

TNIT newsletter

Toulouse Network for Information Technology

Issue 8 - October 2012

Dear Readers

“ We hope this newsletter finds you well and relaxed after a great summer. This issue begins with an interview with IDEI's Scientific Director Jean Tirole, who shares with us his view about important topics in the economics of Information Technology and Intellectual Property. We also have a piece by Josh Lerner on the effect of angel investments on the success and growth of new ventures, and a “What” article by Ilya Segal on the foundations of intellectual property rights. We hope that you will enjoy this issue and send us any ideas or reactions you may have upon reading it.

Jacques Crémer & Yassine Lefouili

”

CONTENT

- Interview with **Jean Tirole**
- **New frontiers in funding innovation**
by Josh Lerner
- How, Why, When, Who, What ?
What are the foundations of intellectual property rights?
by Ilya Segal

Call for papers: Seventh Bi-Annual Conference on the Economics of Intellectual Property, Software and the Internet

The Toulouse Network for Information Technology (TNIT) is a research network funded by Microsoft and managed by the Institut d'Economie Industrielle. It aims at stimulating world-class research in the Economics of Information Technology, Intellectual Property, Software Security, Liability, and Related Topics.

All the opinions expressed in this newsletter are the personal opinions of the persons who express them, and do not necessarily reflect the opinions of Microsoft, the IDEI or any other institution.

<http://idei.fr/tnit>



**I N S T I T U T
D'É C O N O M I E
I N D U S T R I E L L E**



Interview with Jean Tirole

TNIT: Jean, thank you for accepting to answer our questions. Maybe it would be useful for the readers of the Newsletter if you told them what your main interests have been in the economics of information technology and of innovation?

JT: The field of industrial organization (IO) aims at studying the strategies of companies operating in strategic environments; as such, it is very broad and covers not only pricing decisions (market segmentation, price wars and tacit collusion, customer loyalty, etc.) but also non-price choices such as vertical restraints, innovation, intellectual property management, and investments in production facilities. The same field serves both managers and policymakers. The latter indeed must have a good understanding of the impact of corporate market strategies on consumer welfare in order to develop guidelines and to make decisions regarding monopolization and abuses of dominant position. Over the years, after years of an ideological pendulum swinging back and forth between undue *laissez-faire* and excessive interventionism, industrial organization has helped antitrust authorities strike a better balance between the pursuit of public interest and the nurturing of an investment-friendly business environment.

My own interest in IO dates back to my student days at MIT in the early 80s, through the lectures of Paul Joskow and Richard Schmalensee and my own research then with Drew Fudenberg and Eric Maskin. My interest in information technology is more recent and results from the confluence of several research lines in the late 90s. Theoretical IO, which was then receiving less attention after the theoretical innovations of the 80s as scholars fruitfully focussed on empirical techniques, received a new impetus; the profession discovered its relative ignorance

in areas such as information technologies, intellectual property, as well as the organization of access in formerly monopolized industries (telecoms, electricity, rail, etc). Many of us then perceived new intellectual challenges. To take my own itinerary as way of (self-serving) example, I was then working with Drew Fudenberg on “behaviour-based price discrimination”, which started being enabled by new technologies and the collection of detailed data about customers’ consumption profiles, and on the pricing of network goods; with Jacques Crémer and Patrick Rey on dominance in the Internet; and with Josh Lerner on patent pools.

Meanwhile, Jean-Jacques Laffont, Patrick Rey and I were exploring theoretical principles for termination fees/ two-sided access in telecoms and Jean-Charles Rochet and I were doing the same for the interchange fee for the payment card industry; these papers, together with other work, such as that of our colleague Bruno Jullien (with Bernard Caillaud), coalesced to produce our broader work on two-sided markets with Jean-Charles Rochet.

The point is, the economics of information technology was in the late 90s a largely unexplored field, and Toulouse researchers, (future) members of the TNIT network, and other scholars around the world embarked in a very fruitful research agenda.

TNIT: Your work with Josh Lerner on Open Source has been extremely influential. Could you tell us why you began working on this topic?

JT: Josh and I were both fascinated by the growing success of open source software and suspicious of the prevailing explanations for why it was gaining momentum. The dominant explanations at the time were either that open-source contributors were do-gooders or that they expected their contribution to be matched by sufficiently many others that a great free product would be developed, thus making it rational to contribute in the



first place. The latter explanation contradicted received theory and empirical observations about free riding in other contexts; for example, few countries, let alone firms or households, restrain their emissions of Greenhouse Gases in the hope that their individual behaviour will trigger a sequence of reactions that will solve the global warming problem. As for the first explanation, I certainly view pro-social behaviours as important in many areas of economic life (and have written extensively on them with my Princeton colleague Roland Bénabou). But somehow, the pro-sociality hypothesis raised more questions than it solved, such as: why what seemed to work in the software industry did not in other industries? Why and how would the open source movement select in pro-social types? Wouldn't commercial software programmers also enjoy contributing to the public good? Also, it left us rather poorly equipped to study the key questions: what is the future of open source software? For what kind of software is it most appropriate? Does the choice of open source software license make a difference? How can commercial software react to, and build on open source software? What should public policy in the matter look like?

The purpose of our and others' research agenda has been to apply the standard tools of economic theory and applied econometrics to investigate these topics.

TNIT: *You have been conducting quite a bit of research on Standard Setting Organizations recently. There have been many discussions in policy circles on the way in which they should be treated from a competition policy point of view. Can you tell us what your take on this is?*

JT: Standard setting involves tremendous stakes for both IP owners and users of technologies. Unsurprisingly it has become highly contentious. There are many distinct issues, some of which have eluded mainstream economics research. Let me select two related ones on the public policy front.

RAND licensing, which participants in standard setting processes often commit to, are vague contracts. Recent disputes between Apple and Samsung and between Microsoft and Motorola, or Rambus' behaviour within JEDEC are cases in point. Such disputes are bound to surface repeatedly as parties will systematically develop self-serving interpretations of what "fair" or "reasonable" means. Somehow we would hope for more complete contracts.

Second, price discussions within a standard setting process are still frowned upon by many antitrust enforcers. Yet unilateral or collective commitments to price caps for the licensing of IP would seem to make sense. First, the attractiveness of alternative combination of functionalities depends not only on the technological aspects (assessed by the "beards") but also on their affordability (the turf of "suits"). Second, patents that are not essential ex ante

may become so once the functionality they implement has been selected into the standard; one would thus expect commitments not to "hold up" users ex post. Price discussions among potential competitors may jeopardize social welfare, but restricting such agreements to caps (forbidding floors) might address this concern.

Of course, IP owners might be reluctant to commit to a price in a situation of great uncertainty, and one of the little-understood aspects of such commitments is the set of contingencies that such caps could be indexed upon. Finally, we need to explain why so few patent pools are formed prior to standard setting.

TNIT: *And now some short questions: What would you say is the most important thing we do not understand in the economics of innovation?*

JT: At an abstract level, innovation involves a principal (society, which aspires to benefit from new knowledge) and agents (innovators). Yet so far innovation economics has not benefited as much as other fields of economics (such as the rest of IO, regulation, corporate finance or labour economics) from the economic theory of contracts. The reason for this is that by definition the "deliverable" is hard to specify; indeed for many innovations, the very fact of being able to describe the innovation means that this is not an innovation in the first place- an exception is a process innovation for which the characteristics (manufacturing cost, efficiency, robustness) of the desired product are well defined and not subject to vague trade-offs, and uncertainty concerns only the way in which these targets can be achieved. Due to our limited ability to model "unforeseen contingencies", innovation economics has often taken as given the regulatory environment (e.g. patent law) without optimizing it.

Many concrete questions connect to this more abstract one, from the optimal regulatory institutions (the governance and incentives of PTOs, courts and prize committees, or the antitrust treatment of IP-related issues) to the economics of licensing.

TNIT: *You work in Toulouse, but have kept a very close connection with MIT over the years. Do you feel that this double connection has influenced your view on research?*

JT: Since my student days, I have had much fascination for the "MIT spirit", and its mutual respect across fields. The mathematical economist and the policy-oriented scholar, the econometrician, the experimentalist and the soft theorist are all viewed as part of the same intellectual family. Rather than engaging in sterile turf disputes, they exchange complementary pieces of knowledge and collaborate with each other. This lesson is all the more important today that the field of economics has become more mature, naturally leading to an increased specialization and a lack of understanding of one's neighbour's sub-field. Up to the 1950s/1960s, top scholars were able to straddle fields,



with the Cowles foundation being a case in point; they could simultaneously do general equilibrium, be at the frontier of econometrics, contribute to macroeconomics and advise President Kennedy. The world is different today. I have found my Toulouse colleagues wonderful colleagues to write or just interact with. And I have been very fortunate to be able to maintain another, much more minor time-wise but important, connection with MIT.

TNIT: *Facebook, LinkedIn or address book? Twitter or not?*

JT: At the risk of appearing snobbish, for idiosyncratic reasons, I don't use Facebook, Tweeter and other social networks, even though I do acknowledge their many benefits. The scarce resource for me is time to engage in quiet and uninterrupted thinking about issues. "Interruptions" do not come only from colleagues, students and institution-related business; I'm often my own greatest enemy when it comes to keeping concentrated on difficult issues. I find e-mail and search engines as distracting as they are indispensable; answering an e-mail or performing a search (like giving a phone call in the good old times) provides some instant gratification for "having done something", while deeper thinking most of the time delivers (apparently) nothing; e-mail and search offer an easy "excuse" for delaying hard work. Participating in social networks would compound the problem for me; people with more self-discipline on the other hand do a different cost-benefit analysis.





New Frontiers in Funding Innovation

by Josh Lerner

The past few years have been the worst of times as well as the best of times for the funding of new high-potential ventures. Traditional sources of entrepreneurial finance in many nations have not fared well. Bank lending to entrepreneurial businesses remains sharply constricted since the financial crisis, due to the hang-over of bad real estate and corporate finance loans, as well as increased regulatory pressures. Venture capital funding remains at levels far below those seen in the late 1990s, which reflects the fact that returns have been very modest since the collapse of the dot.com bubble in 2000. Initial public offering markets have been significantly less active as well. (Notable exceptions include emerging markets such as Brazil and China, at least until recently.) These conditions have generated numerous expressions of concern from policymakers and practitioners alike.

But at the same time, there has been a plethora of innovation in the financing of new ventures. These have included “crowdfunding” of ventures and projects, the rise of angel groups and “super-angel” funds, and the bundling of financing and consulting services in various incubator-like facilities. Policymakers have increasingly embraced these alternative ways of funding entrepreneurial firms. For instance, the recently enacted JOBS Act in the United States facilitated crowd funding, while nations such as the United Kingdom, France and Israel have sought to subsidize angel investing.¹

But these new developments remain relatively poorly understood. While the ability of entrepreneurial firms - and venture capital-backed firms in particular - to generate a disproportionate share of employment and innovation is widely accepted,² these new mechanisms for funding these ventures have been little scrutinized.

In “The Consequences of Entrepreneurial Finance: Evidence from Angel Financings,”³ my colleague Bill Kerr, Antoinette Schoar of MIT, and myself look at the question of whether angel investments affect the success and growth of new ventures. We focus on angel groups: these investors are increasingly structured as semi-formal networks of high net worth individuals, often former entrepreneurs, who meet in regular intervals to hear aspiring entrepreneurs pitch their business plans. The angels then decide whether to conduct further due diligence and ultimately whether to invest in some of these deals.

Our analysis exploits very detailed data of ventures that pitched to two prominent angel investment groups (Tech Coast Angels and CommonAngels) during the 2001-2006 period. These organizations generously provided us access to confidential records of the companies who approached them, how angel interest formed and the financing decisions made, and subsequent venture outcomes.

Several clear patterns emerge from our analysis: First, we look at the impact of angel funding on venture success, venture operations, and access to venture financing. We begin by comparing firms that received funding to those that did not. We show that funded firms are 20%-25% more likely to survive for at least four years (or until December 2010). They are also 9%-11% more likely to undergo a successful exit (IPO or acquisition) and 16%-19% more likely to be generally successful (as measured by a successful exit or reaching 75 employees by December 2010). Funded companies have 16-20 more employees in 2010, are 16%-18% more likely to have a granted patent, and are growing faster as measured through web traffic performance between 2008 and 2010. Finally, funded companies are better financed. Overall, they have a 70% higher likelihood of obtaining entrepreneurial finance and have on average a little less than two additional financing rounds.

Our second set of findings considers ventures just above and below the funding threshold using the regression discontinuity methodology, which removes the endogeneity of funding and many omitted variable biases. We robustly confirm several of our outcomes: the ventures are more likely to be alive, and they have superior operations in terms of employee counts, patenting, and web traffic growth.

Our final analysis compares the returns of the venture capital industry to that of one of the angel groups. A natural concern is that these investments are by angels who are not professional investors, and thus their decisions and voting may be shaped by factors other than economic considerations (e.g., the joy of working with start-up companies). While our project focuses on the consequences of financing for start-up ventures, this additional analysis helps confirm that the investments were warranted for the angel group as a whole. We find that the angel group outperformed the venture capital industry overall during the period of study.



Thus, this paper provides a fresh look at and new evidence about an essential question in entrepreneurial finance. It quantifies the positive impact that these two angel investment groups make to the companies that they fund in a way that simultaneously exploits novel, rich micro-data and addresses concerns about unobserved heterogeneity. We should note, however, that the angel groups that we worked with for this project are two of the largest and most established

groups in the U.S. Given the substantial heterogeneity across angel investors, the magnitude of the impact that we estimate is likely to be at the upper end of the angel population. In ongoing research, we are examining the activities of angel groups around the world to better understand their role.

1 - For an overview, see Organisation for Economic Cooperation and Development, *Financing High Growth Firms: The Role of Angel Investment*, Paris, OECD, 2012.

2 - See, for instance, T. Hellmann, and M. Puri, 2000, The interaction between product market and financing strategy: The role of venture capital, *Review of Financial Studies* 13, 959-984.; S. Kortum, and J. Lerner, 2000, Assessing the Contribution of Venture Capital to Innovation, *Rand Journal of Economics* 31, 674-692; and M. Puri and R. Zarutskie, 2010, On the Lifecycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms, *Journal of Finance*, forthcoming.

3 - *Review of Financial Studies*, forthcoming.



What are the Foundations of Intellectual Property Rights?

by Ilya Segal

The legal community has seen some lively debates about the nature of Intellectual Property Rights (IPR), which include patents, copyright and trademarks. Some legal scholars, such as Easterbrook (1990) and Epstein (2006), believe that intellectual property rights should be given the same near-absolute protection as “tangible” property, such as land and objects. Other scholars, such as Lemley (2005), disagree. However, there is shortage of formal economic analysis to support either point of view.

To understand the debate, we need to first understand why most economists and legal scholars believe that absolute property rights over tangible assets are desirable in most cases. A formal foundation for this belief stems from the the “full appropriation principle:” giving an economic agent an absolute right to exclude others from the enjoyment of an asset gives this agent the socially optimal incentives to invest into creating and maintaining the asset. This principle is justified as follows: if the owner can prevent others from enjoying the fruits of his investment without his consent, he may be able to extract from them his full contribution to the social value, and this gives him the right incentives to maximize this contribution. It can indeed be shown that when different agents compete in offering assets that are sufficiently close substitutes for each other, such competition will not only result in nearly-efficient use of assets but also allow each competitor to capture a value that is close to his marginal contribution.

As a result, absolute property rights will, in this case, induce optimal investments by all agents. (For a formal derivation of this argument, see Makowski and Ostroy (2001).)

Let us now turn our attention to “intellectual assets” such as patentable innovations and copyrighted software. Such assets do not fit the assumptions of this story nearly as well as tangible assets. Namely:

- (1) It is impossible to exclude people from enjoying the fruits of intellectual discoveries, even using very broad property rights protections, because such discoveries can indirectly spur others to pursue subsequent innovations.
- (2) Once innovations are produced, it is efficient to share them with everybody, since information is a “non-rival good.”
- (3) We cannot count on robust competition among innovations, as innovations are more likely to complement each other (for example, sequential innovations that build on each other) than to be substitutes for each other.

Because of (3), intellectual property rights will necessarily endow innovators with substantial market power, which will result in inefficient use of innovations (innovators will exercise their market power by setting high royalties to exclude low-value users) and will also prevent innovators from capturing their full contributions, resulting in suboptimal incentives to innovate.

Because of these issues, we must use economic theory to reexamine the foundations of intellectual property rights in a “second-best” world, in which full appropriation is not achievable. The best-known economic theory of property rights is developed by Hart and Moore (1990). However, this theory focuses on investments in “human capital” (which cannot be useful to others without cooperation by the investor), as opposed to “physical capital” or “intellectual capital.”

In work supported by the TNIT, Michael Whinston and I set out to modify the Hart-Moore theory to make it applicable to investments in “intellectual assets,” which we assume to be complementary to each other (such as sequential innovations). We consider a broad class of property rights regimes that includes absolute patent protection on one extreme and common access (e.g., open-source regime for software or an ex ante patent pool) on the other extreme, and which also allows for differential protection of different innovations. We show that absolute property rights generally do not ensure full appropriation: even though such rights would prevent agents from misappropriating the fruits of each other’s investments directly, they give rise to misappropriation via bargaining over the surplus from combining complementary innovations. For this reason, it is often optimal to specify property rights that are less than absolute, permitting some direct misappropriation but reducing the misappropriation taking place through bargaining by a greater amount. When considering the other extreme of “common access” to all the assets (such as “open source” or an “ex ante” patent pool), we find that this cannot be optimal in our model. Instead, with two innovations, when we can vary the strength of property rights protection, it is always optimal for one of the innovations to be protected with an absolute patent, while the other may optimally get weaker protection. Intuitively, it is not optimal to give weaker protection to both innovations because an agent is comparatively better incentivized by giving him the right to exclude others from his innovation than by giving him access to others’ innovations.

Thus, while it is never optimal to give each agent access to the other’s innovation, it may be optimal to



How, why, when, who, **what?**

give one of the agents both the absolute right to his innovation and access to the other's innovation when his investment is much more important or much more responsive to incentives than the other agent's. With more equal importance and responsiveness of the two agents' investments, both innovations should be given absolute protection.

Of course, our model is very stylized. For example, it assumes that the owners of innovations always bargain efficiently towards their joint utilization. Without this assumption, it may become optimal to have common access, which ensures efficient utilization of innovations once they have been discovered. Other simplifying assumptions of the model can also be relaxed. The main point remains: in the absence of the "first-best" / "full appropriation" argument, the design of "second-best" optimal intellectual property rights becomes a delicate balancing act that balances incentives for different innovators (as well as the efficiency of utilization of innovations), and this balancing is greatly sensitive to the details (such as the relative novelty or obviousness of innovations, the elasticity of innovation efforts to incentives, etc.). Thus, economic analysis favors thorough case-by-case legal determination of property rights of

the sort advocated by Lemley (2005), rather than the "one-size-fits-all" approach of Easterbrook (1990) and Epstein (2006).

Easterbrook, F.H. (1990), "*Intellectual Property is Still Property*," in *Property: The Founding, the Welfare State, and beyond - Symposium on Law and Public Policy*.

Epstein, R. (2006) "*The Structural Unity of Real and Intellectual Property*," The Progress & Freedom Foundation.

Lemley, M. (2005) "*Property, Intellectual Property, and Free Riding*," *Texas Law Review*.

Makowski, L., and J.M. Ostroy (2001) "*Perfect Competition and the Creativity of the Market*," *Journal of Economic Literature*.

Hart, O., and J. Moore (1990) "*Property Rights and the Nature of the Firm*," *Journal of Political Economy*.

Segal, I., and M. Whinston (2010) "*A 'Property Right' Theory of Intellectual Property*," working paper, Stanford University.



Seventh bi-annual conference on:



The Economics of Intellectual Property, Software and the Internet

Toulouse, June 5-7, 2013

➔ **THE OBJECTIVE OF THE CONFERENCE**, co-sponsored by the Institut D'Économie Industrielle and the Toulouse School of Economics, is to discuss recent academic contributions to the economics of Intellectual Property, and of the Software and Internet Industries, whether theoretical, econometric, experimental or policy oriented.

For the first time in 2013, this conference will be part of TSE's TIGER Forum (see announcement overleaf), the Toulouse forum on Industry, Globalization, Environment and Regulation, which will include three cutting-edge scientific conferences held simultaneously to foster cross-disciplinary interactions as well as a number of special events.

➔ **TOPICS TO BE COVERED** include (this list is suggestive and not exhaustive; all contributions to our understanding of the new information industries and their impact on the economy in general are welcome):

- The industrial organization of the software and internet industries (competition and regulation, contractual relationships, strategies of firms, demand).
- Issues in intellectual property policy.
- Consequences for growth and employment of the software and internet industries.
- E-Commerce, including jurisdictional issues/taxation and competitive strategies.
- Social networking and Web. 2.0.
- New technologies of information and communication and the organization of firms.
- Standards and intellectual property patents.
- Software platforms as two-sided markets.
- The economics of cloud computing.
- The economics of R&D.
- Internet advertising.
- Public policy towards privacy.

➔ **THE ORGANIZING COMMITTEE** is composed of *Jacques Crémer and Paul Seabright*.

➔ **PROSPECTIVE PARTICIPANTS** are invited to pre-register and/or to submit papers by sending an e-mail to: softint@tse-fr.eu

Papers should be received by 15 January 2013 (abstracts will be considered, but papers are preferred). A decision will be made by 15 February 2013.

➔ **REGISTRATION FEES:** €250 (includes lunches, conference dinner and coffee breaks). Waived for speakers and discussants, special rates for certain other attendees.

FURTHER INFORMATION is available on the conference web page, and more specific information will be sent to those who have pre-registered. Travel on the base of economy class, accommodation and local expenses will be provided for speakers. For further information contact the conference secretariat:

➔ **Florence Chauvet**

Institut d'Économie Industrielle

Université Toulouse 1 Capitole,

Manufacture des Tabacs,

21 allée de Brienne, 31015 Toulouse cedex 6 - France

Phone + 33 5 61 12 86 33 - Fax + 33 5 61 12 86 37

E-mail : softint@tse-fr.eu

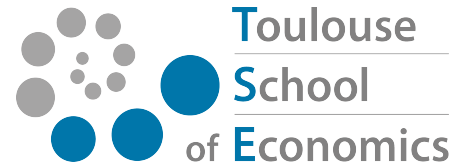
<http://www.idei.fr>





Toulouse
Industry
Globalization
Environment
Regulation

5-7 June 2013
Toulouse, France



5-7 June 2013: TSE launches its TIGER forum!

For the first time in 2013, three cutting-edge TSE scientific conferences will be reunited under a unique label, the TIGER forum, in order to foster cross-disciplinary interactions.



The 2013 TIGER forum will focus on three areas of current concern:

- Information processing in macroeconomics and finance
- Pricing long-term projects and assets in an uncertain world
- The economics of intellectual property, software and the Internet

In addition to the independent programmes of the three scientific conferences, this exclusive forum will gather participants selected from leading corporate executives, academics researchers of international reputation, and top regulators and office holders around a sequence of policy-oriented lectures, workshops and round tables, in order to promote the exchange of ideas and brainstorming on new tools for economic decision-making.

Further highlights will include award ceremonies (Jean-Jacques Laffont Prize), gala dinners and a rich cultural programme. So don't miss it, more information coming very soon!

We strongly believe your presence will add much value to this forum and sincerely hope that you will be able to participate.

Please save the date, and let us know at your earliest convenience if you can join us.

We look forward to seeing you in Toulouse!

Yours faithfully,

Jean Tirole
President, TSE

Christian Gollier
Director, TSE