discuss "two-way" access pricing, in which owners of competitive bottlenecks (e.g. mobile phone companies) give each other access; there is an abundant literature on this since the early work of Armstrong (1998) and Laffont et al (1998).

Regardless of their market power, whether they are Google or a free newspaper like Metro,

- they choose to allocate a lower burden to the side (say side *i*) whose presence benefits most users on the other side. In equation (2), v_j represents how much a side-*j* user values an extra user on side *i*. This willingness to pay for an interaction with an extra user on side *i* can be recouped by the platform through a price increase on side *j*; the platform's real, or opportunity cost is therefore the platform's production cost *c* per interaction (perhaps equal to 0) minus v_j,
- like ordinary businesses, they choose a lower burden for the side which has a relatively elastic demand (a high η_i in the formula).

$$\frac{p_i - (c - v_j)}{p_i} = \frac{1}{\eta_i} \tag{2}$$

Equation (2) often results in very skewed pricing patterns, with one side paying nothing (free search engine, portal, newspaper) or even being paid to enjoy the service (cardholders receiving cash-back bonuses[18]), while the other side is heavily taxed. The simplest example is that of sponsored-links/advertising-financed platforms: advertisers put a high value v_j on interacting with (especially well-to-do) buyers, while the latter attach little value to, or possibly perceive as a nuisance the presence of ads[19].

A regulator failing to understand the nature of two-sided markets might misleadingly complain about predation on the low-price side or even excessive pricing on the high-price side, despite the fact that such price structures are also selected by small, entering platforms. Regulators should refrain from mechanically applying standard antitrust ideas where they do not belong.

[18] The case of payment cards is more complex than the other examples as the card/cash payment decision is coupled with the decision of whether to come to the store and inspect and purchase the good. This coupling implies that the merchant may be willing to take cards even if the benefit he derives from a card payment relative to a cash payment is smaller than the "merchant fee" that he has to pay for the card payment. The reason for this is two-fold: he may want to attract informed customers by accepting cards (Rochet-Tirole 2002) and he may be afraid that card refusal will lead to lost sales from unaware customers (Bourguignon et al 2014). Either way, the merchant perceives the card as a "must-take card".

[19] There are many theoretical and empirical analyses of two-sided markets, including among the early theory pieces Armstrong (2006), Caillaud-Jullien (2003) and Rochet-Tirole (2003, 2006).

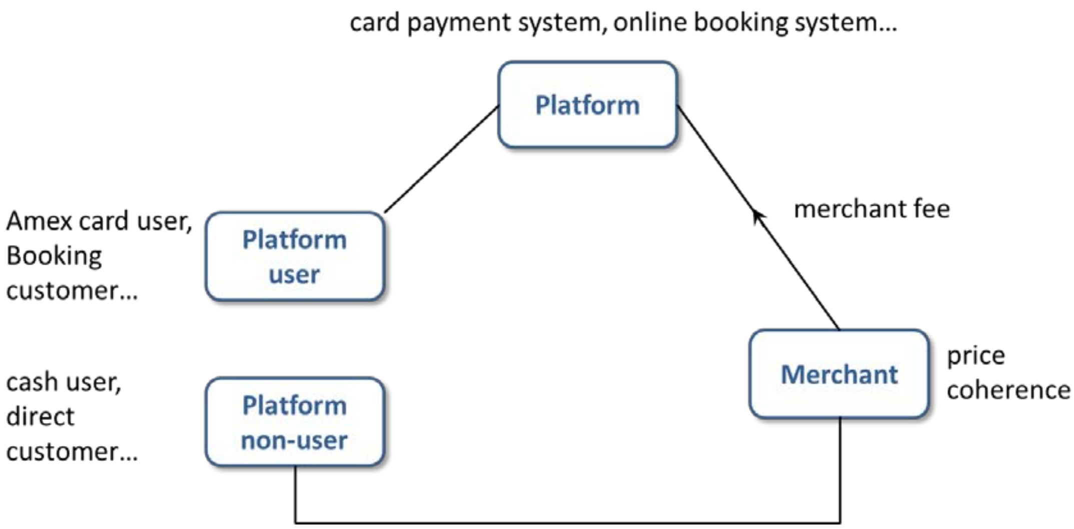

Figure 5

This does not mean that they should turn a blind eye when facing two-sided platforms. A case in point is provided by platforms that supply a service to their members, but are not the only route for a purchase (see Figure 5). For instance, American Express provides the cardholder with a service, but other payment methods such as cash, check, or other card systems are also available. A hotel or airline flight can be booked either through an online booking platform, such as Booking.com, or directly.

Such platforms usually charge a merchant fee and demand "price coherence" (the merchant is not allowed to surcharge for a transaction performed through the platform relative to a transaction that does not use it). While price coherence has sound justifications (it prevents surcharging hold-ups by the merchant[20]), it also comes with hazards; for, high merchant fees are in part passed through to third parties, namely consumers who do not use the platform. This may result in excessive merchant fees[21]. The market failure in this instance is not the skewed pricing pattern (which is typical of two-sided markets), but the externality on non-contracting parties.

The analysis reveals that the merchant fee should obey the following Pigovian principle: In the case of card payments, the merchant fee should be equal to the benefit that the merchant derives from a card payment[22]. The consumer, who decides on the payment method, then exerts no externality on the merchant. This principle is now the European Commission's doctrine for regulating open systems Visa and MasterCard.

[20] See e.g. Bourguignon et al (2014) and the literature on hold-ups/shrouded attributes.
[21] See Rochet-Tirole (2002) and for a recent and elegant framework Edelman-Wright (2014).
[22] This principle is called the "avoided cost test" or the "tourist test" (would the merchant rather have a customer pay by card rather than cash, given that the customer is in the shop, can pay by either means of payment and a tourist and therefore will not be attracted in the future by the merchant's accepting the card?). See Rochet-Tirole (2011).

In this realm as in many others, neither laissez-faire nor a shotgun regulatory approach is warranted. Only sound economic analysis will do.

IV. Intellectual property

The rule-of-reason approach to competition policy requires some confidence as to which, of efficiency and anticompetitive effects, dominates. In this respect, simple rules can greatly strengthen our confidence in policy choices.

Consider intellectual property (IP), for which the shortage of data can be acute, with technologies not having yet hit the ground. Biotech and software technologies are often covered by a multiplicity of patents of varying importance and owned by different owners. This "patent thicket" is conducive to "royalty stacking" (or "multiple marginalizations" in the parlance of economics).

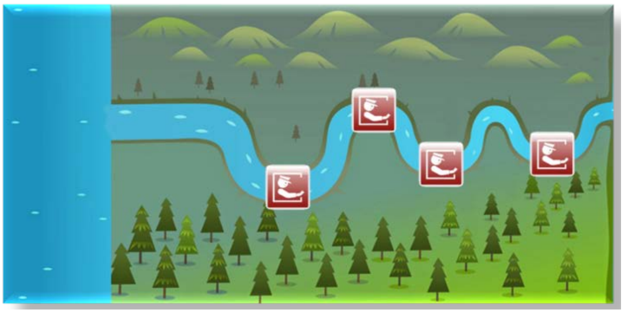

Figure 6

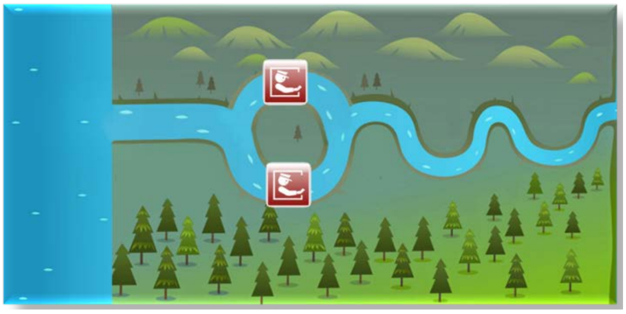

Figure 7

To understand royalty stacking, which was brilliantly formalized in 1838 by Antoine Augustin Cournot (1838) and more recently by Carl Shapiro (2001), it may be helpful to use an analogy (depicted in Figure 6) and return to medieval Europe, whose river transit was hampered by a multiplicity of tolls; for instance, there were 64 tolls on the Rhine River in the 14th century[23]. Each toll collector set his toll to maximize his revenue, oblivious of what this meant not only for the users but also for other toll collectors. Europe had to wait until the Congress of Vienna in 1815 and subsequent legislations to see the removal of toll-stacking[24].

High technologies are currently witnessing an evolution toward more affordable prices, similar to that for river traffic in the 19th century. New guidelines have been set, so as to encourage the co-marketing of intellectual property through patent pools. Patent pools reduce the overall price of licensing complementary patents, benefiting both intellectual property owners and technology users.

[23]There were 13 tolls between Mainz and Koln only. Similar observations apply to the Elbe River or the French rivers (Rhone, Seine, Garonne, and Loire): see Spaulding (2011).
[24] Actually, all tolls were abolished along the Rhine River.

Alas, patent pools and more generally co-marketing arrangements also may allow firms to raise price. For instance, the owners of two substitute patents (like the toll collectors on the two river branches in Figure 7) can raise licensing price to the monopoly level by forming a patent pool (setting a collusive toll for downstream access in the figure), akin to a cartel or a merger to monopoly.

A flashback is useful again. A little known fact is that, prior to 1945, most high-tech industries of the time were run by patent pools[25]. But the worry about cartelization through joint marketing led to a hostile decision of the US Supreme Court in 1945 and the disappearance of pools until the recent revival of interest.

But couldn't competition authorities just ban bad (price-increasing) pools and allow good (price-decreasing) ones? They unfortunately do not possess the relevant information: There is often no long history of licensing, and furthermore the pattern of substitutability/complementarity changes with the uses made of the technology[26].

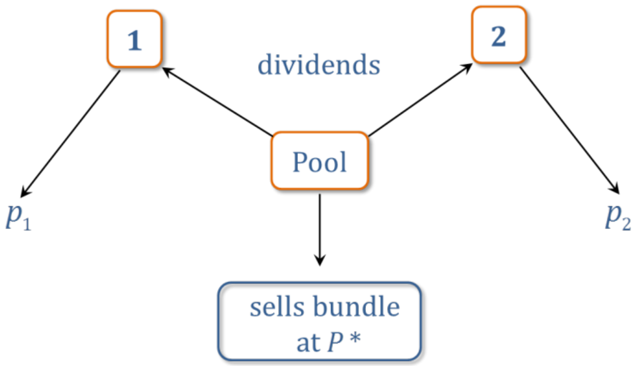

Figure 8

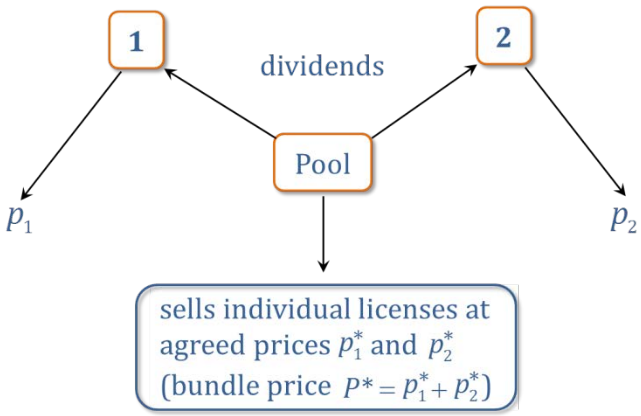

Figure 9

Simple regulations however allow such sorting. First, "individual licensing" (the ability for individual owners to keep licensing their patents outside the pool, see Figure 8) recreates competition when patent pools would otherwise have raised price. Patent pools with individual licensing therefore neutralize bad pools while allowing good ones to achieve their price reduction.

The reasoning is best illustrated in the very simple case of two substitute patents. The competitive price for the licenses is then equal to 0 (assuming away any licensing cost). A pool has the potential to raise the price up to the monopoly price P^m, say. Suppose that the pool tries to sets a price $P\left(\leq P^m\right)$. Then each IP owner receives in dividends $P\,D\,(P)/2$,

[25] These included airplanes, railroads, cars, TV, radio, chemicals, and many others.
[26] Another issue is that patents may be complements at low prices (users will use the complete set at such prices and so an increase in a licensing price reduces the demand for the overall technology) and substitutes at higher prices.

letting *D* (.) denote the demand function for licenses and assuming equal sharing[27]. Rather than receive half of the pool's profit in dividends, each IP owner can undercut the pool slightly, and receive (approximately) the entire profit *P D* (*P*) for itself[28].

Second, and to counter the threat of tacit collusion (in the reasoning above, individual IP owners might forgo the short-run gain of undercutting the pool through a cheaper individual-license price, so as to prevent a price war and to keep sustaining the pool's high price in the future), it is wise to append a second, information-free requirement, called "unbundling": The users can buy individual licenses from the pool, and the pool price for multiple licenses is the sum of the individual prices (see Figure 9). Individual licensing together with unbundling implies that accepting a pool does not reduce welfare[29].

Interestingly, both precepts derived from theory- independent licensing and unbundling- have been incorporated in the European guidelines (in 2004 and 2014, respectively); the US Department of Justice had required independent licensing in its Business Review Letters in the late 1990s already.

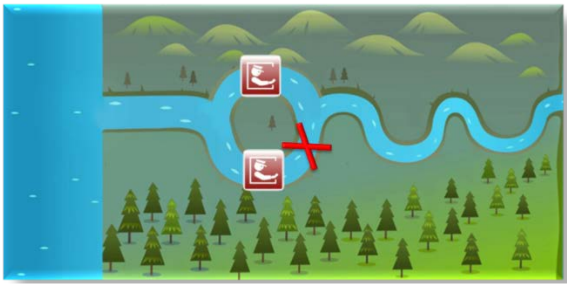

Figure 10

Another information-free precept for the treatment of intellectual property originating from theoretical work is the suggestion that intellectual property owners commit to a cap on their licensing price before a standard is finalized. When a standard is designed, in many cases there are multiple routes to solving a given technological problem. Each one of these may be equally viable, but often a standard setting body will choose only one avenue (to pursue the analogy, the public authority may have enabled traffic on the upper branch of the river by building a lock on that branch; or the presence of a major city on the upper branch may have made this branch a superior alternative, as in Figure 10). After the decision has been made, however, the chosen patent becomes a "standard-essential patent (SEP)," and the patent owner can ask for a high royalty even though another patent could have offered comparable value, had the technology been designed differently.

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[27] Unequal sharing would imply that the IP owner with a lower share would have even more incentives to undercut.

[28] The undercutting equilibrium still restores the pre-pool level of competition for a bad pool when there are more than two patents and/or when the patents are imperfect substitutes. But coordination problems then may lead to multiple equilibria (when $n > 2$). Boutin (2014) shows that appending the unbundling requirement (discussed below) selects the competition-restoring equilibrium.

[29] See Rey-Tirole (2013).

To restrain firms from taking advantage of the fortuitous essentiality of their patents, an essentiality that resulted only from being included in a standard and not from technological merit, standard setting bodies commonly require firms to commit in advance to license their patents on fair, reasonable and non-discriminatory (FRAND) terms. The problem with this approach is that FRAND commitments are very ambiguous: What exactly is a fair and reasonable rate? And in fact, large lawsuits regarding the meaning of the commitment proliferate all over the world.

One would not build a house on a piece of land whose price is not known in advance. The same obtains for technologies. We have proposed that intellectual property owners commit to their licensing conditions prior to the final choice of standard and we tried to explain why this commitment requirement is unlikely to result from competition among standard-setting bodies[30].

V. Concluding remarks

The theory of industrial organization has proved a very useful tool to think about one of the major challenges of our economies. It has fashioned antitrust and regulation. Recognizing that industries are different from each other and so one size does not fit all, it has patiently built a body of knowledge that has helped regulators to better understand market power and the effects of policy interventions, and firms to formulate their strategies.

Industrial organization has gone a long way, but much work remains to be done. An especially gratifying aspect is that the field of industrial organization is currently thriving, with many top young researchers producing exciting work.

Making this world a better world is the economist's first mission. I believe that the entire community of industrial organization researchers has contributed substantially to this mission. On behalf of this community, I was humbled, honored and grateful to be awarded the 2014 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.

[30] See Lerner-Tirole (2015).

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