

TOULOUSE
SCHOOL OF
ECONOMICS

A HUMAN ADVENTURE

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Students taking a break in the TSE courtyard.



PREFACE

What a pleasure it is to write these few words about those who made the TSE miracle possible; my dear friends, Jean-Jacques Laffont and Jean Tirole !

I first met Jean-Jacques Laffont in 1970 when we were both students at Harvard University. Jean-Jacques was a first year doctoral student and I was a fourth year student. We met regularly during the lively QJE seminars led by Jerry R. Green, where we discussed recent submissions to the Quarterly Journal of Economics (within which many of our critiques were eventually included as referee reports). There were four participants in these meetings: Elhanan Helpman,¹ Robert Cooter,² Jean-Jacques, and myself. You can imagine the exceptional and engaging character of these meetings, of which I was not really aware at that time. Unfortunately, I didn't take advantage of this time when we were together at the same university to work with Jean-Jacques, unlike Elhanan. Together they wrote a novel analysis of moral hazard and adverse selection in the case of general equilibrium. Furthermore, Jean-Jacques' work with Jerry Green on incentives in the public decision making process earned him his first instance of international recognition.

After his PhD, Jean-Jacques returned to France and taught for several years at the École Polytechnique and the University of Amiens. It was during this period that I started working alongside him. I recall that we had such good times together, especially during our holidays on the Costa Brava and in Lacanau.

1. Elhanan Helpman is currently Professor of International Trade at Harvard.

2. Robert Cooter is currently Professor of Law at Berkeley.

Since his departure from Toulouse, Jean-Jacques has not stopped wanting to return there. For a researcher of his calibre, and with the magnificent career that lay before him, this desire was somewhat out of sync with the norm. Paris was the city of stars in the world of economics. Nonetheless, despite the advice of us all, he decided to return to Toulouse in 1978, and immediately began to work on the major project of his life: to help the Toulouse economists to gain worldwide recognition.

In 1981, he founded the Groupe de recherche en économie mathématique et quantitative – a research group in mathematics and quantitative economics (GREMAQ) at the University of Social Sciences in Toulouse. Following this he reached another milestone in 1990 with the creation of the Institut d'économie industrielle – the institute of industrial economics (IDEI). His extraordinarily engaging personality allowed him to attract a large number of talented economists to Toulouse. He developed an innovative model that relied on the financial support of private partners in a country where academic institutions are mainly supported by the State.

In order to put such a project in place – while continuing to carry out his own research programme – Jean-Jacques Laffont could rely on another of his talents: his formidable powers of concentration. One day while I was waiting at the Logan Airport in Boston, I saw him sitting in the departure lounge. His flight had been delayed and he had taken the opportunity to do some work, making calculations on one of the blocks of graph paper that he used. He had not seen me, of course, so in order to have a little fun I quietly walked forward and stood right in front of him. More than five minutes passed before he noticed my presence.

Certainly hard work and concentration alone are not enough to establish a research centre such as Toulouse School of Economics (TSE). In order to attract talent and funding, a certain charisma is essential, and for Jean-Jacques this was a natural part of who he was. Who could resist his big smile, his warm personality, and his limitless enthusiasm, especially when it came to his wife Colette's homemade *foie gras*, a game of tennis before lunch or reading the latest article on the subject of incentives?

In addition to these extraordinary qualities, Jean-Jacques had a weapon – his little secret – to guarantee the success of TSE: Jean Tirole. I first met Jean Tirole at the Massachusetts Institute of Technology (MIT) in 1978 where he was completing his postgraduate studies and I was a young assistant professor. Together with his classmate, Drew Fudenberg,³ he took several of my classes and they both eventually completed their PhDs with me as their supervisor. In fact, they were my first PhD students, which caused me a few problems later on, as having no one to compare them with at the time I naturally assumed that all students were like them. Obviously, this was not the case.

After completing his thesis, Jean Tirole returned to work for a few years at the École nationale des ponts et chaussées in Paris. Within a short time, MIT contacted him and offered him a professorship. He could have enjoyed a good life there had it not been for the well-known magnetism of his colleague and friend, Jean-Jacques Laffont. He eventually made his choice, and in 1991 he came to IDEI and to the pleasant surroundings of Toulouse where he settled with his family.

3. Drew Fudenberg is currently Professor of Economics at Massachusetts Institute of Technology.

Up until the death of Jean-Jacques in 2004, they were the two pillars of IDEI: Jean-Jacques as the Director, and Jean as the Scientific Director. They developed the economic research programme in Toulouse so well that TSE now has more than 150 researchers, 250 postgraduate students and 100 doctoral students. Currently, the RePEc (Research Papers in Economics) places the School 10th in their classification of the most important schools of economics in the world.

Jean-Jacques and Jean began working together in the early 1980s. Inspired by the increased interest of Europe and the US in the control of natural monopolies, they produced a series of important articles on regulation, a large part of which was consolidated in their 1993 treatise, *A Theory of Incentives in Procurement and Regulation*. From there, they collaborated with Patrick Rey on the nature of competition between interconnected networks: work that inspired their political monograph published in 2000, entitled *Competition in Telecommunications*.

Until I met Jean Tirole, I had encountered few people with the energy and creativity of Jean-Jacques Laffont. Throughout our collaboration – going right back to when he was a student at MIT – I was surprised by the speed at which Jean-Jacques worked. Many times in the evenings we divided up our remaining work and I would discover the next morning that Jean had already quite brilliantly completed his share. My only regret in relation to our collaboration is that it leaves me with the impression of being slow.

In 2014, Jean alone received the Nobel Prize in Economics for his research into regulation and the power of the market. However, a glance at the report prepared by the board members of the Nobel Committee is enough to appreciate that they specifically recognise the collaboration of Laffont and Tirole. Undoubtedly, if

Jean-Jacques Laffont had still been with us, he would have shared that tremendous honour, proudly carrying the colours of TSE before the eyes of the world.

Eric Maskin

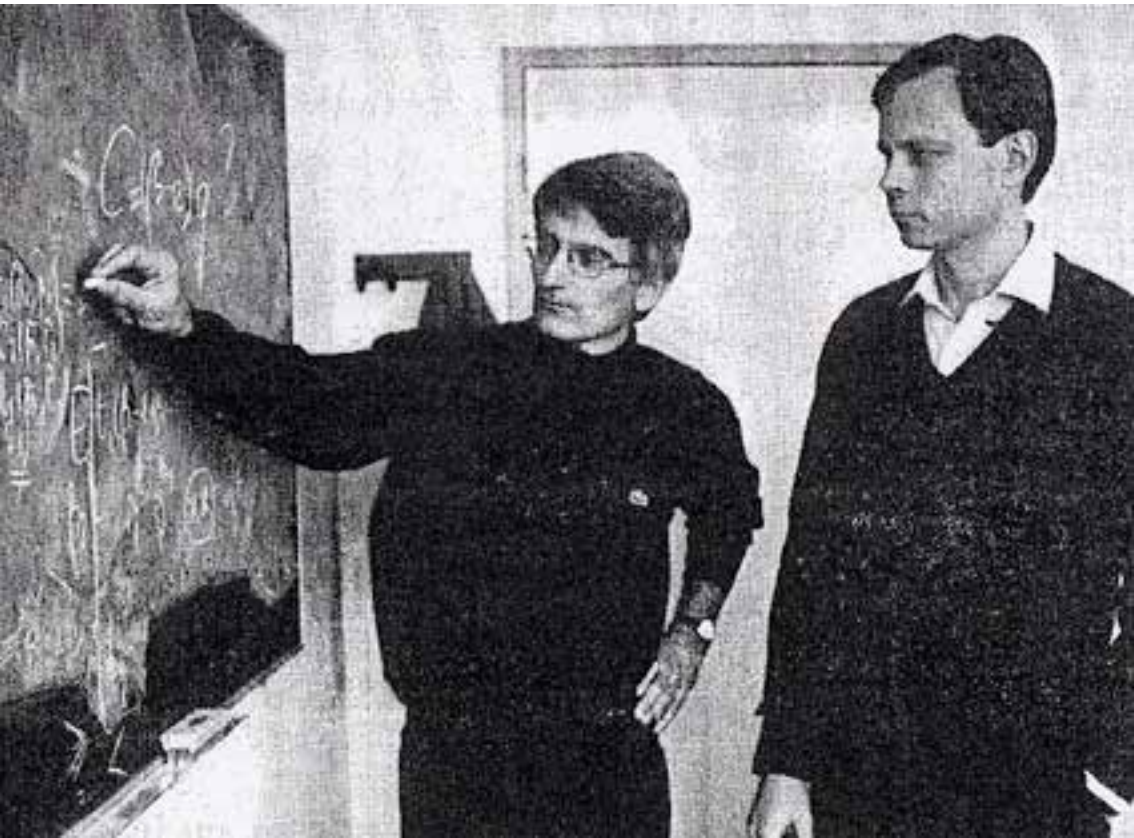
Harvard professor and American economist, Erik Maskin is Co-Laureate of the Bank of Sweden Prize in Economic Sciences, in memory of Alfred Nobel, with Leonid Hurwicz and Roger Myerson.

THE ORIGINS OF TSE

Visionary Spirits

Jean-Jacques Laffont: “We will create it all!”

Scene one: Toulouse, spring, 1978. Jean-Jacques Laffont, a young economics researcher with a doctorate from Harvard University, who has already been identified as one of the most brilliant of his generation, has returned to his homeland of France. With his wife Colette and their children, they have come to spend the Easter holidays with their families, away from the University of Amiens near Paris where he has recently been appointed Professor of Economics. In the course of his stay he meets with his old friend Georges Molins-Ysal,¹ his study companion from the 1960s. During a car journey together, Jean-Jacques tells Georges of his wish to find a job in Toulouse. Startled, George brakes suddenly, pulls over to the side of the road, and turns to his friend. He cannot believe what he hears. “What? You want to return to Toulouse? But what are you going to do? There is nothing there in your discipline; it’s nowhere near your level!” But Jean-Jacques is determined: “It doesn’t matter. We will create it all, and then there will be!” Barely 30 years old, and with the habit of often saying, “To me, Toulouse is my America”², this casual conversation became the catalyst that initiated the undertaking of his lifetime, and that of many of his future colleagues: the creation of a world-class higher education and economics research centre on the banks of the river Garonne, able to stand as an equal alongside the most prestigious universities in the world.



Jean-Jacques Laffont (left) and Jean Tirole at work in the Toulouse 1 Capitole University.
Taken from an article in *La Dépêche du Midi*, 1992.

1. Georges Molins-Ysal has since become Professor of Economics at the University Toulouse 1 Capitole.

2. « *Toulouse c'est mon Amérique à moi* »

Jean Tirole: Nobel recognition

Scene two: Toulouse, 13 October 2014, late morning. On a radiant autumn day, Jean Tirole is finalising a European research project in his office at the Manufacture des tabacs, Toulouse. The President of Toulouse School of Economics realises that he has missed two calls with the prefix 46 (Sweden) on his mobile phone. He answers the third call: it is Sweden calling again. The caller tells him that he has been awarded the 2014 Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel. The jury has chosen to reward this prize to “one of the most influential economists of our time” Jean Tirole, for his analysis of market regulation. The Nobel Prize...

For some time now, Jean Tirole had been listed as one of the most likely potential contenders for the prize, although at 61 years old he was still generally considered to be a little too young. With this award – the highest in economics – Jean Tirole became the equal of other Nobel Prize winners in economics: Paul Samuelson, Friedrich von Hayek, Milton Friedman, Ken Arrow, amongst others, and closer to home, Joseph Stiglitz, Eric Maskin and Paul Krugman. No other Frenchman (or Frenchwoman) had been crowned in Economics by the Swedish Royal Academy of Science since Maurice Allais in 1988. For TSE, this was the pinnacle of success. The Toulouse research centre had without doubt entered into the “big league” of the most prestigious universities in the world, alongside MIT, Harvard, Yale, Princeton, Chicago, Berkeley, and so on.

This prize not only rewarded an undisputed personality in the world of economics but it also paid tribute to an entire research centre and over 20 years’ work by its team.

After the initial emotion upon hearing the news had subsided, Jean Tirole’s first words at the press conference following the announcement of the prize were for his friend and fellow researcher, Jean-Jacques Laffont.

It was he who had made the Nobel Prize possible for Jean Tirole, who, since 1991, had deliberately held the position of researcher/teacher within a French university rather than a position in the United States. Had Jean-Jacques Laffont not died prematurely in 2004 at the age of 57, it is widely believed that he would have also seen his name added to the list of winners of the coveted Nobel Prize.

Less than 40 years separated these two scenes. Almost 40 years, during which time the research centre had risen to challenge the very frontiers of knowledge, joining an exclusive group as one of the world’s leading economics departments. A rise that was most certainly made possible thanks to the audacious vision, energy and charisma of a man who was able to provide substance to his ambitious dreams. In addition, thanks was due to a number of people with a formidable level of scientific and intellectual effervescence, starting with Jean-Jacques Laffont and followed by Bruno Biais, Jacques Crémer, Jean-Pierre Florens, Christian Gollier, Bruno Julien, Thierry Magnac, Thomas Mariotti, Patrick Rey, Jean Tirole, and many others. If they were not yet known to the wider public, they had most certainly been hailed for years within international academic circles. The Nobel Prize, which rewarded an exceptional economic scientist as an individual, also collectively recognised Toulouse School of Economics, and consolidated the many prestigious awards from around the world already bestowed upon its researchers. This award validated the vision and foresight of one

man and his team – comprised of many internationally renowned researchers – who had chosen the “adventure” of Toulouse over other large Anglo-Saxon universities. Indeed, these two words with their charmed sound, the Nobel Prize, were greeted with pride, and a certain (yet not unexpected) degree of surprise in a country where this type of entrepreneurial enterprise was often regarded with restraint.

A journey full of obstacles

And yet... When Jean-Jacques Laffont announced his plan to Georges Molins-Ysal, few people could have predicted such a monumental outcome. Within himself, Jean-Jacques did not lack the conviction or self-assurance to be able to confidently state that he would one day create an entity such as TSE. While he particularly wanted to return to Toulouse, at the same time he did not want to relinquish his intellectual ambition. Indeed, the idea he had in mind could only be the best within the university. He was about to embark on a journey full of obstacles that must be overcome, one by one; a human and scientific feat of epic proportions that would ask him – over and above his normal level of output – to demonstrate daily his talents as an entrepreneur, strategist and leader. This chosen pathway would be even more complicated, as other similar courageous attempts had struggled to take root in 20th century Continental Europe leaving the field open to Anglo-Saxon institutions. If Europe had formerly “held its own” in terms of international scientific competition before the Second World War, the second part of the 20th century saw the triumph of American and British universities, which were based on very different academic principles. Universities in the US, both then and now, fiercely compete to attract the best researchers, the best teachers and the best students, while at the same time contributing towards students a significant proportion of their costs required for their education.

To appreciate the reaction of Georges Molins-Ysal to Jean-Jacques’ proposal and the inevitable difficulties that would arise, we must remember what the academic world was like in the 1970s.

The university world of the 1970s

For Jean-Jacques Laffont, the situation was not straightforward. Egalitarianism in academia and the endorsement of higher education were values that were very much in vogue in Europe at the time, particularly in France, and often at the expense of attempts to defend scientific excellence at the level of international competition. It was in this context, and against the advice of all, that Jean-Jacques Laffont decided to attempt his pioneering trial.

The teaching environment of economics in Toulouse in the 1970s was presented as an agreeable setting within a provincial department of economics, supported by a system which perpetuated itself from generation to generation, while remaining somewhat wary of innovation. Even so, some scientists, such as Professors Henri Caussinus,³ Georges Létinier and Jean Vincens⁴ continued in their attempt to organise a research agenda at the highest level.

In the city of Toulouse, where the university tradition dates back to the Middle Ages, the possibilities for excellence available to the aspiring economist were few. To pursue a research career in France worthy of its name required time spent in Paris, at the very least. Even better was to aim for Harvard and MIT – both situated on the banks of the Charles River in Cambridge (Boston, USA), which even then were the two leading global centres in the field. Unlike the French system, major economics departments in the US, England, Germany, and Switzerland are, for the most part, situated in locations other than capital cities.⁵

3. Professor at the Université Paul Sabatier (Toulouse), he created, in 1985, with Jean-Jacques Laffont the “Magistère d’économie statisticien” (cf. p. 84).

4. He was the first Director of the Unité de formation et de recherche – training and research unit (UFR) of Economic Sciences during the creation of the University of Social Sciences following the Faure Law. He was at the same time Director of the Institut d’Étude et d’Emploi – institute of study and employment (now known as the LIRHE). It was also he who brought Georges Molins-Ysal from Canada. The latter would succeed him as Director of the UFR.

5. The exceptions are the University College London and the London School of Economics, and

The foundation of a research centre

Economics is a relatively young subject in French universities, where its teaching was introduced only after the Second World War. This discipline, considered to be “unclassifiable”, was initially considered in terms of political economy before being attached to the Faculty of Law. Toulouse 1 Capitole University (formerly Toulouse 1 University) housed within itself a department of economics, which was seen as the “poor relation” in respect to the more prestigious law schools, and without the necessary resources to approach the standards of the best overseas universities. This situation provided little incentive for young lecturers who taught there and who were given only minimal guidance in their research projects. Already present amongst them were Michel Moreaux, André Grimaud, Claude Crampes, Marc Ivaldi, and Bernard Belloc, who, thanks to Jean-Jacques Laffont and his vision, regained their motivation and came to form the lifeblood of TSE and the new school.

An outdated system, a poorly valued subject, modest means, and an outlying city in a centralised country: only an exceptional personality could hope to tackle such an immense challenge, with so many scientific as well as organisational issues. And the man who chose to meet this challenge – while abandoning the comfortable life of a researcher as promised to him in America – most certainly had the intellectual means to match his ambitions.

Columbia New York University in the United States if the remark is extended to economic capitals. These elite departments, however, are not amongst the world’s top eight economics departments.

Jean-Jacques Laffont: an outstanding personality

A brilliant academic career (1968-1995)

Born in 1947 in Toulouse, Jean-Jacques Laffont owed his unmistakable taste for climbing mountains to his father's family, who originated from the Ariège in the Pyrénées. During holidays spent at the family cottage, his father also passed on to him the qualities of patience and conviction, and a resolute will necessary to reach the greatest heights. It was from these formative years that he developed his propensity to meet challenges, to excel and to transmit the same desire to others. During the ceremony where he was made a Knight of the Legion of Honour of France in 1991, Jean-Jacques Laffont's first words were for his family, especially his grandmother: "It was she who very early on gave me her extraordinary taste for knowledge, and self-study."

After a remarkable period of schooling at the *Lycée Pierre-de-Fermat*, he began a double major in economics and mathematics at the Faculty of Sciences in Toulouse, where he met his future wife, Colette. In 1968, he was admitted to the second year at the National School of Statistics and Economic Administration (ENSAE) in Paris. He followed the teachings of Edmond Malinvaud, the world famous French economist who headed ENSEA and then INSEE in the 1970s and 1980s, and Paul Champsaur, who also directed INSEE before chairing the *Autorité de régulation des communications électroniques et des postes* – the regulatory authority for

« Today in Toulouse,
I'm dreaming of living, one day,
in the biggest university
of South Europe. »

Jean-Jacques Laffont



electronic communications and posts (ARCEP) and the Authority for Official Statistics. As the Assistant Professor of Mathematics at the *Université Paris-Dauphine*, Jean-Jacques Laffont was one of only a handful of French economists to test his theories with data and econometric tools, the calculations of which required the use of a centralised computer system. At a time when computers were not yet commonplace, his friend and colleague Jean-Claude Demerson and he were among the first to experience using these “gigantic modern monsters”. He then took steps to incorporate a PhD (doctorate) course into his studies at a university in North America. In 1972, and having been accepted by many of them, he chose Harvard, where he studied under the direction of Kenneth Arrow, who that same year had been awarded the Nobel Prize in Economics. He also followed the seminars of Jerry Green and forged links with other future famous names in economics, such as Eric Maskin, who was awarded the Nobel Prize in Economics in 2007, and Elhanan Helpman. Just as he began his thesis, Jean-Jacques Laffont was obliged to interrupt his studies in order to complete his military service with the French army. Nevertheless, in the end he returned to his studies, and wrote three essays on different topics, a form that eventually became the standard methodology in France. Unlike Anglo-Saxon countries where doctoral students produce a thesis comprising three chapters, each of which may be published in scientific journals, the French standards of the time enforced the writing of hundreds of pages, commencing with a substantial review of the existing literature. This format did not lend itself to publication and implied a very literary approach to economic science. His resulting thesis was completed in less than three years, even with the constant travelling to and from the University of Montreal where he carried out his military obligations.



Jean-Jacques Laffont received the *médaille de chevalier de la Légion d'honneur* in 1991.

For this he earned the prestigious Wells Award for the Best Thesis at Harvard, across all disciplines.

Several American universities then offered him attractive projects in order to enable him to pursue his career in the United States. He declined these offers for two reasons: first, on a personal level, due to the impending birth of his first child; and second, due to his professional ideal which was to return to his homeland of France. In 1975, Jean-Jacques returned to Paris. He became a lecturer at the *École Polytechnique* in the department of Claude Henry,⁶ and a researcher at CNRS. It was also at this time that he met Nicholas Stern, a British economist and member of the Scientific Council of TSE who would go on to write the famous 2006 report on the economics of climate change (Stern Review on the Economics of Climate Change), after his role as Vice President of the World Bank. He also met Jacques Crémer, who would become the Director of IDEI from 2003 to 2007 and Scientific Director of TSE from 2011 to 2014.

His return to France did not prevent Jean-Jacques from continuing to work with several North American universities such as the University of Montreal, where he struck up a friendly scientific relationship with Marcel Boyer.⁷ As a result of this interaction, Jean-Jacques Laffont was instrumental in the development of the economics department at the University of Montreal.

With the commencement of a new system of equivalency between universities, the thesis Jean-Jacques Laffont obtained at Harvard was

6. A physician who became an economist, Claude Henry worked at the *École Polytechnique* for over 30 years as a professor and director of the econometrics laboratory. During this period, he was co-editor of the *Review of Economic Studies* and then of the *Journal of Public Economics*. A member of the Economic Analysis Council under Prime Minister Lionel Jospin from 1997 to 2002, he is currently the Professor of Sustainable Development at Sciences-Po Paris and at Columbia University (New York), Chairman of the Scientific Council of the IDDRI, member of the *Academia Europaea*, fellow of the Econometric Society and silver medalist of the CNRS.

7. TSE Associate Member and Professor Emeritus of the Department of Economics, University of Montreal.

recognised as an economics thesis in France. However, in order for him to secure a teaching position within a French university it was necessary for him to take an *agrégation* examination of higher education held before a disciplinary panel selected by the Ministry of Higher Education. After completing the *agrégation*, the candidate could then choose a job based on their ranking and the availability of positions.

Jean-Jacques Laffont succeeded in this examination on his first attempt, with the pivotal support of Georges Molins-Ysal who was an examining member for the oral exam. Applicants had 24 hours to prepare a topic drawn at random. On discovering the subject, “Is development also a political problem?” Jean-Jacques was despondent. As exciting as the subject matter was, it was completely outside his realm of knowledge.⁸ His first reaction was to leave the preparation room, which he did. However, he was brought back by Georges Molins-Ysal, who, after having literally chased him through the corridors of the *Panthéon*, managed to dissuade him from giving up. The chase was well worth it as he was awarded second place.

The opportunity of a position led him to Amiens. This proximity to the capital allowed him to live in Paris while continuing his research at the economics laboratory of the *École Polytechnique*. However, Jean-Jacques Laffont had planned that his stay in Amiens would be short lived, as he was eager to return to his native South of France. In 1979, he finally returned to Toulouse and laid the foundations of what three decades later would become Toulouse School of Economics.

8. This, however, was a theme to which he devoted a lot of work towards the end of his career.

First internationally recognised theories

Throughout this time, what interested this young professor and would continue to motivate him throughout the course of his life was his passion for research. The period was now ripe for the complete renewal of the scientific agenda of economics, and in this he played a vital role. At that time, Jean-Jacques Laffont was an extremely high-level economic scientist, whose contribution to economics – which would eventually include 15 books and over 200 articles published in renowned international journals – was already substantial. This scientific excellence recognised by his peers was the first and the best argument for those who followed him, and the most solid foundation upon which to ambitiously build his new organisation.

Jean-Jacques Laffont was part of the group which revolutionised economics in the early 1970s by developing incentive theory. In his collaborative work, first with Jerry Green on the Groves mechanisms for the management of public assets⁹ and later with Eric Maskin and Roger Guesnerie, the problems of information that affected the regulatory authority's actions were highlighted. He focused his research on the use made by companies of the data that they held and the strategies they adopted in the course of their commercial activities.

9. Public assets cause the following problem: everyone wants to take advantage of them whilst seeking to limit of contribution to their financing. This is the case for an urban infrastructure or actions taken for the environment. The main issue is to reveal the willingness to pay of the different stakeholders. If the public asset is paid for by third parties (the State budget, for example), then all of the beneficiaries will overestimate what that public asset brings to them in order to support the interest in the project. Conversely, if they are told that they will pay what they declare to be their willingness to pay, all of them will underestimate it. The Groves mechanism allows the honest revelation of the willingness to pay.

In the late 1970s, whilst continuing to work with Jerry Green, Eric Maskin and Roger Guesnerie, Jean-Jacques Laffont developed the theory of resource allocation mechanisms in the presence of information asymmetries. This theory allows for the identification of the best arrangements between partners when one holds relevant information that is unknown to the other, and where there is a risk that those with privileged access to this information may abuse it. In 1977, an article by Jerry Green and Jean-Jacques Laffont shed new light on the problem of the “stowaway” or “free rider”. These are terms used to describe economic operators who wish to benefit from the goods and services provided in the interests of the community (such as the police or public transport) but who prefer to leave the task of financing to others. These works were assembled together in a book published in 1979, *Incentives in Public Decision Making*.

From this foundational research, multiple applications were developed: in the field of auctions (an area of research for which Jean-Jacques Laffont retained his passion for study throughout his career), the regulation of public companies and even mechanisms for regulating the economy of public assets. In particular, these applications envisaged the various modalities of state intervention in order to address some of the shortcomings of the market economy when resource allocations are particularly deficient (for example, during financial crises).

Another important part of the scientific output of Jean-Jacques Laffont arose as a result of his collaboration with Jean Tirole. In their 20 years of joint research, they built a theoretical framework developing a new approach to public intervention and regulation. In two fundamental works, *A Theory of Incentives in Procurement and Regulation* (1993) and *Competition in*

Telecommunications (2000), both authors offered almost exhaustive views, where they took into account the limited information public authorities (including regulators) have in terms of the companies they control. Public authorities are aware that these companies can strategically exploit this informational advantage. The work of Jean-Jacques Laffont and Jean Tirole in this area explains how and why it is in the interest of public authorities to consider this informational advantage, by creating a unified framework for the supervision of regulated companies and public procurement. The foundations of information theory were thus assembled, and at the same time a “new public economy” was born, which spoke directly to the public authorities. This work remains internationally acclaimed.

As an extension of this research, Jean-Jacques Laffont took an interest in organisation theory¹⁰ alongside Jean Tirole and former student, David Martimort. The themes of corruption and the capture of regulators by lobbying groups became subjects of interest from that time on. Through their studies on collusion, they examined the manoeuvres used by subgroups acting within organisations. This new branch of incentive theory took into account the possibility of hidden re-negotiations and secret transfers between economic agents, against which institutions represent a defensive stronghold. By opening up different perspectives in organisational sociology and political economy, these studies have had, and will continue to have, a profound impact on the social sciences. Laffont’s book *The Theory of Incentives: The Principal-Agent Model* co-written with David Martimort remains a central reference work on incentive theory.

10. Cf. p. 48

Jean-Jacques Laffont also played a key role in opening up network industries to competition and to the deregulation of this sector, developing new models with Patrick Rey and Jean Tirole. Their book and articles on the economic modalities of the interconnection between telephone and Internet networks, which decipher the telecommunications revolution of the last decade of the 20th century, remain an essential work of reference in the field.

Jean-Jacques Laffont covered such a wide spectrum of research that he became an authority both in theoretical economics and applied economics. Some of his early writings still serve as reference works on these subjects. An article co-authored (with Dale Jorgenson) in 1974 puts forward a method of estimating nonlinear models, and is still used today by many statistical analysis and econometric software programmes. It extends the macroeconomic analysis of imbalance, while his research in econometrics has the parallel goal of perfecting his examination of information theory.

From the 1980s, Quang Vuong became one of his key research partners, particularly in the econometrics of panel data. Their comprehensive studies, which were notably complemented by a remarkable collaboration with Farid Gasmi on the detection of illicit cartels, had multiple practical applications, and constituted one of the foundations of the new empirical industrial economics. In conjunction with Hervé Ossard, a pioneer in the econometrics of auctions, Jean-Jacques Laffont was one of the first to understand that it was possible to compare incentive theory with data. Together they published two important articles (in 1995 and 1996) which confirmed the assumptions which had been made in information theory. Jacques Crémer

said of this work: “I always found it amusing that he [Jean-Jacques Laffont] worked with Quang Vuong and Hervé Ossard on the aubergine auctions in Marmande, less than two hours from Toulouse, on the road to Bordeaux.”

Reconciling work and relaxation, leisure and reflection

In order to paint a better picture of Jean-Jacques Laffont’s unique personality, we must remember that he was a friendly and approachable man, far removed from the image of a self-contained researcher concerned only with his work. He was a spirited, fun-loving person with a lively approach to each of his goals. A wine tasting would become a blind tasting contest between friends. A walk in the desert, a place he particularly loved, would become more exciting if one tried to discover flowers there. And it was better not to have too much hope of victory when facing this formidable chess player. As a loyal Toulousain, he was particularly inspired by rugby. The esprit de corps, with each player in his position, each making the most of their skills and playing towards the same goal: these were values that resonated with him and also proved indispensable to his institutional work. He knew how to reconcile work and relaxation, leisure and reflection, and his mind was constantly alert and curious about everything. Jean-Jacques Laffont knew how to enjoy life, and was always in contact with his family, Colette and their four children, and with his friends and colleagues.

To celebrate his 50th birthday in 1997, the entire research team, with their families, and staff travelled to Tataouine in southern

Tunisia, invited by one of his Tunisian co-authors. The agenda of activities included brainstorming of the long-term strategy of the group, a 4x4 drive and trek in the desert, a night in a Bedouin tent and, of course, intense scientific debates. When the start of an airline strike threatened to ruin the trip between Tunisia and Toulouse, Jean-Jacques Laffont found an emergency back-up plan. After a few phone calls, he successfully organised transport for his whole team to Roissy Airport instead.

A desire to change the world

Each of Jean-Jacques Laffont’s recommendations in economics have made it possible to develop effective regulatory mechanisms; the objectives of which have always been accompanied by the means to prevent them being diverted for the profit of a few. The French economist Thomas Piketty wrote, “Jean-Jacques was a liberal in the sense that he believed in competition. But he was wary of laissez-faire economics because he knew only too well that competition must be regulated.” Bernard Belloc, President of the University Toulouse 1 Capitole from 1998 to 2003, added, “It is precisely by thinking about this regulation and by questioning the structure and organisation of institutions responsible for education that Jean-Jacques has gradually become interested in the organisations and the effectiveness of institutions. [...] As some economists have developed the theory of imperfect competition, Jean-Jacques has developed the theory of the imperfect state.”

During the last 10 years of his life, Jean-Jacques Laffont intensified his efforts in the field of development economics, as he was

greatly concerned by the difficulties facing the poorest countries. In relation to institutional requirements in particular which necessitate “the challenges of growth and development”, he believed that public policy should be based on the tools of the theory of incentives, tailored to specific cases. However, at the same time, analysis by the World Bank and the International Monetary Fund (IMF) were greatly confined to macroeconomic approaches. He then devoted his energy to this so far little studied area of research, and to training managers in developing countries. As a great observer of reality, he was concerned about the damage caused to people by gaps in structural reforms and their laborious implementation. Working specifically in the health sector, he sought to overcome these deficiencies by means of more efficient and effective organisation.

Without doubt, Jean-Jacques Laffont has a large number of achievements to his credit, with one of the most outstanding being the establishment of research and training centres in several countries, including the Ivory Coast. He helped to organise an education sector of quality and to improve the education of those in senior management roles. He also worked with major international organisations such as the World Bank and the IMF. The depth of his understanding of economic theory developed throughout his career, and combined with his generosity of spirit and innate humanity, found a tremendous field of application in development economics. Not long before his death, he took the time to read the proofs of his latest book *Regulation and Development*, which was a synthesis of his work and ideas in this field.

This incomplete overview of the rich work of Jean-Jacques Laffont provides us with an idea of his consistent and exemplary scientific



Jean-Jacques when he received the CNRS silver medal in 1990.

career. Throughout all fields – his theoretical work, his applied and quantitative research, his advice to policymakers and the industry partners who consulted him – he worked tirelessly to create a modern vision of the economic and social role of the State, of the efficacy of its interventions, as well as highlighting their limitations. Over the years he became an undisputed specialist in public economics and information theory. To measure the importance of this leading economist, one need only cite some of the awards and honours that were bestowed upon him: Honorary Member of the American Economic Association, President of the Econometric Society (the most prestigious association of economists in the world), Honorary Foreign Member of the American Academy of Arts and Sciences, President of the European Economic Association, CNRS Silver Medal recipient in 1990, the Yrjö Jahnsson Prize for the European Economic Association, in conjunction with Jean Tirole the same year, and so on. Tragically after a period of illness, Jean-Jacques Laffont died of cancer at age 57 on 1 May 2004, well before his time. Countless economists and leading personalities from around the world paid a deeply moving tribute to him. They recalled his outstanding career and the undeniable contribution of his research, and underscored his active participation in building a better world with more effective institutions for greater equity and justice. Erik Maskin delivered a fine speech at his funeral Words for Jean-Jacques: “Jean-Jacques Laffont was my friend. We first met 32 years ago when we were grad students together. On an occasion like this, it’s impossible for me to express all that he means to me. So let me just tell you about a small incident that occurred when my wife Gayle and I were visiting J-J and Colette during their summer vacation at Lacanau. This would have been sometime in the early 80’s.

Jean-Jacques had decided that after dinner we were going to play the word game *Scrabble*. This is a game in which you try to make words by placing tiles with letters on a board. But in his typical imaginative and exuberant fashion, this wasn’t going to be ordinary Scrabble; it was bilingual- any word in English or French was allowed.

Well, at one point I decided to add a Q and a U to an E already on the board to make the word *que*. Not very exciting. But in Scrabble, playing a Q is worth 10 points, so it wasn’t such a bad move. And after all, it was a French word.

Next, it was Colette’s turn, and she did something extremely clever. She wanted to make use of the Q that I had played but she didn’t have any U’s. Now, in English, a Q in any word must be followed by a U. But in French there’s actually a word with a Q and no U: *coq*. And that’s what she played, which was greeted by an enthusiastic round of applause from the rest of us.

But then it was Jean-Jacques’ turn. I could tell he was up to something tricky because he had this devilish glint in his eye. And indeed, I was right. With great panache, he proceeded to lay down all 7 tiles from his rack – giving him a huge bonus – M, A, G, N, I, F, I. This plus my own pathetic little *que* spelled *magnifique*.

Well, we had to stop playing at that point. How could we possibly continue after such a stroke of brilliance? But looking back on this episode, I can’t help thinking how fitting it was that the game ended this way. Because that’s just the right word for Jean-Jacques - *magnifique*.”

The outstanding distinction of his scientific journey, as brilliant it may have been, was not sufficient to explain Jean-Jacques Laffont’s success, which was by nature a collective

effort. He could have been content to conduct his research in Toulouse or elsewhere, and to advance science through his pivotal discoveries. This would have been in itself a wonderful achievement. Most people in his place would have been well satisfied, but he was deeply motivated by an additional ambition and inner strength. “In fact, Jean-Jacques wanted to change the world. And he succeeded,” recalled Jacques Crémer, who was one of his collaborators throughout his adventures. He succeeded because his human qualities gained the support of his associates, the institution, and ultimately, all of those who worked with him. Against the odds, he chose to build his project in Toulouse, using the boundless energy and motivation for which he was known, his unbending will and powers of persuasion, his great charisma, and his tremendous audacity. These are all characteristics of a great leader, allied with a genuine depth of character. Likewise, he believed that the objectives of his scientific work were to correct the excesses and deficiencies of today’s world through public action, and to participate – in his own unique way – in understanding and transforming the world. In his daily life he was generous and selfless. As an illustration of his humanist vision of life, Jacques Crémer describes this revealing episode:

“When Jean-Jacques began working on development economics, Estache Antonio, who worked at the World Bank, told him about the need to teach regulatory courses in Africa. Jean-Jacques reacted immediately: ‘Get me a ticket and I’ll take care of it,’ he said, without even thinking to ask for a fee or any other compensation.”

This was an experience that was to prove a major source of scientific inspiration and public action for him during the last decade of his career.



Jean-Jacques Laffont and Jean Tirole were the first to receive the European Economic Association (EEA), Yrjö Jahnsson Prize in 1993, for their collected works.

Collective strength

The same team spirit

In all of his endeavours and projects, Jean-Jacques Laffont knew that he could count on the unwavering support of his wife, Colette. Constantly present by his side, she would play a discreet but crucial role in his success. The second pillar on which he could rely was the collective strength of his team. A research centre worthy of its name could not rest on his shoulders alone. In order to succeed, he knew he must form a group within which he would recreate the atmosphere and intellectual rigour that he had known elsewhere. Always on the alert, he had remained in contact with the best American universities and returned every summer to Harvard with a collection of new projects. Eric Maskin remembers that each year when they met again Jean-Jacques Laffont's first questions were always focused on new ideas that had emerged since his last visit. The plan he had in mind was to bring to Toulouse those who shared his innate values of scientific excellence, academic entrepreneurship, and empathy. He knew that he must have the best possible teachers and researchers in an internationally credible atmosphere. It was essential that these figures should be driven by the same team spirit, and, in particular, to be fully aware that they were participating in an exceptional project in the French academic landscape. Indeed, a handful of teachers and researchers were already present at the University Toulouse 1 Capitole when Jean-Jacques fulfilled his dream to return. They included Michel Moreaux, who he had noticed several years previously when he was a young student, Bernard Belloc, Claude Crampes, André

Grimaud, Marc Ivaldi and, of course, Georges Molins-Ysal. These pioneers would remain unreservedly loyal to him. Other recruits from prestigious Anglo-Saxon universities would further enhance the group, better known later on as the “Toulouse economists”. In 1989, Jean-Jacques Laffont met David Martimort, a brilliant student at the *École Polytechnique*, who expressed his desire to study economics alongside him in Toulouse. Jean-Jacques saw this as another significant step forward, which filled him with immense satisfaction. The arrival of David Martimort marked the beginning of a fruitful collaboration, built on intense intellectual ties enriched with a deep and sincere friendship. Later there followed other doctoral students with remarkable academic careers, such as Emmanuelle Auriol, Ingela Alger, Wilfried Sand, and Stéphane Straub.

The creation of a great scientific duo

Jean Tirole played a decisive role in the following stages of the development of the Toulouse school, and subsequently, the creation of Toulouse School of Economics. Six years younger than Jean-Jacques Laffont, Jean Tirole and his colleagues embraced the vision to create the success that is now evident. Even though the original idea had taken root in Jean-Jacques Laffont’s mind when Jean Tirole was not part of the groundbreaking early years, they had certainly shared the same vision from the early 1980s. In addition to a strong and sincere friendship between Jean-Jacques Laffont and Jean Tirole, accompanied by 20 years of successful collaboration, the two men shared a similar vision for their discipline; a vision not dissimilar to that of the school of French economist engineers who had richly contributed to the field of economic science over

the last two centuries. In the same way that Jean-Jacques Laffont first became interested in mathematics before finding a field of application in economics, polytechnician Jean Tirole had also been greatly influenced by this science. From the outset at Toulouse School of Economics, they imposed a demand for quantitative rigour, breaking with the French tradition of more philosophical and political economics. In order to evaluate the scientific quality of their work they compared it with facts and data, thus contributing to a better understanding of real phenomena. From their formative years of training, they shared a real empirical culture, which naturally led them towards microeconomics and the study of the company (industries, firms, decision and policy makers). In this way they shared an exceptionally rigorous requirement for scientific excellence. Like Jean-Jacques Laffont, Jean Tirole rapidly emerged as one of the most prominent researchers of his generation, quickly confirming the hopes placed in him as he gained in international stature.

The turning point for the industrial economy

Born in Troyes in 1953, the son of an obstetric-gynaecologist and a Professor of humanities, Jean Tirole was a graduate of the *École Polytechnique* in 1976 and then crossed the Atlantic Ocean to study in the United States. He obtained his Doctorate in Economics at MIT in 1981 under the direction of Eric Maskin, a close friend and one of Jean-Jacques Laffont's co-authors. From 1981 to 1984 he returned to France as a researcher at the *École nationale des ponts et chaussées* – the national school of bridges and roads (ENPC) where a new research laboratory specialising in the analysis of public intervention had been recently created, called the *Centre d'enseignement et de recherche en analyse socio-économique*. This was a teaching and research centre in socio-economic analysis (CERAS) led by Serge-Christophe Kolm. It was at this time in 1981 that he first met Jean-Jacques Laffont at a conference of the Econometric Society in Rio de Janeiro, Brazil. This was an essential encounter for the academic paths of the two men in more ways than one and for the future of the Toulouse School of Economics which had yet to be created. In 1982, they worked together on the regulation of network industries and public procurement. Structural reform projects in the telecommunications, electricity, postal, and railway industries were in their early stages at the time. While the performance of incumbent operators in most countries was weak, economists and policy makers were considering how best to optimise their costs and facilitate competition. The two scientists foresaw that the new theories of information and industrial economics could provide important insights into both the choice of reforms and their limitations, provided that they were

developed further. Ready to accept a teaching offer as an associate professor at MIT, Jean Tirole was told by Michel Moreaux and Jean-Jacques at a seminar dinner organised by Jean-Jacques Laffont: “One day you’ll be there in Toulouse with us!” Jean Tirole laughed heartily at the idea, little knowing how prophetic this comment was. He did not hide his admiration for the energy and enthusiasm displayed by Jean-Jacques Laffont and his team, and despite their being separated by an ocean, the two economists continued to work together.

From MIT to Toulouse

From 1984 to 1991, Jean Tirole was a professor at MIT. There he enjoyed seven years of research and teaching under ideal conditions: a very manageable teaching load with time to focus on doctoral courses without any administrative work and within a remarkable intellectual climate. The atmosphere within the Department of Economics was very collegial. The humility of the teachers, such as Paul Samuelson, Bob Solow and Franco Modigliani (all Nobel Prize winners) who had an open relationship of exchange with their students, set the tone. “For a researcher, the United States is an absolutely wonderful place; the freedom of research is incredible, one never has to worry about anything,” said Jean Tirole, reminiscing about his younger years.

Beyond the obvious intellectual appeal, he discovered the mechanisms that lay behind the effective management of a university department. Later on his return to France, he would put this into practice at IDEI which had been newly created in 1990 by Jean-Jacques Laffont. Jean Tirole knew of the ambitious dreams of his

friend who kept him regularly informed of the progress of his project: to make Toulouse one of the best European universities in economics. In 1991, Jean Tirole took a sabbatical year during which time he and his wife, Nathalie, returned to Toulouse in order to complete a book he was writing with Jean-Jacques Laffont: *A Theory of Incentives in Procurement and Regulation*. He also spent the following year in Toulouse as he finally accepted the proposal of Jean-Jacques Laffont to join IDEI.

However, after a sabbatical, the general rule was that the researcher/teacher must continue their career in their university of study. If Jean Tirole had complied with this rule he should have returned to the United States once his sabbatical was complete. But his path would take him along a very different route. The leadership team at MIT were most sympathetic towards him and offered him visitor status, a status that he still holds today.¹¹ His motivation to join Jean-Jacques Laffont was total, with their long distance collaboration already at an intense working level. Jean Tirole was completely won over by the collective spirit of entrepreneurship, the nature of the project and the undeniable talent of Jean-Jacques Laffont in managing his team. Jean Tirole had the utmost trust and confidence in his colleague, something rarely seen in the world of research.

By deciding to stay in Toulouse, Jean Tirole also greatly surprised the academic world. At 38, he was already one of the foremost specialists in the world of industrial economics and his authoritative works had been published by the MIT Press. The “establishment” could not accept as true that anyone could be attracted to a destination within France (Toulouse nonetheless) other than its capital, Paris. In the United States the news was met with disbelief, with some

11. For 25 years, Jean Tirole has spent six weeks a year at MIT including four in July which is the quiet academic period in Toulouse.

researchers looking on a map to see where this unknown territory of Toulouse was, the fame of which had not yet been spread by the commercial success of Airbus.

Jean Tirole contributed to many economic domains: pure theory (game theory and contract theory), macroeconomics (as the first to work on modelling bubbles and liquidity shortages in the economy), international economics, corporate finance and banking regulation, and since the late 1990s, psychology and economics. Traditionally the Nobel Prize is awarded for a specific study and not for a body of work (except in Literature). In 2014 the areas covered by the prize were industrial economy on the one hand and regulation on the other, where industrial economy referred to competition law and corporate strategies. In 1988 Jean Tirole published a book based on his earlier work, *The Theory of Industrial Organisation*. Nearly 30 years later this book remains a major work of reference in most doctoral programmes throughout the world. In the 1990s the Toulouse economics research centre was one of the two or three principal centres in the world in the field of economic competition, with contributions from Jacques Crémer, Patrick Rey, Bruno Jullien, Paul Seabright and many others. The second area, the topic of regulation, covered public policies in network industries (telecommunications, electricity, gas, post, rail, etc.). Market regulation in the context of the opening up of network industries to competition – which until then were monopolies – was a critical axis for the duo. They needed to define the most effective intervention mechanisms to ensure that the best services were available at the best price for users, who were now customers, taking into account the disparity of information available to the various operators and the regulator. The aim of this work, synthesised in *A Theory of Incentives in Procurement and Regulation* was to

“reflect on the conceptual framework for this modern public economy of regulation”. There was general agreement that they would continue to work with Patrick Rey by studying the specific case of the telecommunications industry, as well as with Paul Joskow in relation to the electricity markets.

Jean Tirole’s second critical axis in industrial economics was the definition of Jean-Charles Rochet’s general theory of two-sided markets, which extended the sectoral analysis of telecommunications markets and payment cards by describing their common function, although they may appear to be very different. The business models of these platforms are based on two distinct types of users: end consumers using the services, and businesses wishing to access these consumers. The challenge in these markets, which are equally comprised of large Internet operators, newspapers, television stations and airports, is to find a balance between both sides of the market, to allocate funding to the platforms and to determine the best way to regulate trade.

The third critical axis of study was that of patent pools. In a world where innovation is continuous in emerging sectors such as information technology, the proliferation of patents penalises both product users and those who want to improve them. Hence the establishment of an already long-standing concept; that of pools of patents offered under a single license but whose effect on the price of the technologies can be either positive or negative. Jean Tirole therefore proposed with Josh Lerner¹² to conduct a theoretical analysis of the economics of patent pools in order to allow regulators to select the positive effect pools.

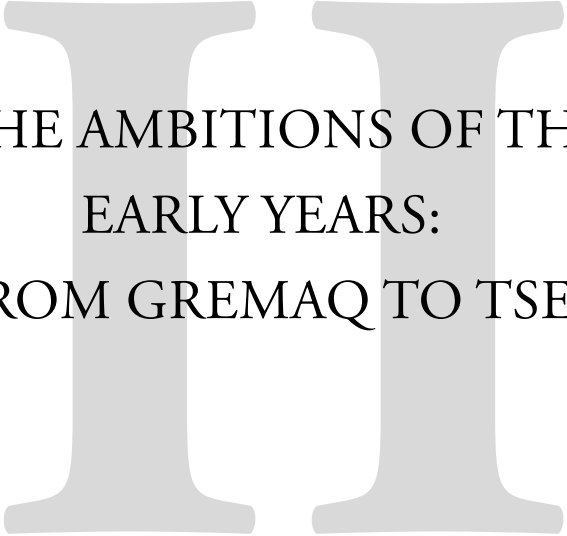
12. Josh Lerner is Professor of Investment Banking and Head of the Department of Entrepreneurial Management at Harvard Business School.

The Nobel Prize

Jean Tirole's research on regulating market competition has directly influenced public authorities and worldwide regulatory authorities, in particular the European Commission by which it has been guided on numerous occasions. It must be said that well before obtaining the Nobel Prize in economics, Jean Tirole's work – consisting of 12 books and over 200 articles – was widely known and recognised in scientific circles, within which he had won acclaim on several occasions. Among the most prestigious awards, are the following: Foreign Member of the American Academy of Arts and Sciences and the American Economic Association, President of the Econometric Society (ES) in 1998, the European Economic Association (EEA) in 2001 and Honorary Doctor of 11 foreign universities. Jean Tirole also notably received the inaugural Yrjö Jahnsson Award of the European Economic Association (with Jean-Jacques Laffont), the CNRS Gold Medal, the inaugural award of the BBVA Foundation and the Nemmers Prize (reserved for non-Nobel Prize winners, of whom seven of the 11 winners have subsequently received the Nobel Prize). However, this has not prevented Jean Tirole from showing humility in a similar manner to the preeminent teachers he met during his early years at MIT. He who had seldom been seen in the media previously, suddenly found himself under the global spotlight on 13 October 2014. He then showed himself to be a person of great discretion, perhaps with a touch of reticence.

This larger-than-life journey of Toulouse School of Economics is not only a result of these two exceptional scientists – Jean-Jacques Laffont and Jean Tirole. The success of this remarkable endeavour would never have been possible without the active participation

and commitment of many other key figures, who have generously given their energy, their excellence in research, and their exceptional human qualities. The survival of the work of Jean-Jacques Laffont 10 years after his death is the best possible evidence of this. After the first heroic years and a time of consolidation, a new generation of researchers is ready to continue the work. Nevertheless, it can't be denied that without this “dynamic duo” which was the result of the meeting of the great minds and personalities of Jean-Jacques Laffont and Jean Tirole, TSE may not have reached such internationally regarded heights. The Nobel Prize won by Jean Tirole in 2014 is the best possible proof of this successful working partnership. Toulouse School of Economics, this renowned centre for research and teaching, can be proud of these two almost legendary figures, who have become an integral part in the study of economics in the eyes of the whole world.



THE AMBITIONS OF THE
EARLY YEARS:
FROM GREMAQ TO TSE



Jean-Jacques Laffont during one of his visits to Abidjan (Ivory Coast) in 2001, at the occasion of a conference on gouvernance.

A new wind blows

At the start of the academic year in 1979 Jean-Jacques Laffont saw the first part of his dream come true. From this moment on and for the next 25 years he would dedicate all his energy to his long-term goal; to set a provincial economics department along a path of excellence, thus transforming it into a global research and teaching centre. This ambition seemed destined to remain a far-fetched dream as the French university system was poorly suited to accommodate this type of project. At that particular time in France, universities were virtually self-managed, with only distant control from the Ministry of Education. Indeed, this project became a tangible case study in the application of the theories of the governance of public services, developed by Jean-Jacques Laffont and Jean Tirole. The boards of directors, evaluation, recruitment, and promotion committees, essentially all consisted of members elected by their peers, researchers, administration and technical staff, and students. It was often the case that presidents were elected by a majority of students and technical staff, who did not always have an ambitious vision or long-term goal for their university, which would of course be facing global competition for innovation and new ideas. As for the Faculty itself, some members had taken advantage of this selection process in order to hire their own students or indeed members of their family, thus reinforcing their power whilst stifling openness to ideas from elsewhere, the source of all scientific progress. By great fortune, there existed at the University Toulouse 1 Capitole the fertile seeds of openness and experimentation, both in the young Faculty of Economics and with its custodian, the renowned and time-honoured School of Law.

At the root of it all, the ambition of one man

All of this was well understood by Jean-Jacques Laffont, who had a comprehensive plan. First he intended to unite a small team of young researchers who were ready to shake up the seemingly immutable order of the French university system. Next he would only recruit those whose curriculum vitae were of the utmost quality. Then as a result of these modifications, he hoped to change the internal balance within the university and become the majority within the economics recruiting committee. This scheme that he envisaged was largely inspired by his experiences in the United States during his PhD years, which immediately appeared to him to be atypical (even iconoclastic or revolutionary) within the French university system. In order to bring about this great research centre, he first had to create a stimulating environment within a dynamic atmosphere of credibility and expertise, values at the Institution that were sorely lacking, and then to attract researchers of the highest level to Toulouse. He also had to provide his new recruits with working and financial conditions not too dissimilar (within the limits of possibility) from those provided at the best European and American universities. In a country dominated by major educational institutions, Jean-Jacques' additional intention was to carry out his project within a public university setting. It was therefore critical to show perseverance and creativity in order to circumvent institutional inertia and to overcome the resistance of conservatism; an underlying mood that was not only ideological but was often heard in phrases such as, "This is not done here," or "This has never been seen here". For these reasons, in constructing his project he focused

primarily on the quality of recruitment, research work and scientific output. He also directed his interests towards the establishment of a system of governance to focus on the search for innovative financing opportunities. Simultaneously, he was trying to reassure those who feared a hidden agenda of privatisation for the university and who foresaw a threat to free and independent research.

The creation of the research team

Initially Jean-Jacques Laffont's ambitious project was received with mixed feelings among the economists at Toulouse University. The teachers at that time had little understanding of this young dynamo who had disturbed their habits and hierarchy, and who even went so far as to question their long-accepted methods of conducting research. But before long some of his colleagues declared their readiness to embark on the adventure with him. They saw his arrival, with his impressive curriculum, as an opportunity; a chance for a new collective beginning. However, others saw him as a threat to the established order and their localised power. A small supportive group was formed, which eventually persuaded Jean-Jacques Laffont that French academic corporatism could indeed be modernised. Amongst them were Georges Molins-Ysal, who firmly believed in the success of the project and immediately brought his unfailing support, and Michel Moreaux, who he had met in 1968, and whose great qualities as a researcher were instrumental in Jean-Jacques Laffont's decision to settle in Toulouse. Another was Marc Ivaldi, a young local talent who would be recruited by

the Toulouse branch of the *École des hautes études en sciences sociales* – the school for advanced studies in the social sciences (EHESS) after his econometrics thesis at the University of Pennsylvania, and in addition, Claude Crampes, who would prove to be an excellent scientist in the study of the economics of intellectual property and energy. Claude Crampes still recalls the insights he experienced when he was first in contact with Jean-Jacques Laffont: “The first shock came from the fact that we met someone whose books we had read; the second surprise was that he had the same accent as us.” With André Grimaud and Bernard Belloc, the original core group constituted a formidable team, a true “Toulouse rugby line-up”; the foundations of a unique structure of which Jean-Jacques Laffont was the architect. They were soon joined by others, including Farid Gasmi, Jean-Pierre Florens, Jean-Charles Rochet, and Jacques Crémer in late 1980s. In a tribute speech delivered in 2005, Bernard Belloc reminded them of their state of mind in the late 1970s:

“We were a small group of post doctorate lecturers who had tried to learn economic theory by reading the best authors: Debreu, Hicks, Samuelson, Allais; all so dramatically absent from the French academic textbooks at the time.

And suddenly his arrival was like a breath of fresh air. A wide-open space was right there in front of us. We now had with us someone who knew economic science perfectly; whose work was a source of inspiration for colleagues around the world. In addition, Jean-Jacques showed us how we could expand the scope of economic science to cover the complexities created by the problems of information and uncertainty. He also opened up the whole field

of public economics to us and the complexity of analysing the most difficult problems in the contemporary market economies.”

In pursuit of excellence, Jean-Jacques Laffont’s first concern was to turn these young teachers into real researchers, operating at the forefront of science. To do so he directed them in their research and encouraged them to obtain their *agrégation*. He had little trouble convincing his young colleagues of the merits of his ambitions. A professor with all of his characteristic dynamism, Jean-Jacques Laffont inspired steadfast loyalty and commitment to his project through his own daily actions and example. He asked each of his colleagues to tell him of their deepest ambitions, convinced that the realisation of the joint project involved the development of their own personal projects. He also sought to give everyone confidence in their individual potential; frequently appearing unannounced in a colleague’s office to discuss their specific career and to suggest to them the possibility of career paths that had previously seemed unfeasible. Those who knew him remember a person able to make important decisions on behalf of the group, whilst simultaneously ensuring that everyone felt that they had been heard and were actively involved. This coaching had a huge impact on the individual fates of these pioneers by respecting their individual aspirations. At different stages of their careers, some would go on to concentrate on cutting-edge research, others would focus on teaching, while others focused on project administration and team leadership. For example, after becoming interested in the integral equations of Lotka-Volterra and economic growth in the late 1990s, Bernard Belloc became the President of the University Toulouse 1 Capitole, before advising the President

of the Republic of France, Nicolas Sarkozy, on issues of higher education and research.

In addition to his human capabilities as a great leader, Jean-Jacques Laffont continued with his teaching at the university. Bernard Belloc remembers this very well:

“The Masters course in public economy that he began to give in Toulouse was a marvel. Hundreds of students took advantage of it. His textbooks are still authoritative works today. The seminars he organised around the papers and books he had written with Jerry Green and Eric Maskin, led to the discovery of the theory of incentives. All of this shed an entirely new light on the theoretical but not very concrete problems of economic theory: the financing of public assets, the manipulation of resource allocation procedures by those agents who are better informed than others, and so on. In short, we discovered with amazement that this microeconomic theory, which we had just learned for fun while it was still little known, was also the basis for understanding and solving the problems of public economics.”

For all of these young researchers, it soon became clear that something significant was happening within their institution. A new wind was blowing, which opened their department of economics to the world and prepared it for future developments. This change of mind-set in the 1980s was the first building block of the new structure within the greater edifice, described by Bernard Belloc as, “the starting point of a crazy adventure for us; firstly in Toulouse, for many others elsewhere in France, for all who had joined us.” Indeed, it was a structure that was assembled gradually, and with considerable effort.

At each stage of the process a host of problems arose which, once solved, gave rise to new challenges. Actions which at first

seemed quite straightforward were quickly complicated by a lack of resources. In order to preserve the overall vision of purpose and to face the daily time- and energy-consuming challenges, the first players in this act had to show dogged determination. Logistics, management issues, and administrative tasks were concrete matters that faculty members were required to manage for themselves. The conclusion was simple: everything was lacking. Budgets for research and seminars were depleted, the library was haphazardly thrown together out of various odds and ends, a few – and highly inadequate – offices existed, topped off with a practically non-existent secretarial service. It was a world apart from the privileged cocoon offered by North American universities where researchers could devote themselves entirely to their scientific work with little concern about daily management issues.

GREMAQ, a different approach to research

These efforts would lead to the first significant institutional advance in 1981; the creation of the *Groupe de recherche en économie mathématique et quantitative* – a research group in mathematics and quantitative economics (GREMAQ). This joint research unit (UMR), common to the University Toulouse 1 Capitole, EHESS, CNRS, and later to the National Agricultural Research Institute (INRA), was the nucleus of what would eventually become Toulouse School of Economics.

In the late 1980s, in addition to the pioneers mentioned above, the research centre included 20 researchers who had recently moved to Toulouse. Even fewer in number, the administrative

staff consisted of dedicated individuals whose commitment would be one of the secrets of the ongoing success of the centre. Thus, Jean-Jacques Laffont became the Director of GREMAQ, while Michel Moreaux headed up the postgraduate diploma (DEA), the former name for the fifth academic year which leads on to the preparation of a thesis. Claude Crampes was appointed Dean, and became Director of the Faculty of Economics.

The creation of GREMAQ marked the beginning of its support by major French research organisations, such as CNRS and INRA. The delegation of scientific personnel without teaching requirements, plus administrative and technical staff (which universities were often unable to provide outside their main teaching function), naturally played a defining role in the daily functional life and international appeal of laboratories. It cannot be overemphasized how essential the administrative support staff were (and are) to the proper function of a university. They support researchers' initiatives, provide multiple services to students, and organise seminars and conferences, that are of course the scientific lifeblood of any research centre.

At GREMAQ an initial weekly seminar was put in place. These meetings were organised around an external researcher who was invited to present his current work to his colleagues. These proved to be extremely rewarding both for the visiting scientist who came face-to-face with his peers, and for his listeners, who were instructed in the most recent advances in research. They contributed to the mutual training of researchers, which became a source of progress and inspiration for the entire scientific community. If this seems to be obvious today in a completely globalised scientific world, it must be

emphasised that this was far from the case in the universities at the time, creating an additional shortfall that allowed the United States – year upon year – to gain a lead which even today remains difficult to reduce.

This sequence of seminars was the first of a long series that continues to grow today, making TSE one of the best-connected and most vibrant centres for economic scientific research in the world. Research notebooks published in English were produced and aimed to provide, amongst other things, visibility to the laboratory and the work of its members, and were immediately accessible to researchers worldwide. This initiative put in place by the founders of GREMAQ was an innovation that was close to the limits of “heresy” within the French academic world of the time, and was indicative of both the strategy the team intended to follow and the ambitions they held for their project. Yet this was not enough: Jean-Jacques Laffont wanted to venture further still. Similar to the practice in Anglo-Saxon universities, he decided to organise the first economic congress in Toulouse. The following anecdotal detail shows to what extent each project required an enormous level of adaptability and daring. In fact, hard as it is to imagine today, Jean-Jacques Laffont did not have a telephone in his office with an international line connection. The only phone with such an innovation was in the office of a colleague, Professor Georges Létinier. Requiring audacity (which he had in abundance), Jean-Jacques Laffont was able to convince Professor Létinier to exchange his office for the period of time it took to finalise the organisation of the congress. To support this endeavour, Jean-Jacques personally organised the office moves, before and after the event.

Excellence, rigour and ambition

These vagaries of life did not prevent GREMAQ from becoming established and following the guiding principles from which it would not deviate: research excellence, absolute rigour in approach, and scientific ambition. United by the same guiding principles, this group of researchers provided evidence that research in economics at the highest level was most certainly possible in Toulouse. As the years passed, the research laboratory remained true to its original objectives and to the desire to participate in public debate, by highlighting the strategic choices of public and private decision makers. However, this did not stop it evolving and diversifying its research themes. Industrial economics, public economics, and the microeconomic foundations of macroeconomic phenomena occupied an important place from the outset. This continues today, as researchers with a common culture and privileged vantage point analyse game theory and the theory of information and uncertainty. An important part of their work focused on market regulation policies, competition law, and intellectual property law particularly in the context of networking issues.

Progressively, GREMAQ implemented collaborative programmes and exchanges with other universities and research laboratories. In France, it has established close ties with the Centre de recherche en économie et statistique – a centre for research in economics and statistics (CREST), which is a structure similar to INSEE, and ENSAE, the Département et laboratoire d'économie théorique et appliquée – a department and laboratory of theoretical and applied economics (DELTA), another Paris laboratory



Jean-Jacques Laffont in his office at GREMAQ, in the middle of the 1980s.

that emerged later, and the Marseille centre of GREMAQ. It was also involved in numerous international partnerships with major European and American universities, the most important being Pompeu Fabra (Barcelona), Northwestern (Chicago), MIT, and Harvard (Boston). The success of this very active network policy helped to strengthen the national and international visibility of the Toulouse centre. Another indication of its growing reputation was the participation of its researchers and PhD students in conferences, such as those organised by the Econometric Society and the European Economic Association, two learned societies chaired by Jean-Jacques Laffont in 1992 and 1998. These societies would also go on to be organised by economists from Toulouse in 1997 and 2014. At that time GREMAQ had only one research laboratory within the University Toulouse 1 Capitole. It had to fight hard for the scarce resources of the university, primarily for the recruitment and promotion of young lecturers. Debates for the allocation of these resources took place within the framework of committees made up of professors who came from different departments within the university. However, the equilibrium was unstable: recruitment in this department rather than that department could easily tip the majority within the electoral body. Significant battles ensued, which often ended late at night as the relative quality of the candidates was discussed in a context where it was difficult to determine common standards of excellence. How could one compare a publication in *Econometrica* with several publications in a French journal without first defining any standard evaluation criteria? Whilst this question did not arise abroad, the debates were hard fought in Toulouse as they were elsewhere in France. At that time opponents defended a French exception. Throughout the 1980s alongside his team, Jean-Jacques Laffont

had to manage a complex game of alliances in order to recruit young researchers to GREMAQ, despite his minority position within the committee. In the late 1980s members of GREMAQ finally obtained a majority which they did not relinquish until the suppression of this type of committee by the Pécresse law in 2007. The University Toulouse 1 Capitole became fully aware of the extraordinary experiment that was taking place within its walls and gave it their support, which went hand-in-hand with the reputation acquired by GREMAQ and the spin-offs that it would generate over the next 30 years.

Following a successful launch, the adventure continues

The momentum had begun. GREMAQ was functioning, and gradually positioning itself as a leading laboratory in France and Europe. The quality of the work at GREMAQ was underscored by numerous awards and prizes, including the Silver Medal of the CNRS received by Jean-Jacques Laffont in 1990. Its researchers regularly published in reference magazines and scholarly journals in the fields of statistics, applied mathematics, public economics and econometrics. Many of these researchers were elected to the University Institute of France¹ or were integrated into scientific societies, national and international institutions, such as the Economic Analysis Council, the Scientific Council of the Bank of France, the Planning Commission, and many others.

1. The IUF brings together a group of high-level researchers selected by an international jury for the exceptional quality of their research work.

During the ceremony for the Knight of the Legion of Honour in 1991, Jean-Jacques Laffont expressed his delight at receiving the award, “in a university which [...] has acquired an impressive dynamism”. He emphasised the quality of recruitment in recent years and said that, “The President of the University Paris-Dauphine has told me [...] that Toulouse stops him from sleeping well at night”.

Did this then mean that the project had reached its goal and that the Toulouse centre would now continue quietly on its way? Jean-Jacques Laffont for one was certainly not content. The first successes had not dampened his energy or his desire to achieve more. He had further ambitions for his team to achieve. His many travels as a guest speaker to some of the most successful foreign universities had inspired him to an even greater degree. In fact the realization of GREMAQ would only be the beginning.

He had the opportunity to mature his ideas during a two-year stay in the United States. He responded first to an invitation from the California Institute of Technology, the prestigious Caltech in Pasadena, after which he spent a few months at his alma mater, Harvard University. Jean-Jacques Laffont noted that these institutions made every effort to recruit the specialists they needed: no random recruitments were made depending on rankings in a national competition; rather recruitments were made through a controlled process and by offering stimulating working conditions. Upon his return, when Michel Moreaux succeeded him as the head of GREMAQ, he told the Toulouse researchers of his new project which was even more revolutionary within the context of a French university: to create a new type of institute that

would build bridges between the university and businesses by conducting research in partnership with them. It was now the beginning of the 1990s, when the undertaking of the Institut d'économie industrielle – the institute of industrial economics (IDEI) began. But why contemplate such a challenge at that particular moment; indeed, a challenge much more complex than the creation of GREMAQ?

At that time there were virtually no links between French industry and the country's universities. The two worlds were totally foreign to each other and yet had so much to offer each other. Companies had everything to gain from the fact that the economic sciences were theoretically interested in the issues within their sector and their markets, and in the changes that were happening in their environment. They could also take advantage by testing results from their own teams of economists with the results of academic research.

Similarly, these researchers, whose overriding ambition was to start from concrete issues that existed in economic life, would find new problems to solve in their partnerships with companies; real cases by which to inspire their research themes while providing the necessary data to test existing theories. The objective in creating an institution such as IDEI was to create a platform to provide a meeting place between researchers and companies. This model, designed by Jean-Jacques Laffont, was far from the current consultancy market. IDEI would produce innovative research, checked and validated via peer review through publications in top international journals, rather than by formulas or immediately applicable “deliverables”.

IDEI, the bridge between industry and research

More resources are needed

What pushed Jean-Jacques Laffont to launch a joint research institute was an institutional and a financial problem. Indeed, within a decade – along with the establishment of GREMAQ – he had managed to significantly raise the standard of the Faculty of Economics at Toulouse and to attract a number of notable talents. However, he was aware that it could not be developed much further, as his ambitions inevitably came up against the question of means. The fledgling school in Toulouse did not yet have the capacity to stand alongside Anglo-Saxon centres or to offer salary conditions and a working environment equal to their competitors' standards. Indeed, it would probably even struggle in the long term to retain its own researchers, who were increasingly in demand by other institutions. Thus, the calculation was quite simple: in order to continue the work which had already been completed by the team leading GREMAQ, it must be accomplished with researchers of the same calibre. For this they must reverse the “brain drain” by increasing the appeal of their location. The American academic system strongly differentiates between universities, according to their quality. If MIT or Princeton spring to mind as two of the elite universities, we often overlook the thousands of other American academic institutions such as the myriad of community colleges specialising in Baccalaureate + 3 (degree level) type training, in order to meet regional skills needs. Their teachers do little or no research for publication, but specialise in advanced education with



Jean-Charles Rochet (left), Jean Tirole (center) and Jean-Jacques Laffont in the new IDEI premises in the Toulouse 1 Capitole University in 1991.

efficiency and aptitude. Of course their levels of remuneration are not the same as the large prestigious universities that compete to attract the best researchers in order to contribute to the economic strength of their country. France, on the other hand, lives in a type of egalitarian utopia, which leads to low wage differentials and encourages the most productive to emigrate overseas, where a meritocracy prevails. In September 2014, the IMF published a list of 25 young economists (under 45 years of age) who were destined to significantly influence the understanding of the global economy. Seven of them were French, one among them living and working in France, while the other six were in the United States or the United Kingdom. In the early 1990s, in order to deal with this growing international competition, the solution of a partnership with public and private companies seemed to Jean-Jacques Laffont to be the only workable possibility.

A plan inspired by the North American model

Thus, the outline of a new research centre was gradually emerging, with its original method of operation inspired by existing models in North America. “This is a unique model in the French university landscape, due in particular to its method of financing through research contracts,” explained Michel Moreaux. Indeed, this was a real cultural revolution. The founders of IDEI were required to show great strategic and pedagogical wisdom in order to make the new model acceptable. Many within the university were concerned about the risk of roles becoming mixed: if companies fund research, would they not then be tempted to influence the results? Would the researchers themselves not be tempted to direct their work to please the businesses? Would researchers still be able to talk about their research? Was this not just a more prosaic form of consulting? Would the new institute not jeopardize the very foundations of all scientific research, namely the independence and total freedom of the researcher? These were some of the many perfectly legitimate ethical questions to which Jean-Jacques Laffont (a man who devoted his life to the utmost in research excellence) was required to provide the most carefully composed and considered answers.

Controlled independence

A new institution which is created under the legal form of a non-profit making organisation has no *raison d'être* unless it is unequivocally irreproachable in terms of scientific independence. From the outset, therefore, IDEI affirmed a number of tangible principles that remain in force today. The resources generated by research contracts directed entirely towards scientific work would

have no other purpose than to provide – in a totally transparent manner – resources in addition to those made available by the university. No consulting work was to be accepted at IDEI, which could not also compete with the major consulting groups.

The comparative advantage and the value of IDEI lay in the scientific excellence of its work. Today, the international scientific credibility of IDEI has for over 25 years been attracting businesses and public institutions that have difficulty understanding and integrating new ideas emerging from science into their strategies. Only IDEI accepts work leading to peer-reviewed scientific innovation, published in the best international journals. They disseminate new acquired knowledge and make it accessible to all, preventing the private appropriation of this new knowledge. From the outset, IDEI's objective was to advance the economic sciences in the direction of general interest and accessibility, in accordance with a genuinely scientific approach.

Working as a team

Traditionally, many economists around the world are individually engaged in advisory activities. Jean-Jacques Laffont was the innovator of this process by organising partnerships; platforms upon which Toulouse researchers could work as a team. This collective approach allowed them to resist any possible requirements by companies in terms of a bilateral relationship. By sharing partnerships, IDEI diversified its sources of funding and increased its capacity to be able to refuse requests from a specific partner, who may not respect the founding principles of the collective project.

While this process was already likely to convince sceptics, the scientific legitimacy of IDEI could be measured by its

meteoric rise in international rankings, with publications in the top five generalist journals: *American Economic Review*, *Econometrica*, *Journal of Political Economy*, *Review of Economic Studies*, *Quarterly Journal of Economics*, or the specialist *Rand Journal of Economics*. In addition, numerous awards were given to its researchers.

In the summer of 1989 Jean-Jacques Laffont devoted much of his energy to making contacts in order to establish initial partnerships, while at the same time continuing his own research. He knew that he could count on the support of his colleagues at GREMAQ, Marc Ivaldi, Michel Moreaux, André Grimaud, Claude Crampes, and especially Bernard Belloc, as well as the recently recruited professors, Jacques Crémer, Helmuth Cremer, Jean-Charles Rochet, and Jean-Pierre Florens. While there was some resistance to them by others (in the form of misunderstandings), they formed a tight group that had already proved its worth. During these groundbreaking times of the Institute's beginnings, researchers were organised into small autonomous groups that Jean-Jacques Laffont often brought together at his house in Colomiers.

There he organised barbecues and other "seminars" on the preparation of foie gras, for example, which helped to cement this community together beyond its teaching and research activities. And the first results soon arrived. While IDEI was officially established in 1990, its relevance was validated by an initial research contract with EDF, which was quickly followed by a partnership with France Telecom (now Orange), La Poste, a Chair of the Federation of French Insurance Companies, and later a five-year agreement with Microsoft. EDF and France Telecom have remained loyal to the team at IDEI and to this

day, remain a key source of private support for the research team, as does Microsoft, La Poste, Scor, Banque de France and many others. The almost systematic renewal of these contracts is a remarkable demonstration of the practical efficacy of IDEI's research for its corporate partners, in a context of fierce international competition. It was this relatively quick success of IDEI which delighted and somewhat surprised Jean-Jacques Laffont, followed by the recruitment of Jean Tirole as Scientific Director in 1991, which further accelerated the incontrovertible credibility of the project.

IDEI, heading towards new challenges

This relationship with EDF – whose partnership helped to launch IDEI – was a prime example of the ambitions of the Institute and its operation. “The themes of the work have evolved over the years,” indicated Claude Crampes and Thomas-Olivier Léautier, researchers at TSE and those responsible for the partnership. When Jean-Jacques Laffont and Jean Tirole initiated this project, priority was given to the regulation of monopolies, to make them more incentive driven. The development of new technologies and the introduction of competition in certain business sectors such as the production or marketing of energy, opened up innovative lines of research. Faced with a new wind of liberalisation blowing from the Anglo-Saxon world, the Toulouse economists emphasised the necessity for this opening to be mitigated by strong and intelligent regulation. From the year 2000 on, thematic interests included the relationship between competitive sectors and sectors that were

necessarily monopolies, such as the transmission and distribution of electricity, as well as the respective merits of vertical integration and unbundling. Other issues arose, such as the issue of climate change. The climate and energy package adopted in 2007 by the European Commission aimed to reduce the emission of greenhouse gases, a topic on which the Toulouse economists (including Jean-Jacques Laffont and Jean Tirole) had worked since the mid-1990s. Finally, work on intermittent energy sources allowed for an in-depth re-evaluation of the economics sector, highlighting public initiatives such as the Action Plan passed by the National Assembly in order to encourage renewable energies.

This partnership perfectly illustrated the participation of IDEI researchers in discussions on the new challenges encountered by their partners on a regular basis. Depending on the context and issues raised, other issues then arose. For example, in the first partnership following the Fukushima accident in 2011, the closure of the German nuclear power plants coupled with the extensive use of wind power to replace them, put producers at negative market prices. IDEI researchers then collaborated with their counterparts at EDF in an attempt to understand the logic and the risks and benefits of these prices.

Another example was the recently emerging concept of a tariff-based solution to the problem of fuel poverty. To any given public policy objective (such as the protection of the poorest against fuel poverty) there are always several policy alternatives, with their respective costs and benefits. Public policies are therefore evaluated in terms of their ability to achieve their objectives at a reasonable cost. The plan for a progressive tariff was the subject of both a descriptive and a prescriptive

study, which concluded as to the incapacity of such a tariff to fight both poverty and excessive consumption. Thus, all work was carried out on the basis that the information transmitted on subjects was jointly defined by the partner and IDEI. In keeping with the philosophy of the Institute, IDEI researchers remained completely free in their chosen methods of analysis and published their modelling work in scientific journals, as long as they did not violate the confidentiality provisions protecting certain data.

In addition to this fundamental research, the founding partnership with EDF included a training component in collaboration with the in-house EDF university. Toulouse researchers have therefore enabled several generations of company executives to better understand the economic challenges of their sector and its complex regulatory environment. The renewal every three years of the partnership with this leading French industrial company perfectly illustrates the contribution of Toulouse economists, whose proposals have ultimately had a positive impact on consumers and taxpayers.

This first contract quickly served as a prototype for further partnerships in the following areas of interest for the Toulouse researchers – telecommunications, postal services, rail transport, water management, insurance and finance, intellectual property, the digital economy, and so on. From the start, the results were positive: IDEI was launched and was moving in the right direction. The quality of the work related to partnerships with IDEI was well illustrated by the resulting publications. Since 1996 the *Rand Journal of Economics* (a global benchmark in the field of industrial economics) has published more than 20 publications from work completed by IDEI. Jean Tirole



Jean-Jacques Laffont (left) and Jean Tirole in the IDEI library in 1991.

explains: “In this way the researchers have participated more or less directly in the citizens’ debates, without ever interfering in national or international politics.”

The talent and qualities of Jean-Jacques Laffont and his team were constantly being confirmed. From the beginning, he had great dreams and did not stop at his first taste of success. His ambition, ideas and desires always drove him forward. The research centre continues to grow today, as does the teaching element in the image of its researchers; with excellence in all regards.

From research to teaching, big ambitions

The creation of ARQADE and LERNA

Always respectful of research excellence and rigour in his approach, Jean-Jacques Laffont further complemented the current institutional framework that he had developed. In the late 1990s, two new research laboratories were created. In 1997, a laboratory specializing in development economics was created, called ARQADE (Atelier de recherche quantitative appliquée au développement économique – a quantitative research workshop applied to economic development). This laboratory was followed by LERNA (Laboratoire d'économie des ressources naturelles – a natural resource saving laboratory) established in 1999 in partnership with INRA, allowing the group to conduct research in the fields of the environment, agriculture and agribusiness. This laboratory works on topics as diverse as the management of water resources, the long-term prospects for the extraction and exploitation of non-renewable natural resources, taking future generations into account in the cost-benefit analysis of public actions, or the value of human life or a tonne of carbon.

The best lessons

To Jean-Jacques Laffont, it was imperative that the development of a research centre of excellence must not ignore the quality of its teaching. Good teachers attract good students, and vice versa, and it was therefore necessary to promote educational excellence.



Each year, more than a hundred students, from more than fifty national and European universities, follow courses at TSE.

Shortly after his arrival, together with Henri Caussin, he created the Magistère d'économiste statisticien – the diploma of the statistician economist, a joint course with the University Paul Sabatier. He recalled that when he himself was a student, he had to follow two different courses: one in mathematics and the other in economics. By creating this diploma, Jean-Jacques Laffont's idea was to train specialists in economics with a background in mathematics, in order for them to be sufficiently solid in their ability to understand and use modelling, especially in the corporate world. Students of this diploma were limited to a group of 30 each year, introducing the students to the Bachelor of Economics,² a non-selective degree at the time.

DEEQA, a first in Europe

In the mid-1990s the doctoral programme in economics with international standards was created. Again, this was an academic path off the beaten track of French academia, inspired by what was happening in the best American doctoral programmes. Indeed, in the French system, students embarked on their theses immediately after their fifth academic year without necessarily having the sufficient quantitative and methodological background. The Toulouse economics PhD established in 1996 was initially led by Jacques Crémer, then Helmuth Cremer, followed by Patrick Fève, and finally Wilfried Sand-Zantman.

2. The degree year at that time corresponded to the Year 3 today. Students received the Diploma of General University Studies (DEUG), an undergraduate degree which was abolished as part of the LMD (bachelor, doctorate) reform in 2003. The DEUG and the Bachelor of Economics represented a total of 1,000 students per year (500 in the first year of DEUG, 300 in the second year and about 250 degree students).

It included a year of compulsory study after the master's degree, that is, DEEQA (Diplôme européen d'économie quantitative approfondie – a European diploma of in-depth quantitative economics) which was integrated into the preparation of a doctorate. During this time students strengthened their fundamental knowledge, their autonomy and their research methods, before starting work on their theses. When the University of Toulouse established DEEQA, it was the first occurrence of such a diploma in Europe. This intermediate year has since become widespread throughout other European doctoral programmes. The Toulouse doctorate has enjoyed great international success, with the proportion of foreign students studying for this now over 80% (including students from Italy, Germany, China, the Russian Federation, America, etc.).

The other distinctive feature of the PhD programme was that its teaching was conducted entirely in English in order to attract the best students from around the world (who inevitably become Francophones during their studies). Such an innovation was, to no small degree, somewhat surprising in a landscape where university students and teachers who mastered English were already few and far between. In the media landscape, several newspapers devoted articles to this university where “French is no longer spoken”. This was especially newsworthy as this development occurred at the time of the adoption of the Toubon law³ which made the use of French mandatory

3. The Toubon law, or law on the use of the French language, stipulates that public and private education must use the French language in the context of teaching, examinations and competitions, as well as theses and memoirs. Exceptions are possible if the establishment justifies the need for the teaching of languages and regional cultures or foreign, or when teachers or associate professors are foreign guests. Foreign schools or schools especially to welcome foreign pupils and schools offering international education are not affected by this obligation (<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte = LEGITEXT000005616341>).

in public services (fortunately, with some exceptions). Gradually English-speaking students began to enrol. This had two consequences: researchers who would never have previously considered France began teaching at the University Toulouse 1 Capitole; and French students suddenly saw their opportunities opening up on an international basis, something which had previously been more or less impossible. Now, 20 years later, when these practices have become widespread, this detail may seem unimportant. But at that time the University Toulouse 1 Capitole proved to be a pioneer in this field. Today, all it takes is to take a stroll for a few moments around the Manufacture des tabacs (the university building, an old tobacco manufacturing plant) to realize how deeply this campus is now immersed in the diversity of the world.

Objective accomplished: Toulouse, the choice of the elite

At the end of these first two decades of patient and resolute innovation and construction, fighting against long-held views and conservatism, the work accomplished was immense. At the dawn of the new century, there was no doubt that Jean-Jacques Laffont had succeeded in raising the reputation of his research group to a level which was sufficiently high to attract many top-ranking researchers. They included, for example, Bruno Bias, one of the best international specialists in the functioning of financial markets, and Patrick Rey, who has since become a world reference in competition law. Others included Helmuth Cremer, internationally renowned in the field of social security and public economy, and Christian Gollier, an undisputed insurance specialist, and member of the Intergovernmental Panel on Climate Change (IPCC). The list of other leading specialists recruited in the 1990s and up until the early 2000s goes on, and includes Bruno Jullien (industrial economics), Michel Le Breton (political economy), Thierry Magnac (econometrics), Thomas Mariotti (incentive theory), and François Salanié (information theory). Nevertheless, this early reversal of the brain drain did not happen smoothly. If it had been a success to convince outside talent to come to Toulouse, they still had to be convinced to remain there. How else but by treating them far better than any other institution throughout their careers, by encouraging them in their desire to invest on a long-term basis in the Toulouse project and, like the pioneers, by helping to facilitate the integration of their family into life in Toulouse?



Work-life balance

For three decades now Toulouse has attracted highly regarded researchers, and there they remain. However, rewarding excellence has its price. Obtaining positions and assigning them to leading researchers from elsewhere is an ongoing challenge. This fundamental principle of the Toulouse economists – which runs counter to the internal recruitment process in force within French universities – is sometimes misunderstood by the committees of experts responsible for monitoring the recruitment of lecturers into institutions.

Nevertheless, what had seemed inconceivable in the late 1970s did indeed transpire: Toulouse has become a world-renowned centre for research in economics, despite its “triple handicap” (as noted by *Les Echos* journalist Jean-Marc Vittori): being located in France, in the provinces and within a university.

Despite the high quality of the intellectual environment, it had to be asked whether or not foreign researchers would in fact want to settle in a city of rather modest proportions in comparison to major cities worldwide, far from Paris and in a country as centralised as France. Ultimately what appeared to be a handicap would eventually prove to be a significant asset. The remoteness from the traditional Parisian channels allowed for greater autonomy, which was essential in achieving objectives that were so out of step with the habits of French academia. In addition, Toulouse had an undeniable comparative advantage compared to larger cities: a much lower cost of living which helped to offset the pay differential with major competing universities. Bringing foreign researchers to Toulouse was to offer them an attractive living environment in the south-west of France, with an extremely pleasant climate, a

preserved environment representative of the quality of French life, complete with a strong regional cultural identity. A city that had enjoyed strong economic growth (thanks notably to the dynamism of the aerospace sectors) and that was the location of the second major academic community in France. Researchers who joined IDEI in the 1990s – beyond the atmosphere created by the university community whereby everything was done for their rapid integration – found themselves in a world where it was possible to reconcile professional commitments and personal interests. This had become the famous “work-life balance”; the working/living equilibrium extolled by North American universities. Many of the researchers who came to Toulouse for a limited time only, in fact decided to stay and follow their careers with TSE. This was the case for Patrick Rey, then Director of INSEE, seconded for a year to IDEI, who decided to settle permanently in Toulouse. Jacques Crémer felt the same attraction. Despite a comfortable academic status in an excellent American university, he came to Toulouse for a year at the invitation of Jean-Jacques Laffont and decided to stay when he realised how stimulating the IDEI project was. Christian Gollier was also immediately captivated. After his thesis at the University of Louvain, followed by a post doctorate at the University of California in San Diego, he was appointed Associate Professor at HEC Paris in 1992. It was at this moment that Jean-Charles Rochet chose to offer him the chance to participate in a seminar in Toulouse with Jean Tirole, Jean-Jacques Laffont and Drew Fudenberg, a Harvard colleague also visiting Toulouse. After the seminar these researchers invited him to a restaurant and between the cheese and dessert courses asked him to join GREMAQ. There, at that moment, he was recruited by some of the top-tier elite of industrial economics, capped off by



Habilitation to direct research (HDR) of Patrick Rey, 1992. From left to right: Michel Moreaux, Roger Guesnerie, Paul Champsaur, Jean-Jacques Laffont (wearing the Harvard gown, his *alma mater*), Jean Tirole, Jacques Cremer and Drew Fudenberg.

Jean Tirole, Jean-Charles Rochet, and Jean-Jacques Laffont. The atmosphere of conviviality and professionalism that he had felt during the few days of his visit added to his motivation, and the decision was quickly made with his wife, Dominique, who came to join him in the South of France. Needless to say the salary was not the same, but like many other colleagues the scientific productivity of Christian Gollier would be significantly increased through his contact with these great researchers, in this atmosphere of the “Wild West” at the frontier of scientific and institutional innovation. Patrick Rey, who was then an Administrator at INSEE and on secondment for a year to IDEI, also decided to settle in Toulouse permanently. The following year Bruno Biais would follow exactly the same route from HEC to Toulouse, at the dawn of his brilliant career.

These newcomers were emblematic of the recruitment wave of the 1990s. Researchers were primarily attracted to this institution as it was proving to be an entirely unique case in France, since no other French university had such access at an international level. Indeed this advantage continues and it remains an environment with an extremely strong sense of belonging to a coherent community and a large scientific family, and continues to build upon its highly original and motivating project.

A centre for research and teaching at the highest level

Within this context of popularity and growth, the Toulouse research centre planned to move into its own premises. The group of economists had expanded with the result that the workspace for each of the researchers quickly became insufficient. Jean-Jacques Laffont therefore planned to establish them in the recently renovated former tobacco factory (the Manufacture des tabacs). With a few exceptions, this initiative had very little support from the Government. Bruno Sire, in charge of the National Education Ministry at the time and President of the University Toulouse 1 Capitole from 2008 to 2016, assisted Jean-Jacques Laffont in seeking the help of the Mayor, the Region of Toulouse, and the National Education Ministry. This resulted in a superb moment in history as the beautiful 19th century industrial building, which had been closed since 1987 and had been destined for demolition, was saved from destruction thanks to the vocal activism of a local association. After a long battle culminating in the historic classification of part of the building by the Ministry of Culture, the



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The library of the Manufacture des tabacs, is a study space which mixes ancient and modern. These premises were renovated by the architect Gabriel de Hoÿm de Marien.

decision was made. Its owner, the City of Toulouse, thus donated the building to the Ministry of Universities, which decided to then grant it to the University of Social Sciences under the framework of Lionel Jospin's "University 2000" programme. Jospin was another who had been charmed by the project and by the personality of Jean-Jacques Laffont. The Manufacture des tabacs became the second university campus for Toulouse 1 Capitole, close to the heart of the historic Arsenal district. After extensive restoration and development, partly funded by the Region of Toulouse, the building was ready for the start of the school year in September 1996. Jean-Jacques Laffont was again closely involved and interested in the progress of the renovation work, tirelessly discussing plans and progress with the architects, to the extent of raising the finance with IDEI for the installation of air conditioning in the wing of the public building reserved for economists. But he was no longer alone with only his team for support. Local and national public figures were becoming increasingly aware of the importance of the project, and decided to trust this remarkable researcher with his contagious gift of enthusiasm. This was one more sign – indeed a more "local" sign – that his goal was well on its way to being achieved. There was now only one thing left for Jean-Jacques Laffont's grand design to be fully realized: the creation of a high-level teaching centre for economics in Toulouse, in the image of the research centre. He knew, of course, that it is not possible to simply "set up a research team", especially if it was to be one of the best in the world. This foresight, this "vision of the future that he had, that was probably one of his most outstanding traits, has enabled him to build a system that is not based on one man, but on a strong and efficient team," said Bruno Sire. Unfortunately, the early death of Jean-Jacques Laffont in 2004 prevented

him from seeing the completion of his life's work. He who remains "a constant source of inspiration for current research teams", in the words of Jacques Crémer, had nonetheless bequeathed two gems to the team he founded: an ambitious long-term vision and a collective willingness to overcome the inevitable obstacles that would be encountered along the way. Indeed, this vision persisted despite the tragic loss of its instigator. It is through the talent and exceptional humility of Jean-Jacques Laffont that this incredible adventure has continued, but it is also due to the abundant qualities of the team who continued his work, now with the support of public authorities: the creation of Toulouse School of Economics, research and teaching centre.

The sustainability of research centres of excellence throughout Europe has regularly been questioned once their founding generation has retired. The death of Jean-Jacques Laffont in 2004 was clearly accompanied by the obvious risk that his ambitious project would cease. Who had the legitimacy to assume the leadership of this team after the passing of such a charismatic personality? Who would, or could, ensure the continuation of the effort to build this great institutional work, unfinished by its founder? Would some of its most productive researchers succumb to the attraction and appeal of options elsewhere? Would the university, CNRS, INRA and EHESS continue their ongoing support of the project? Indeed, would companies continue their research partnerships with IDEI?

III

2004-2014: TSE –
“THE CONVERTED TRY”

Toulouse School of Economics after Jean-Jacques Laffont

For the Toulouse economists the period ahead looked somewhat perilous. Poorly navigated, it could lead to the end of the magnificent undertaking initiated by Jean-Jacques Laffont, or at least to the neglect of the project's initial ambitions. It was indeed a period of great trial and immense sadness. How could this close-knit community recover from the loss of such a leader as Jean-Jacques Laffont? Someone who had given so much of himself to the project's development, who had shaped it step by step, without ever deviating from the goals he had set, and who had deployed such extraordinary energy to challenge himself against the odds? He was such a prominent figure whose success in no way diminished his humanity.

The testimony of Jacques Crémer is eloquent in this respect: "Let's be clear: TSE would not exist today if it had not been for the leadership and capacity of Jean-Jacques to attract other people to help transform his dreams into reality. He had always been very active in the management of the University of Toulouse and within the profession. He travelled the world, visiting universities, giving seminars, sometimes meeting with policy makers, but always paying particular attention to young researchers and doctoral students. An extraordinary number of people of all nationalities have said to one or another of us, 'I once heard Jean-Jacques during a seminar,' or 'I had a short conversation with him and it radically changed my views of the problem,' or 'of my career,' or 'of my life'."

Without his personal input, was the work he had supported for all of those years on the verge of collapse? In 2004 many feared this to be the case, especially since his death at 57 years old had occurred so prematurely and unexpectedly. Yet remarkably this collapse did

not happen. Even at that time, the Toulouse research centre was much more than a group of people gathered around one man. It was a true community based on solid foundations, united by ambitions and common objectives. It was recognised in international academic circles for the high quality of its team and its scientific output, and was now supported by a number of local public powers in Toulouse. In addition, changes in governance had been established, notably with the appointment of Jacques Crémer to the management of IDEI in 2002, thus ensuring the sustainability of the centre. All the care and attention taken during the period of recruitment in the 1980s and 1990s would come to fruition. A team created from the start by Jean-Jacques Laffont took up the realisation of his dream. They included Jacques Crémer, Christian Gollier, Patrick Rey, and Jean Tirole (to mention only four researchers involved). Jean Tirole would take over the running of TSE and IDEI in subsequent years. This determination to continue the collective adventure and to complete the work of Jean-Jacques Laffont was the starting point of a new 10-year cycle, which would see the consolidation of the previous years’ achievements and the evolution in the structure itself, resulting in the creation of Toulouse School of Economics.

A delicate transition within a difficult context

Beyond the unavoidable sadness caused by the loss of its founder and the inevitable period of uncertainty and moments of downheartedness, the research centre was now at a pivotal moment in its history with an imperative to imagine new solutions in order to continue its progress within the global hierarchy. The continued development of the project was again likely to come up against the

question of means, which could threaten it in the short term. Some attempts at high-level recruitment had failed in the past either because of the lack of appeal for the position offered or because of the complexity of the French research institutions. A particularly representative case, due to the latter problem of the French system, was that of Peter Howitt, a Canadian economist, whom Jean-Jacques Laffont had sought to recruit to CNRS. One of the founders of the endogenous growth theory, Peter Howitt spent two years in Toulouse (1995-1997) and was keen to settle there. He applied for the post of Director of Research at CNRS in a year when three posts at this level in economics were open. In light of his credentials, his appointment seemed to be certain. However the National Commission decided otherwise, favouring the internal promotion of research fellows. To add further to this disappointment, he was not classified (not even in fourth position), thus preventing the possibility of any recourse or reversal of the situation (which is possible only for those positioned second and third).

The diversification of sources of funding generated by the creation of IDEI had, in part, provided a light at the end of the tunnel, which would go some way to resolving the recruitment difficulties faced by all universities within France. At this stage of the adventure, the Toulouse team – consisting of approximately 100 researchers and as many doctoral students, assisted by 20 support staff – had a budget that was out of step with the world’s leading institutions in economic research. The budget was insufficient in the context of accelerated international competition of the mid-2000s, not only in North American, British and Swiss universities, but also in relation to the best German and Italian universities where researchers were offered significantly higher

wages than those offered throughout France, and in Toulouse in particular. While the immediate need for recruitment had eased to some extent, the group of scientists gathered together in Toulouse at that time was certainly exceptional. According to Tom Coupé's research (the analysis of all publications and citations in scientific journals between 1990 and 2000¹), from amongst the 1,000 best economists in the world, 22 lived in France, with 12 of them grouped at the University Toulouse 1 Capitole. They included Jean Tirole (already then the second-best economist in the world according to this classification), Jean-Jacques Laffont (ranked eighth), David Martimort, Gilles Saint-Paul, Jean-Charles Rochet, Michel Le Breton, Christian Gollier, Jacques Crémer, Patrick Rey, Helmuth Cremer, Bruno Jullien, and Thierry Magnac. Another classification established by the EconPhD website on bibliometric criteria covering the period 1993-2003,² ranked Toulouse first in the world for industrial economics and the theory of incentives, and first in Europe for business economics, environmental economics, public economics, and political economics.

This international recognition has been confirmed by the number of prestigious scholarships awarded by the European Research Council.³ Furthermore, the number and quality of publications in scientific journals has enabled the University Toulouse 1 Capitole to join the world's top 50 economic research centres, with TSE alone entering directly at 35th position in the Shanghai ranking of the top 300 universities in the world. This is a remarkable feat considering the starting point, when the possibility of being placed within the top ranking seemed remote.

1. Journal of the European Economic Association (2003). See also <http://ideas.repec.org/coupe.html>

2. cf. <http://ideas.repec.org/coupe.html>

3. cf. “A world-renown” (p.134-135).

However, after the initial influx of talented economists who had settled permanently in Toulouse, there existed a real risk of these top researchers moving to other more attractive universities.

In Europe, Toulouse was fighting on unequal terms, not only with the historical leaders in the world of economics, such as the London School of Economics and University College London, but also with several other universities that had undergone extensive reforms. These universities had introduced attractive mechanisms for the most productive researchers, and were therefore at the forefront of the type of competitive environment that was developing in Continental Europe.

In terms of the education sector, even though the Toulouse doctorate launched in 1996 (which was absolutely essential for the development of a high-level scientific research project) was beginning to yield satisfactory results, the current bachelor degree programme did not yet fit into this project of excellence. It offered high-quality training at degree level, but lacked an international dimension. French universities suffered from a lack of prestige in comparison to the grandes écoles.

A new project with new leadership

To break through this barrier, the Toulouse model had to find a way to overcome these handicaps and become more attractive to young students. For Jean-Jacques Laffont, it was imperative to define an institutional structure with a memorable and notable brand, to give the doctorate more clarity and appropriate governance. The structuring of the research centre was difficult to understand because of its three research laboratories (GREMAQ, LERNA and

ARQADE), an association (IDEI), a faculty, and four trusteeships (UT1, CNRS, INRA, and EHESS). In addition, science policy was discussed independently within each institution and recruitment was not being analysed in a coherent manner. With the loss of the one person who embodied the project and leadership of the team, the multiplicity of these institutions gave everyone the opportunity to provide their own different representations of the project.

Between 2004 and 2006, as these problems were more clearly identified, the primary focus was to find solutions to them. Remember that this was a period when the Toulouse economists were mourning the loss of Jean-Jacques Laffont, where the group lacked an innovative vision that would allow it to recover and aim even higher. And it became evident that this recreated vision could only be a collective one.

A call for projects: the opportunity to renew?

Following the adoption of the Pact for Research in 2005 by the French Parliament, the State gave the Toulouse research centre an opportunity to regroup. In 2006, it launched a call for proposals for the creation of 10 *Réseaux thématiques de recherche avancée* – thematic networks for advanced research (RTRA), to which the Toulouse economists responded. The objective of these new “spearheads of French research” was to facilitate the development of scientific centres of international scope with the financial assistance of the State. These centres would be based on a new legal structure, the *Fondations de coopération scientifique* – foundations for scientific cooperation (FCS), – which were then responsible for raising funds from public and private sources. In addition, the RTRAs which were developed by different institutions and research organisations must



At the end of August 2014, TSE welcomed more than 1,500 researchers, for the 29th annual congress of the European Economic Association and the 68th European congress of the Econometric Society.

also allow for the consolidation of several teams of top researchers working towards with same scientific purpose.

During this lack-lustre period which the Toulouse group was going through, participation in the call for projects organised by the Minister of Higher Education, François Goulard, was not a matter of course. Indeed, Dominique de Villepin, Prime Minister at the time, said at a press conference in early July 2005, to the general astonishment of all, that the Paris School of Economics would be amongst the winners, as it was – in a manner of speaking – *hors compétition* (that is, far in advance of its competitors, in a position of its own). How then would it be possible to imagine that a second centre of economics could successfully participate in this call for projects when the State had announced that only 10 RTRAs would be created across all disciplines, and that economics would represent only a minor part of the scientific disciplines in the competition? This was a major blow for the ambitions of the Toulouse group, and many were convinced that they had been *de facto* excluded from the competition. However, many others also saw it as an opportunity to set aside their sadness at the loss of Jean-Jacques Laffont and prepare for the next step: together they would decide to send an application to the Pre Project for the RTRA programme. One man in particular, Christian Gollier, was resolutely committed to this endeavour.

Christian Gollier:⁴ a new leader

Like many others, Christian Gollier was moved by the tremendous gratitude that he felt towards the Institution. He was convinced that the dynamic process created 25 years earlier could again find fertile ground to resume its development. But time was of the essence. The

4. Deputy Director of TSE from 2006 to 2009, and Director from 2009 to 2015.

closing date for the competition was 15 September 2006. Throughout the summer he worked on this project, finalising it with a core group composed of Jacques Crémer, Marc Ivaldi, Patrick Rey, and Jean Tirole. The document entitled Toulouse Sciences Economiques would be submitted to the jury on 14 September 2006. Christian Gollier made the following assessment:

“It is customary to note the low attractiveness of France for foreign researchers of international reputation and to deplore our brain drain. This situation is very worrying at the dawn of an age in which the economy will be largely based on knowledge. The discipline of economics is, unfortunately, no exception to this general observation, with serious consequences. In particular, the lack of research into companies and markets in France leads to a shortage of high-level players trained in economics and finance, as well as a lack of economic culture amongst the public and amongst decision makers.”

The entirety of the Toulouse response to the RTRA competition was organised around these issues.

In total, 37 candidates were submitted to the jury, which was chaired by Jean Dercourt, Secretary of the Academy of Sciences. The results were announced by the Prime Minister on the 4 October 2006. Thirteen winners were selected, with a total budget of 200 million euros. The Toulouse Economic Science project was part of the selection, producing an RTRA based on the establishment of scientific foundation, named the “Jean-Jacques-Laffont-Toulouse School of Economics” (JJL-TSE Foundation). Its creation was endorsed by decree on the 1 February 2007, and published in the *Journal Officiel*. Alongside this valuable certification, the new TSE could immediately take advantage of the provisions of the law on the freedom and responsibilities of universities (LRU) promulgated

a few months later by the new Minister of Higher Education and Research, Valérie Pécresse.

Thus, not only was the system built by Jean-Jacques Laffont not dissolved, but it emerged much stronger as a result of this difficult period. This was the highest tribute that could be paid to its founder. His entrepreneurial spirit had been successfully transferred to his successors allowing economic research in Toulouse to continue to pursue excellence and the adventure to continue. The cohesion of the group, made possible by a remarkable team spirit, had allowed it to navigate this challenging phase. The Foundation then became the flagship of Toulouse economists, under the direction of Jean Tirole and Christian Gollier. Thierry Magnac and Patrick Fève agreed to take roles in scientific leadership and leadership of the graduate school, respectively. IDEI became a privileged partner of TSE while retaining legal independence. Jacques Crémer remained as Director for a few more months before passing on the responsibility to Patrick Rey. In the wake of this process, the team would undertake an impressive restructuring project of the group’s governance and implement a “policy of talent”, thus strengthening the role of IDEI.

In search of new funding

Now that the new structure had been created, it also needed to be provided with the means to function long term. However, the challenge for the immediate term was to start the process of sourcing new financing in order to complement the allocation of 12.8 million euros paid by the State. This was to be partly consumed over five years at a rate of 20% per year, with 800,000 euros contributed by some of the founding institutions (UT1, CNRS and INRA).

Thanks to its recognised status as a public utility, the Foundation had the opportunity to raise funds from private patrons. From the outset, the management of the new institution decided that this capital would be non-expendable. The funds would be invested and the Foundation would only be permitted to use the interest generated by the capital. This was a crucial decision in the establishment of the new structure in order to ensure its independence, to launch high-level recruitment, to attract the best students, and to develop new projects in line with its ambitious scientific goals. While most of the other RTRAs created at this time used public capital to become a kind of local ANR (national research agency), the management of TSE decided that State support would serve the project’s long-term ambitions, rather than providing it with temporary breathing space until the capital was exhausted. In particular, TSE was careful not to follow the German example, wherein the federal government imposed immediate consumption of funds on its universities, hence making it very difficult for them to keep their best talents and attract new ones. Thus by building an annual budget financed solely by the interest of the capital, TSE was committing itself on a long-term basis to its best researchers and to those it would recruit in future. This was a commitment that the IDEI partnership system was unable to offer.

An ambitious fundraising campaign

However, 12.8 million euros invested at 3% would earn approximately 400,000 euros per year. Clearly it would be difficult to base an ambitious and sustainable skills policy on this basis. In the spring of 2007 the JYL-TSE Foundation decided to embark on an extensive fundraising campaign. In order to encourage scientific foundations to raise funds whilst balancing the nature of their funding, the government decided to further strengthen the scheme by committing

to pay one euro of public money for each private euro collected, provided the capital raised was non-consumable. TSE was the only one to take up the challenge and to succeed in this new fundraising method, thanks in part to the contacts that its researchers already had with businesses via IDEI. Since 1991 its partners had been able to measure the quality of work carried out in Toulouse, while the creation of the RTRA further shaped and consolidated the system.

For over a year, with the energetic and enthusiastic support of prestigious personalities from the business world such as Michel Pébereau,⁵ Jean Tirole and Christian Gollier would devote all their energy to this campaign. The success of this fundraiser proved to be largely in line with their expectations. During its official opening on 2 June 2008, TSE announced that it had received the support of 12 public and private partners (Banque de France, Caisse des Dépôts, Axa, BNP Paribas, Crédit Agricole, EDF, Exane, La Poste, France Telecom-Orange, Engie, Total, and the Meyer family), for a total amount of 33 million euros. By offering a stable financial base for the young Foundation, the donations of these companies would have a significant role to play in the renewal that would take place through the creation of TSE. It was an extraordinary fundraising performance that Minister Valérie Pécresse wanted to see replicated, as she stated in her inauguration speech:

“Such success will not remain isolated for long, I am sure. In the eyes of all, it can only testify to the complete self-evidence of the exceptional dynamics that can emerge from such balanced and innovative partnerships. When the walls that hitherto separated

5. As President and CEO of BNP in 1993, he led the merger with the investment bank Paribas and formed BNPP in 2000 which he directed until 2003. After serving as Chairman of the Board of the BNPP, he became its Honorary Chairman from 2011. Member of the Board of Directors of the TSE (designated by the partners from the business world), he has been President of the ARC Foundation for Cancer Research since 2014.

the universities from corporations crumble, the dialogue which then opens up is not slow to produce fruit: companies are all too aware of the advantages that a grouping of so many like-minds can bring. Universities know only too well that the strength that they will benefit from, with support from university and business partnerships such as this, will flourish far and wide in the future. In my view, the links that have been forged here in Toulouse may also be established wherever French universities and research organisations pursue their quest for excellence.”

Thanks to the additional matching contribution announced by the State, the starting capital of TSE was greatly enriched. In total the JLL-TSE Foundation was able to rely on capital of more than 75 million euros to sustain the ongoing work of the project. Five years later, and as a unique example amongst the 13 RTRAs, this capital remained intact – including its expendable portion – despite the considerable development of TSE and the global financial crisis of 2008 which greatly reduced most of the endowments received by the major US universities. In its 2012 Annual Report, the Cour de Comptes (court of auditors) also praised the management of the Toulouse research centre. In an unsympathetic observation of the RTRA system as a whole, the “wise minds” of the Rue Cambon (the location of the headquarters of the Cours des Comptes) repeatedly referred to TSE as the “notable exception”: “Only the Jean-Jacques-Laffont-TSE Foundation was able to fully utilise the new legal instrument established by law in 2006 for the benefit of its scientific project.” The Cours des Comptes also highlighted the success of the Fondation de coopération scientifique (FCS) at TSE in terms of fundraising:

“TSE has implemented an extremely well-thought through and innovative approach to raising private funds. [It] is the only

institution that has exploited the “foundation” status wisely: it has significantly increased its capital through the contribution of private funds; it has spent its consumable endowment with care; and has invested its capital with a view to its long-term preservation. Its operational budgets have been realistic and no particular risks now threaten its sustainability.”

The fundraising work was now complete. Combined with the unique Toulousian methods that can be highlighted as “best practice”, the JYL-TSE Foundation was enabled to be more effective in a highly competitive environment, where it significantly increased its attractiveness to researchers and its international reputation.

TSE labelled *Laboratoire d'excellence* (Laboratory of Excellence)

After the success of the RTRA project, TSE would soon efficaciously engage in another national programme. Launched by the Government in 2009, the future investments fund provided a budget of 21.9 billion euros for higher education and research. In 2010, the Toulouse research centre was selected under the *Laboratoire d'excellence* – the laboratories of excellence label (Labex). This designation aimed to “equip laboratories with international exposure, with significant means to enable them to compete on an equal level with their foreign counterparts, to attract researchers and internationally-renowned researchers and lecturers and to build an integrated policy of high-level research, training and development.” In early 2011 and again in early 2012, the international jury chaired by Professor Manuel García Velarde (Complutense University of Madrid) received proposals for 436 projects in total, of which only 171 were selected. Of these financed projects, two were presented by

Toulouse economists. The first, the Labex IAST (institute for advanced study in Toulouse) aimed to create an international network of interdisciplinary social science research within the University Toulouse 1 Capitole, and to facilitate the transfer of knowledge to help public and private decision making. With a budget of 25 million euros over 10 years, IAST was an extremely ambitious project. While hitherto limited to economics, it now aimed to integrate several new dimensions involving political science, psychology, law, history, anthropology, and sociology. The positive assessment of its instigators, especially Jean Tirole, Paul Seabright, Ingela Alger, Michel Le Breton, and Karine Van Der Straeten, demonstrated that these disciplines would have much to gain by increasing their interaction after a long period of disciplinary isolation. In addition, this project would benefit TSE students who would now have access to knowledge in social sciences provided by researchers recruited through this new spin-off of the University Toulouse 1 Capitole, with the support of leading researchers in these disciplines. The second project, the Labex IAM-TSE (for “incentives, actors and markets”, one of the favoured research areas of the Toulouse group from the beginning) was endowed with 15 million euros over nine years. Its ambition was to consolidate the overall dynamics of TSE, in particular by strengthening its attractiveness and influence.

As an additional part of the Future Investment initiative, the TSE School launched in September 2011 by the University Toulouse 1 Capitole and TSE University was labelled as an IDEFI (Initiatives d'excellence en formations innovantes – excellent initiatives in innovative training courses) in 2012 for its FREDD project (Former les économistes de demain – training tomorrow's economists).

Toulouse School of Economics

The aim of this project was to raise the new school to the highest international standard while giving priority to equal opportunity to students of all social levels and backgrounds. The project received funding of seven million euros over seven years.

If the Toulouse university centre had been asking questions about its future at the dawn of this new era, official recognition and response by the authorities was unequivocally positive. The various international science competition juries of the Future Investment initiative considered TSE as one of the supreme leading centres of research and teaching in France, across all disciplines.

This IDEFI label demonstrated belief in its potential and gave it the means to further develop in a sustainable manner.



The Tiger Forum, one of the major global gatherings around economic questions (globalisation, cyber- criminality...) in June 2013.

Towards the highest degree of excellence

This new dynamic that saw TSE flourish and resume its march towards the top of the global hierarchy was based on a series of guidelines that highlighted its strength and originality. Most of these guidelines originated from Jean-Jacques Laffont's project, and were consolidated or restructured with the creation of the Foundation. The provision of new means to overcome the difficulties that had been identified meant that the original humanitarian spirit of its initiator was preserved.

Governance, far from French standards

The first of these major guidelines was governance.

The leadership ability of Jean-Jacques Laffont was effortlessly succeeded by the complementary duo of Jean Tirole (Chairman) and Christian Gollier (Director, at that time). These two world-class researchers had mutual ambitions and objectives in line with achievements already made: the quest for scientific excellence and the building of an effective and sustainable institutional structure. With humour, Claude Crampes summarised the role the two men had played in the recent development of TSE: "They are able to see windows, where others see walls."

While leadership in the 1990s had been provided by Jean-Jacques Laffont in an informal fashion, the development of the team and the reinforcement of the project and its sustainability required a more formal structure of governance. This was made possible by the creation of the JJL-TSE Foundation. Governance was well supported by its Board of Directors, the governing body responsible for

the Foundation's strategy and for monitoring its implementation by the Director, who it is able to appoint and dismiss. Unlike the boards within the general French academic system, the Board of Directors of TSE is small (15 members), with five seats reserved for public research institutions (CNRS, EHESS, INRA, and two seats for UT1-Capitole), five for public and private enterprises who are members of the TSE partners group, and five for other qualified persons who are for the most part economists. This mode of direction did not interfere with the scientific orientation of the research centre. Indeed, this was exceptional in the French academic landscape where more often than not members of the boards were both "judge and jury". In the case of TSE, 13 of the 15 Directors were external to TSE, whereby the members of the TSE Council currently serving were limited to a representative elected by the researchers, and Jean Tirole (as a qualified person).

For its part, the scientific Board today continues to guide and evaluate the scientific policy, as well as the quality of the work produced. Again its composition deviates most resolutely from the French academic standard, with the entirety of its members being external to TSE. All are eminent economists – professors at the most prestigious universities, including Harvard, Paris School of Economics, MIT, Chicago, Princeton, Berkeley, and the London School of Economics. Among them, five Nobel Laureates of Economics currently sit, or have sat, on the Board. They include Roger Myerson, Eric Maskin, Amartya Sen, Thomas J. Sargent, and Bengt Holmström. Few French academic structures have chosen to set up governing bodies open to the outside world to quite this degree. In contrast, this practice is common in the Anglo-Saxon academic world. By calling in third parties for the monitoring of compliance with its missions and the scientific evaluation of its activities, TSE

is clearly demonstrating its principles. In terms of the quality of these members, whether they are important business leaders or academic luminaries, what they undoubtedly bring is a new dimension and a spirit of openness, with its different demands, motivation and aspirations. Thus the quality of decision-making in this context is made exclusively on the substance of subjects and in the general interest of TSE. This mode certainly contributes to the credibility of the Foundation's approach.

In addition, this governance is complemented by a departmental council, an internal recommendation body composed of top researchers and representatives of the administrative staff. Indeed, a research institution cannot function without quality administrative and logistics support. From the beginning the various structures put in place have gradually helped to develop this support, especially in the recruitment of an extremely talented administrative team. This invaluable research support has facilitated the organisation of a number of scientific conferences, as well as the construction of strong financial and legal affairs management, under the leadership of Sylvie Lucas, the Associate Director of Accounting, Legal and Financial Affairs. A new milestone in the development of the professionalism of TSE administrative support was reached in 2010 with the creation of the post of Deputy Director of Services, ably filled by Joël Echevarria. In spite of a complicated institutional context, Joël has strengthened this team. This has especially been so in terms of scientific communication and the establishment of structures to foster effective cooperation between TSE and public institutions, in relation to the majority of administrative tasks and traditional techniques of the research centres (IT, research support, technical

support for the development of research projects, the organisation of seminars and conferences, among others).

In June 2013 the members of the Departmental Council voted unanimously to recommend a merger of the three historic laboratories – GREMAQ, LERNA and ARQADE – into a joint research unit, the UMR-TSE-R. The four guardians (Toulouse 1 Capitole, CNRS, INRA, and EHESS) validated this merger, effective 1 January 2016. The first director of the UMR-TSE-R was Jean-Marie Lozachmeur, a CNRS-TSE researcher.

A policy to reverse the brain drain

The second major guideline of TSE, which was a common theme of the Toulouse economists since the 1980s, was the quality of recruitment. The TSE leaders were united on this subject, “because brains are the basic resource for research in the social sciences,” said Claude Crampes. It was also asserted by Jean-Jacques Laffont, “[that] there is only one strategic choice in universities: recruitment!” In this regard, TSE did not deviate from the rule adopted at the inception of GREMAQ which was to recruit the best candidates in their field of expertise and to offer optimal conditions throughout their careers. This also required the rejection of the practice of internal recruitment, that is to say the recruitment of PhD students by their own supervisors. This practice remains characteristic of the French system today which tends to maintain a relationship of dependency between senior teachers and their students who then become colleagues. This type of recruitment can quickly generate the phenomenon of a “royal court” around the supervisor, with each PhD student seeking to win the coveted position of lecturer and each professor

struggling against his colleagues to defend their own interests. This rejection of internal recruitment has meant that TSE prohibits itself from recruiting its own PhD students. Alternatively, TSE strives to support its graduates in the best way possible, so that those wishing to can pursue an academic career by joining a leading university and by consequence gain exposure to new ideas and contribute in due course to the highly regarded reputation of TSE. In essence, TSE prefers to let the entire international scientific community judge the quality of its young PhD graduates from Toulouse. The sole purpose of the thesis supervisor thus becomes unambiguous: that is to help students to produce their best possible thesis in order to achieve their goals. Conversely, TSE also competes on the international market for talented graduates, in order to recruit – based on the work contained in their thesis – the most promising young researchers they can find, already trained at other major universities around the world.

The Job Market: job opportunities for economists

The RTRA labelling and the associated additional resources have undoubtedly enabled the research centre to relaunch itself as an international competitor. The LRU law (university reform law or Pécresse law, 2007) on the autonomy of universities has also played its part, by allowing a recruitment process more suited to this competition.

There exists an international market for young PhD graduates in economics in search of their first academic position. These young researchers come together to meet the heads of departments of various universities and organisations during the first week of January in an annually selected large American city. This is called the Job Market or Job Openings for Economists (JOE).

Organised across the Atlantic by the American Economic Association (AEA), this unique job forum brings together nearly 13,000 participants in a different location each year. It aims to connect young people who have a high level of potential with their future employers. The world's best universities position themselves to attract newly qualified scientists, who they hope will become the future's best. Over the course of three days, thousands of interviews are conducted, leading universities to invite candidates whose profiles seem the most fitting to visit them. These visits take the form of a seminar given by the young doctoral student before all members of the scientific department, preceded and followed by a large number of face-to-face meetings with interested researchers. Scientific discussions often continue over breakfast, lunch and dinner. At the end of the day's visit, members of the department generally have a fairly clear idea of the candidate's research and teaching prospects. From late February, universities forward their offers to their preferred candidates, not unlike a worldwide marketplace. The best candidates will have numerous offers, enabling them to play the market in order to better negotiate contract terms for themselves, in terms of salary, teaching load or research facilities. In mid-March the process is over, to the disappointment of the departments that have failed to attract the young graduates they have pursued. In France before the LRU was created, universities could not submit offers before June, which from the outset excluded any attempt to reverse the brain drain, not to mention the constrained framework of remuneration. Fortunately, since 2007, autonomous universities have had the opportunity to recruit overseas, an opportunity that has coincided perfectly with the new TSE strategy. While the new funding offered by the Foundation has made it possible to improve the financial terms of any offers made, the University Toulouse 1

Capitole has at the same time decided – under the authority of its President, Bruno Sire – to take full advantage of the provisions of the LRU. For TSE, optimizing its recruitment process has not stopped there. In the French system, the university was taking a significant risk since the quality of a thesis does not guarantee the scientific productivity of its author in their future career: indeed, a very good thesis may be followed by a modest academic career. This is why most universities worldwide have instituted a so-called “tenure-track” process, which offers the young doctor a clear contract with a tenure guarantee of no less than six years, which normally provides new recruits with enough time to prove themselves. At the end of this contract period, the university commits to evaluating the work carried out according to strict international standards. In the case of a positive evaluation, and only in this case, the researcher would then be offered a professorship with the promise of lifetime employment to ensure their independence. In France, the usual standard is to offer this guarantee of lifetime employment as a civil servant straight after the publication of the thesis. In 2009 TSE decided to implement a tenure-track system with the unique support of the university, and thus appeared to be the only university in France that no longer recruited its economics lecturers.

Operation “seduction”

In its efforts to reverse the brain drain, TSE was also able to count on the benefits of the actively promoted “work-life balance”, and the specific strengths of the quality of life in France, particularly in Toulouse. As Bruno Sire explained, “the attractiveness of TSE is based on a global recognition that monetary criteria are not the only ones considered by newcomers.” This is confirmed by Patrick Rey, who stated that from the very start of his time in Toulouse,

he benefitted from “warm, active support or mentoring by senior colleagues, a great freedom in the choice of [his] work and how to approach it, and a very pleasant atmosphere, where researchers move from one office to another to discuss issues that interest them.” This work on the reception and integration of young researchers into the scientific community has become one of the main tools at TSE in its attempts to reverse the brain drain.

For several years TSE has developed support services for researchers who have met the expected level of scientific excellence, in order to facilitate their arrival and that of their families (the search for schools, housing, French language courses, banking services, and so on).

Considerable efforts have been made to attract new talent and to build loyalty. Aligned with international best practices, these efforts have largely borne fruit, since the academic staff has been to a large extent retained. This new dynamic is particularly notable amongst the younger population. Their community has been profoundly transformed, becoming more international and more integrated into global scientific networks. In this way, many young “stars in the making” at TSE have accepted offers following the completion of their thesis from Columbia, MIT, Yale, and Princeton.

The results are more mixed for older, more experienced, researchers in their thirties or early forties. For example, Christian Hellwig (UCLA), Augustin Landier (NYU), Guillaume Plantin (London Business School), Nour Meddahi (Imperial College London), and Alexander Guembel (Oxford), who all benefit from a worldwide reputation in their field, have been well integrated into the Toulouse centre, further increasing its international status. However, TSE has also seen some of its best researchers leave, such as Jean-Charles Rochet, to the

University of Zürich, Hippolyte d’Albis, David Martimort and Gilles Saint-Paul to the Paris School of Economics, and more recently, Guillaume Plantin to Sciences-Po Paris. Here is proof indeed, if proof is needed, that TSE is facing significant pressure from other major recruiters.

Nevertheless, the requirement of a high-level recruitment programme is directly related to the third major guideline that underpins its success: excellent in research, from the original perspective of partnerships with business, and, of course, as a direct legacy of the Jean-Jacques Laffont years.

An independent research partnership

The need to be independent

Without returning to the debate on the relevance and legitimacy of the research partnership contracts that emerged from the creation of IDEI, it is worth recalling that from the scientific point of view they have constituted a strong and distinctive characteristic of the Toulouse economists since the 1990s. Within the very clear framework that was established from the beginning, which required the publication of research in scientific journals with referees and full respect for the independence of researchers, a code of ethics was added in 2011 adopted by the Board of the Foundation. This is a requirement for researchers to openly declare in their articles the financing they have received, in order to avoid any conflict of interest. “It is important to note that the partners do not have any right of censorship in the work carried out by scientists who work alongside them, let alone in their results,” said Patrick Rey. Shortly after receiving his Nobel Prize, Jean Tirole re-emphasized this issue:

“No business can prevent us from publishing what we want. In 23 years and after dozens of partnerships, only one company has wished to question this independence, at which point we ended the partnership. Moreover, if we were not serious, our reports would be rejected by the major international journals.”

The situation is the same in terms of ideological or political independence. Some see TSE as an institution marked by a liberal or even an ultra-liberal ideology. Christian Gollier has remarked: “We are, on the contrary, in a strong position, able to regulate the markets that are essentially inefficient.” The same can be said for ideological or political independence.

World-renowned

Thus, the excellence of the research work carried out at TSE is reflected in the growing reputation of the institution and its researchers. In only a few years, and in line with its objectives, TSE has become one of the best economics departments in the world. Moving in the same direction as the different rankings that have positioned TSE first or second place within the discipline, other indicators are relevant for measuring the level it has achieved. An impressive statistic is to be found in the number of research fellowships granted by the European Research Council (ERC). In 2007 the European Commission decided to create substantial scholarships (from 500,000 to 2,000,000 euros over five years) for the best European researchers. Their stated objective was to retain the best researchers in Europe and to bring in top researchers from the US to Toulouse. TSE, with 17 scholarships since 2007, is ranked in the top three in Europe, behind two leading economics institutions (the London School of Economics and University College London), and is ahead of some of the most outstanding

institutions, such as Bocconi (Milan), Pompeu Fabra (Barcelona), and Oxford and Cambridge (UK). TSE is rated first in France, with 59% of the French scholarships in economics.

Several official French bodies have given emphasis to these excellent results. The *Cour des Comptes* has welcomed its growing scientific power, in addition to the sound financial management of the Foundation. The *Agence d'évaluation de la recherche et de l'enseignement supérieur* – an agency of research evaluation and higher education (AERES) of the Ministry of Higher Education and Research in 2010 published an extremely favourable report on the three component TSE laboratories (GREMAQ, LERNA and ARQADE). “It is in economics, within the TSE RTRA, that the UT1-Capitole receives its greatest international recognition in terms of research; visibility that is at quite an exceptional level.” The same satisfaction was indicated by the National Research Agency, when in 2015 it conducted the mid-term evaluation of Labex IAM-TSE and Labex IAST.

Education at the highest level

Finally, the fourth guideline which showcases the specific nature and the success of TSE is the consolidation of a very high standard of tuition provided as a complement to the research centre. While the creation of a doctoral programme based on excellence has been successful, some questions have arisen concerning the first years for students at the university. For Jean-Jacques Laffont, the situation was clear for a long time. Foreign universities, especially those in the US, offered the undergraduate more than a “seat for a few hours in front of teachers”, he emphasised.

They also provided a social and cultural framework that fostered a sense of belonging to a community, almost like a family. For Jean-Jacques Laffont, it was not the curriculum that needed to be reformed, but rather the need to examine the conditions for the student in a broader sense. By the mid-2000s, voices such as those of Franck Portier and Jacques Crémer rose within the TSE team to include this new objective on the collective work agenda. In France the image of excellence promoted by the preparatory classes and the grandes écoles, favoured by a selective entry system and significant fees, overshadowed the attractiveness of TSE. However, its international reputation has enabled it to attract many excellent international students. Maintaining this attractiveness abroad and developing it within France’s territory are its new challenges.

After a feasibility study, the transformation of the Faculty of Economic Science into a School of Economics within TSE in 2011 complemented the process by establishing a course of excellence from the very first year of study. The ambition today is to create a “third way”, halfway between the classical university and the grandes écoles. Two main intentions lie at the origin of this revolution. First, that of the university which supports the objectives of TSE with the intention that students are fully engaged, and second, that of the researchers, for whom the model is the Anglo-Saxon universities where research and the transfer of knowledge go hand-in-hand. As President of the University Toulouse 1 Capitole, Bruno Sire is spearheading this project. The recent autonomy of universities and the presence of the Foundation have facilitated the acceptance of this extraordinary task, which takes them outside the European harmonisation of academic qualifications mandated by the Bologna Process (the LMD system – three cycles of higher education qualifications: bachelor, master and doctorate). The architecture that TSE prefers to implement is inspired by some of the practices of the grandes

écoles. First, there is a preparatory cycle of two years with non-selective entry (whereas the entry into preparatory class for colleges or IUT is by dossier), but with a process of “active guidance”. This includes, in particular, bringing students’ abilities in maths up to the required level and continuous assessment starting in September, allowing each student to assess the path ahead of them. For those who have validated their first two-year cycle and are motivated by quantitative economics, a cycle of three years within the school is proposed. Others who are more attracted to management studies, head towards the Institute of Business Administration (IAE) or the Business School (now TBS – the Toulouse Business School). Others may turn towards additional university courses, such as law, economic or social administration, etc. If there is indeed a process of selection by which to gain entry to the school in the third year, it remains more flexible than that usually found in the grandes écoles, where there is a points-based contest, and where everything is decided during three or four days of intensive tests.

Bruno Sire won the case with the Ministry of Higher Education and Research for this original project, about which he said: “TSE offers an alternative educational model that opens up all of the doors leading to excellence.” As the main designer of this success, he has enabled the realisation of another of Jean-Jacques Laffont’s dreams. The educational programmes offered at TSE were an immediate success. They were initially led by Marie-Françoise Calmette, then by Jean-Philippe Lesne from 2012, followed by David Alary, and finally by Stéphane Gregoir,⁶ who has been the Dean of TSE since January 2016. It continues to attract many French and foreign

6. A graduate economist from the École Polytechnique and ENSAE, and a PhD in Applied Mathematics, Stéphane Gregoir, spent much of his career at INSEE, notably as Director of CREST (Centre de Recherche en Économie Statistique – research centre in statistical economy), then Director of Methodology and International Relations and Coordination. He was also Director of Research and Dean of the Faculty of EDHEC for seven years.



The Business Networking Day is a much awaited day of exchange between businesses and students, on the subject of employment.

students who greatly prefer this programme of advanced training with its strong international coverage of all scientific fields of the economy and the worldwide reputation of its faculty.

This School of Economics within the university remains a challenge for its team in a context of competition which can be distorted by the constraints imposed on universities. Indeed, effectively “free-of-charge education” is a handicap in the competition to win the best young foreigners, who often have generous scholarships granted to them by their countries of origin.

In particular, it offers abundant prospects for TSE by creating social value through the ongoing training of high-level economic experts needed by France.



Jean-Jacques Laffont received the medal of an officer of the Légion d'honneur in 2002 for his irreproachable civic qualities.

TSE, the consecration of a collective ambition

By remaining faithful to the founding principles of Jean-Jacques Laffont, by adopting new means of action and by re-energising around the four basic guidelines – effective and relevant governance, quality of recruitment, excellence in research partnerships and training-Toulouse School of Economics has indomitably entered the club made up of the best research centres in the world. Interestingly word of the success of TSE has remained relatively quiet in France (that is, until 13 October 2014), while its headlines are regularly advanced in the media, with official French and European agencies frequently seeking its expertise. The Tiger Forum, organised under the direction of Marc Ivaldi in 2013 and again in 2014, brought together the world's leading economists, and also began to attract more attention to the Toulouse University. The Forum has counted two Nobel Laureates among their guests of honour – Eric Maskin in 2013 and Joseph Stiglitz in 2014 – who were awarded the Jean-Jacques Laffont Prize established in 2006.⁷ The awarding of the Nobel Prize for Economics in 2014 to Jean Tirole beautifully closes this cycle and places TSE without doubt in the world's spotlight. Exactly 10 years after the death of Jean-Jacques Laffont, a more appropriate tribute could not have been paid to the great economist and the most outstanding element of his work, which was to have created this magnificent scientific and institutional project. Symbolically, and in the same way that the development of GREMAQ and IDEI led to the research centre settling into its home at the Manufacture des tabacs, the transition towards a new period will also result in a new

7. This prize is awarded by IDEI and the City of Toulouse to researchers of international renown whose works combine theoretical and applied aspects.



Joseph Stiglitz received from the Maire of Toulouse, Jean-Luc Moudenc, the Jean-Jacques-Laffont Prize, in the salle des Illustres, in the Capitole building on 2nd June, 2014.

2004-2014: TSE - "THE CONVERTED TRY"

move. The University Toulouse 1 Capitole has decided to provide TSE with a dedicated building in the heart of Toulouse. It has been commissioned by an Irish architectural firm, Grafton Architects, which has since received numerous international awards. The proposal features the foremost qualities of openness to the world, the sharing of knowledge, the integration into an emblematic area of the city, while successfully reinterpreting the architecture of the Toulouse region. Covering 10,000 square metres, the building will house a community of researchers, doctoral students, and TSE personnel. It will provide a setting to match that of the highest standards of ergonomics and comfort at the major international universities, with spaces dedicated to hosting international conferences and seminars at the highest level. A new building for a new era: a new chapter in the history of Toulouse School of Economics is now beginning, starting a dynamic new process with many more opportunities and with it many challenges, prompted and made possible by winning the Nobel Prize in Economics.



Eric Maskin (center), accompanied by Hervé Ossard (left) and by Jean Tirole (right), received the Jean-Jacques-Laffont Prize from the city of Toulouse on the 6th of June, 2013.



Jean Tirole hands over to Elhanan Helpman on the occasion of his lecture, before he received the Jean-Jacques-Laffont Prize 2015, at the Toulouse Mairie.

POSTSCRIPT

Jean-Jacques Laffont was one of the greatest economists of his generation. His goal was to build a truly unique “school of economics”. At the heart of his ambition was the firm conviction that economics could be a force for good in the world. For him, success was not simply a matter of being published in the best scientific journals, but by having an impact on the lives of “real people”. As Jerry R. Green (Harvard) said in 2004, as a tribute to Jean-Jacques Laffont shortly after his untimely death, “Jean-Jacques knew instinctively that the greatest usefulness of the theory is to improve the lives of real people – especially those born into less fortunate circumstances.”

A great visionary, Jean-Jacques Laffont understood that he had to take the best of all that he had discovered in the United States and combine it with the best of French and European research education; to invent a new model of the international school of economics.

And so it has happened that from what was only a “gleam in the eye” of its founder, Jean-Jacques Laffont, TSE has become one of the leading and most influential institutions of its kind in the world.

It is no exaggeration to say that over the last 30 years, the work of economists at TSE has led to a better understanding of economic processes, and has thus improved the world in which we live. These researchers have worked on some of the most important economic and social issues of our time. They include the transition from a regulated and planned economy to a more open economy, energy and climate issues, the regulation of the financial system, innovation and intellectual property, changes in infrastructure savings (telecommunications, energy, transport, etc.), the digital transformation of society, aging populations in industrialized societies, violence and

political instability, and persistent poverty in many parts of the developed and developing worlds.

Most of these challenges are, or will soon become, urgent issues. In order to respond effectively, public and private decision makers need to be better educated, have more informed experts and to be inspired by richer, more transdisciplinary and independent scientific research. TSE aims to significantly contribute to the improvement of public and private decision-making by becoming an innovative platform for research and education in economics and social sciences. To do so it must continue to be supported by the four pillars on which it has based its success so far: the highest scientific and intellectual requirements, entrepreneurship, the capacity for innovation, and a connection to the real world.

The challenges that the TSE community will face in the coming period are threefold.

First, it must strengthen the bonds within its scientific community, which means, above all, retaining the loyalty of its top researchers in Toulouse, who are increasingly in demand elsewhere in France and abroad. These bonds must also be strengthened in order to draw to the banks of the Garonne the most promising young researchers and their more eminent elders, reinforcing the policy to reverse the brain drain implemented a decade ago. TSE must therefore consolidate the resources established for the support of research, scientific excellence, the recognition of educational distinction, and career management.

Secondly, the research centre must continue in its aim to become a world-renowned centre of education. Although its doctoral school already has good results, it is the whole education sector (the bachelor, master and doctorate programmes) which must be consolidated, as the main international reference centres (LSE, Bocconi, Oxford,

MIT, Harvard, etc.) are all considered excellent in both research and teaching. In the future the impact of TSE will also be measured by its ability to train the best economists, future public and private decision makers, and to build a strong network of alumni which in turn will strengthen the position of TSE. Particular attention will be paid to the quality of training programmes, pedagogical innovation, and the working and living conditions of students. They will continue to be a benchmark in social and cultural diversity, with particular focus on the quality of what occurs inside and outside the classroom, up to and including professional employment and integration. And since training is not limited to within the walls of the university, TSE is also committed to the dissemination of its courses as closely as possible to where needs lie, in business or at home, with notable online content.

Last but not least is the challenge of innovation through transversal and partnership research. Pioneered via IDEI and IAST, the TSE community has yet to affirm this specificity. IAST is already host to non-economists, social scientists (anthropologists, political scientists, historians, sociologists, lawyers, etc.) while at the same time developing research programmes outside the traditional confines of social sciences, such as biology. These initiatives will promote the establishment of multidisciplinary training programmes and innovative research in order to promote dialogue between researchers from different backgrounds, and thus draw a new analytical framework for contemporary issues.

These future unwritten pages in the life of TSE are just as exciting as the previous ones, making the TSE community a strong and diverse group, unique in the world, and widely recognized and respected for its scientific excellence.

The virtual image of the future TSE building.



ANNEXES

The texts in the appendix provide scientific insight into the work and vision of TSE and demonstrate once again, that scientific excellence is at the heart of the spirit that drives this school:

- An excerpt from Chapter 4 of *Economics for the Common Good* by Jean Tirole;
- The speech made by Jean Tirole at the nobel banquet, 10 December 2014;
- The prize in economic science, 2014.

THE EVERYDAY LIFE OF A RESEARCHER (An excerpt from Chapter 4 of *Economics for the Common Good*)

by Jean Tirole, Princeton University Press, 2017

The world of economic research is not well known to the public. What could academic economists possibly do with their time when they are not teaching students? How does the creation of knowledge in economics happen? How is economic research evaluated? Research in economics has been much criticized in recent years. Some of these criticisms are justified and others are not, but all have raised important questions: Is economics a science? Is it too abstract, too theoretical, too mathematical? Do economists have a distinct way of seeing the world compared to other social sciences? Is the discipline too dominated by orthodoxy and by the English-speaking world?

This chapter and the following one try to answer these questions. I will begin by describing what researchers do on a typical day, the process of modeling, and empirical validation in economics. Next, I will describe the strengths and weaknesses of the process of evaluating research. Then I will examine economists' cognitive characteristics: Are they different from specialists in other disciplines? Are they "foxes" or "hedgehogs," to adopt the distinction introduced by philosopher Isaiah Berlin (foxes know many things, hedgehogs know one big thing)? I will discuss the use of mathematics. Finally, I will describe two tools that have revolutionized the discipline over the past forty years: game theory and information theory. I will end with a discussion of the importance of methodological innovations.

THE INTERPLAY BETWEEN THEORY AND EMPIRICAL EVIDENCE

As with most academic disciplines, research in economics requires a combination of theory and empirical evidence. Theory provides the conceptual framework. It is also the key to understanding the data. Without a theory – that is, without a system of interpretation – data is no more than some interesting observations, implying no conclusions for economic policy. Conversely, a theory is enriched by empirical evidence that may invalidate its hypotheses or conclusions, and thus can improve or overturn it.

Like all academics, economists learn by groping their way forward by trial and error. They adhere to the method of the philosopher Karl Popper, who argued that all sciences are founded on (imperfect) observations of the world and that the scientific method consists of deducing general laws from these observations, corroborated by further testing. This process of constantly shuttling back and forth between theory and empirical evidence never produces certainty, but it gradually increases our understanding of the phenomena being studied.

At the time of Adam Smith, economic theory was descriptive, but it has been gradually mathematicized. Historically theory has played a very important role in the development of the discipline of economics. To mention only a few names that will be familiar to readers, Kenneth Arrow, Milton Friedman, Paul Krugman, Paul Samuelson, Amartya Sen, Robert Solow, and Joseph Stiglitz have built their careers on their theoretical insights, as have (at least in part) many economists who became well known to the public as central bankers (e.g., Ben Bernanke, Stanley Fischer, Mervyn King, Raghuram Rajan, and Janet Yellen) as Treasury

secretary (e.g., Larry Summers) ; as chief economists of multilateral organizations (e.g., Olivier Blanchard, who was an influential economic counsellor and director of the Research Department at the International Monetary Fund from 2008 through 2015) ; or as heads of the Council of Economic Advisors. Let us note that the great majority of names mentioned above are macroeconomists (who analyze the behavior of the economy in the aggregate rather than individual markets or organizations). Media attention has tended to focus only on a few areas of the discipline, despite the fact that microeconomists have had no less influence on policy, for example competition policy and regulation, through their academic writings, in their capacity of chief antitrust enforcer or chief economist in agencies,¹ or as government advisers on various policy issues (such as Sir Nick Stern on climate change).

For several decades empirical data has rightly played an increasingly important role in economics. There are many reasons for this: the improvement of the statistical techniques applied to econometrics, the development of techniques such as randomized controlled trials like those used in medicine and a systematic use of experiments in the laboratory and in the field. These approaches were at one time quite rare, but they are now widely used in top universities. Finally, new technology has made possible the rapid and widespread dissemination of databases, helped analyze data using efficient and inexpensive software programs and provided greater computing power. Today Big Data is enriching the empiricist's toolbox.

Many nonspecialists view economics as essentially a theoretical science and do not appreciate how far this is from the truth.

1. E.g., John Vickers, Damien Neven, Massimo Motta, Lars-Hendrik Roeller, and Tommaso Valletti in Europe, or Tim Breshnahan, Dennis Carlton, Joe Farrell, Michael Katz, Aviv Nevo, Nancy Rose, Carl Shapiro, and Fiona Scott-Morton to name a few recent chief economists at the US Department of Justice.

Although theory continues to play a crucial role in the development of public policies, from competition law to monetary policy and financial regulation, policy takes data into account much more than it used to; in truth, a large part of current research is empirical. As early as the 1990s, most of the articles published in the *American Economic Review* (one of the five most influential journals in the profession) were already empirical or applied.² That is unquestionably still the case today. Most of the rising stars at prestigious American universities have turned to applied work, though without abandoning theory.³

At heart, modeling in economics is rather like modeling in engineering. Economists start with a real-world problem, whether it is well recognized or new question posed by a public or private decision maker. They then identify the substantive core of the problem in order to focus on the essentials. The theoretical model is said to be ad hoc: it is never an exact representation of the truth, but a simplification, and its conclusions can never totally explain reality. There is always a trade-off between a theoretical model describing behavior in a detailed and realistic way, and the much greater difficulty of analyzing such a model in more general terms.

2. Partha Dasgupta, "Modern Economics and Its Critics," in Uskali Maki, ed., *Fact and Fiction in Economics: Models, Realism and Social Construction*, (Cambridge: Cambridge University Press, 2002). Partha Dasgupta analyzes 281 articles published between 1991 and 1995; among them, 25 are purely theoretical, 100 apply theory to a particular problem in economic policy, and 156 (thus more than half) are empirical or experimental.

3. Daron Acemoglu (economic institutions, labor economics), Susan Athey and Jon Levin (industrial economics), Raj Chetty and Emmanuel Saez (evaluation of public policies), Esther Duflo (economics of development), Amy Finkelstein (health care economics), Roland Fryer (economics of discrimination), Matthew Gentzkow (the media and economic policy), Steve Levitt (social phenomena and economics, the author of the best-seller *Freakonomics*), to limit myself to the ten researchers who have won the Clark Medal (a prize for the best economist under forty years old who works in the United States) between 2005 and 2015.

An analogy with some familiar concepts from physics might be useful at this point. The Newtonian theory of gravitation and the theory of ideal gases are founded on hypotheses that we now know to be false.⁴ These theories have, however, proved to be important in two ways: first, later theories (such as the theory of relativity) would probably never have been formulated without them. The simplicity of the theories made them easier to understand and so made it possible to move on to the next stage. Second, Newton's laws and the theory of ideal gases have been excellent approximations in many environments (low velocities in the case of Newton's laws, and low pressures in the case of the theory of ideal gases), and thus have direct applications. In most sciences, especially the social sciences, approximations have proved to be much less precise than those derived from these examples from physics, but their usefulness is undeniable.

I do not pretend to compare the precision of predictions in the social and human sciences with those of Newtonian theory. In some ways human and social sciences are more complex than either the natural or life sciences. Some people argue that the social sciences are too complex to be modeled at all. Human beings are governed by many motivations, some of them dependent on their environment. They make mistakes and their emotions influence them to behave in ways that others would consider irrational. The social sciences are at the heart of the organization of our society, however, and so we must try to make progress in them. Fortunately for researchers of social sciences (whose work would otherwise be hard to justify), patterns of individual and collective behavior can be observed.

4. For example, in the first case, a three-dimensional, homogenous, and isotropic space, and in the second case, the absence of electrostatic interactions.

An Example

Without going into the details of the analysis to follow in chapter 8, we can take global warming as an example. Climatologists observe that we have only a small “carbon budget,” that is, the volume of greenhouse gases (GHG) that we can still emit before we reach the maximum threshold of a 1.5 or 2.0 degree Celsius increase in global surface temperature. Economists rely on this consensus among climatologists and take it as their point of departure. Their challenge is to describe the policies that will allow us, at a reasonable cost, to remain below this threshold. To do this they have to model the behavior of the agents emitting GHGs: businesses, government agencies, and households. To make a start, they assume – and this is a hypothesis – that these will all make a rational choice: if the cost of avoiding pollution is higher than the cost they are made to pay for emitting pollutants, they will choose to pollute. Otherwise they will abate; in other words, they will act in their material self-interest.

The next step in modeling behavior is a normative analysis of regulation. Economists ask what arrangement might produce the result the regulator would favor. Once again, we adopt a simple, even simplistic hypothesis to get a sense of what is going on. The assumed aim is to limit the cost of implementing the environmental policy. Otherwise the policy would decrease the purchasing power of consumers, make businesses less competitive, and reduce employment – and would also increase the fervor and persuasiveness of lobbyists who oppose this type of environmental policy.

If regulators knew enough about each business, they could adopt an “administrative” approach and simply order the firm to

cease polluting every time the cost of not polluting dropped below a specific level. If this approach were adopted, this level would have to be set to keep the global temperature increase below the maximum threshold. However, regulators are unlikely to have enough information to take this approach. In this case, the economic analysis shows that it is better for society to trust the firm to make the decision, making it responsible for its pollution by requiring it either to pay a carbon tax or to purchase negotiable emission permits.⁵ This analysis goes back to the work of the British economist Arthur Cecil Pigou, first published in 1920. It leads to straightforward economic policy recommendations that have greatly contributed to the success of environmental policy in the past thirty years.

But of course this is only an initial approximation. The actors do not behave exactly as we have described. They do not always have the information to allow them to make good economic decisions (for example, about the level of the carbon tax that a polluting business will have to pay twenty years from now). They may also not always maximize their economic profits. The actors might have a genuine environmental conscience, or they might want to behave virtuously in the eyes of their neighbors or colleagues. A company may wish to behave in a more socially responsible way.⁶ A deeper analysis thus involves consideration of economic agents’ social preferences and the imperfect nature of their information. Then numerous other relevant factors, such as the credibility of the state’s commitment, the uncertainty of the science of climatology, innovation, negotiations between states, geopolitics, and so on come into play. Enriching the analysis also involves testing

5. See chapter 8 for more details.

6. See chapter 7.

the underlying hypotheses. For example, the recommendation that an economic instrument like a carbon tax or negotiable emission rights should be used rather than the case-by-case administrative approach is based on the hypothesis that regulators lack enough information (or else that a case-by-case approach might lead unscrupulous regulators to grant special privileges to their friends or to powerful pressure groups). Although this seems justified anecdotally, it is also only a hypothesis. We can either study it directly or verify it indirectly by studying its consequences. Economists have conducted empirical studies showing that, depending on the type of pollutant, the use of an administrative approach increases the cost of an ecological policy by between 50 and 200 percent. This confirms our intuition that regulators have incomplete information about the best ways to reduce pollution.

Theoretical formulation

To get back to the general issue of economic modeling, a lot of the difficulty of the exercise lies in defining its scope. Since it is not feasible to take everything into consideration, we have to distinguish between what is important and what is merely anecdotal (and can therefore be safely ignored). Researchers' experience and their discussions with practitioners prove very useful at this stage, even if – once the problem has been better understood and, if possible, explored empirically – it is ultimately necessary to return to the initial assumptions. Any model will therefore be at best a metaphor for (and at worst a caricature of) reality.

The economist's construction of a model, whether it is a model of the internal organization of a firm, competition in a market, or a macroeconomic mechanism, needs a description of the decision makers' goals as well as hypotheses about their behavior. For example, we can assume, as a first approximation, that capitalist enterprises seek to maximize their profits to satisfy their shareholders. This calculation is, of course, intertemporal.⁷ It is often in the long-term interest of the firm to sacrifice short-term gains – for example, by respecting the interests of employees, suppliers, or customers and by spending on equipment or maintenance – in order to reap profits in the long term. If necessary, we can refine our simplistic hypothesis of profit maximization with an enormous body of knowledge about the governance of businesses and the effects of the incentives offered to CEOs and boards of directors. In this way we can understand and incorporate behavior that is distinct from the analytical framework of maximization of profit – for example the emphasis that business leaders may in reality put on short-term profits to the detriment of long-term profits.

As far as behavior is concerned, remember that our initial assumption was that decision makers act in a rational manner – i.e., in their best interests as assumed – given the limited information available to them. Once again, we can refine this basic analysis thanks to recent research into behavior that exhibits limited or bounded rationality. Finally, we need to model the way in which

7. It consists of summing up, in a single figure, financial flows that are, a priori, not directly comparable because they are realized at different times. In order to do this, the interest rate i is used, reflecting the trade-off between 1 dollar today and $1 + i$ dollars a year later (this is a simplification; other factors can come into play, such as risk or the discounting of distant profits. See in particular Christian Gollier's book, *Pricing the Planet's Future? The Economics of Discounting in an Uncertain World* [Princeton: Princeton University Press, 2012]).

multiple actors, for example competitors in a market, interact. For this, game theory is useful (I shall return to this).

This pared-down, even simplistic, model allows us on the one hand to predict what will happen in a market or the economy as a whole and, on the other hand, to formulate recommendations for private or public decision makers – in other words, for economic policy making. More than other social sciences, economics claims to be normative; it aspires to “change the world.” Analyzing individual and collective behavior and finding certain patterns in it is important; but the ultimate goal is economic policy.

Thus, economics compares the costs and benefits of alternative policies. It could stop at selecting the solution that gives society the greatest net benefit (the benefits less the costs). This would be the right approach if it might be possible to compensate through transfers those who would lose out from the policy. In the absence of such transfers, the analysis is more complex, because public decision makers must then weigh the well-being of different actors, deciding which ones they want to prioritize.

Although they are pared down and simplistic, these models can nevertheless be quite complicated to analyze. Criticism is easy, but the art of modeling is difficult – and criticism of a model is not very useful if there is no viable alternative. Consequently, although debates in seminar rooms and lecture halls may be lively, although reviews by anonymous referees in international professional journals are often unsparing, and although the academic community agrees that questioning theories is essential, criticism is only truly useful if it is constructive.

The economist’s approach is that of “methodological individualism,” according to which collective phenomena are the

result of individual behavior and in their turn affect individuals’ behavior. Methodological individualism is fully compatible with (and perhaps even indispensable to) the comprehension and subtle analysis of group phenomena. Economic agents react to incentives, some of which derive from the social groups to which they belong: they are influenced by social norms; they yield to conformism and fashions, construct multiple identities, behave gregariously, are influenced by the individuals with whom they are directly or indirectly connected in social networks, and tend to think like just other members of their communities.⁸

Empirical tests

Once a theory has been formulated and its implications understood, we need to test the robustness of the results against the initial hypotheses and, as far as possible, test the model’s hypotheses and predictions. We can imagine two kinds of tests (three, if we include the “common sense test”). If past data are available in large quantities and are of sufficient quality, we can subject the model’s predictions to econometric tests. Econometrics is the application of statistics to economics and more generally to the social sciences; it determines the degree of confidence we can have in the relationship between several variables.

But maybe the data are insufficient or the world has changed so much that past data are not a reliable guide to the present. For example, when governments decided in the 1990s to put radio spectrum frequencies up for auction (rather than allotting them free of charge, as they had often done in the past), they had to proceed in

8. I cannot cite here the hundreds or thousands of articles devoted to this subject in the literature of economics. For a very limited survey of the references, the reader might consult the works cited in my articles with Roland Bénabou on identity and social norms.

two stages. From a theoretical point of view, they had to decide how best to sell the spectrum over several geographical zones, knowing that telecom companies might be more interested in one segment of spectrum if they also had contiguous segments. Furthermore, once the government had decided on an auction, they had to determine whether the businesses really understood the mechanism for the sale – and also whether the economists designing the auction had overlooked details that could become important when it was implemented. (Had they, for example, accounted for the possibility that buyers might try to manipulate the auction mechanism?) For these reasons, both economists and governments conducted experiments to check the theory before putting the radio spectrum up for sale. The auctions have since brought in a great deal of money for public treasuries (sixty billion dollars in the United States alone since 1994).

There are two alternatives to standard econometrics: experiments in the field and experiments in the laboratory. In a field experiment, a sample of individuals may be, for example, subjected to a “treatment” in an environment distinct from that of a “control” sample, to analyze differences in behavior and consequences as a result. Experimentation using random sampling⁹ is a well-trodden procedure in physics, the social sciences, marketing, and medicine (in the latter case, for clinical trials of drugs and vaccines). Let us recall, for instance, that in 1882, Pasteur had randomly divided a group of fifty sheep into two subgroups – one vaccinated, the other not – and had them all injected with anthrax to test a vaccine.

9. Naturally, the sampling has to be truly random. This would not be the case if subjects self-selected into participating in the clinical test; those who choose to participate in a trial usually have characteristics that differ from those of the population as a whole.

Sometimes the sample is naturally divided into two parts; then we speak of a “natural experiment” – for example, two identical twins who have been separated at birth and brought up in different families. A social scientist can then try to distinguish innate characteristics from those acquired from the social environment. Another example is when a person’s fate is determined not by their choices, which depend on individual characteristics or circumstances, but by a lottery (for example, admitting pupils to school or assigning conscripts to their units).¹⁰

Economists have developed and deployed a methodology for “randomized control trials” (RCTs), using control and treatment groups to study, for instance, the impact of new electricity tariffs, new forms of health insurance, or support for the unemployed. This approach has come to play a particularly important role in development economics.¹¹ A famous example of this approach is the *Progres*a program, which was set up in Mexico in 1997 to fight poverty. It gives money to mothers on the condition that they allow medical supervision of their family, that their children attend school regularly, and that they promise to devote part of the family’s budget to food. This program was evaluated using an RCT.

Similarly, the situation captured in a theoretical model can be recreated in the laboratory by having subjects (students, lay

10. Another case of random sampling is (or was) the gender of infants born to a couple. For example, it is hard to study how the number of her children affects a woman’s career: a mother who benefits from a promotion may decide to have fewer children or to have them later. Then the causal relation is unclear: Does having children cause a mother’s career to be compromised or, on the contrary, does being successful in her career cause a mother to have fewer children? However, the fact that a family with two sons or two daughters is more likely to want a third child makes it possible to push forward the analysis of causality (see Josh Angrist and William Evans, “Children and Their Parents’ Labor Supply: Evidence from Exogenous Variation in Family Size,” *American Economic Review*, 1998, vol. 88, no. 3, pp. 450–477).

11. See in particular Abhijit Banerjee and Esther Duflo, *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty* (New York: Public Affairs Books, 2011), and more generally the pioneering contributions made by these researchers, who teach at MIT.

persons, professionals) act it out and observing what happens. This method of laboratory experimentation won a Nobel Prize in 2002 for psychologist Daniel Kahneman and economist Vernon Smith. A famous experiment conducted by Vernon Smith analyzed markets such as those for government bonds or commodities. It divided the participants into two equal categories: sellers (with one unit to sell) and buyers (who could buy one unit). Actors who did not exchange anything received nothing except the initial sum they were paid for taking part in the experiment. Gains other participants could make from exchange above this initial sum were set by the experimenter (and also varied from group to group – they were determined by drawing lots). For example, a buyer might gain $10 - p$, where p was the price he paid and 10 represented his willingness to pay (that is, the maximum he was prepared to pay to go ahead with the transaction). Similarly, a seller might be allocated a cost of 4, so that he would emerge from the experiment with a gain of $p - 4$ if he sold at the price p . The theoretical outcome is a price p^* such that the number of sellers with costs lower than p^* is equal to the number of buyers willing to pay more than p^* . The market is then said to be in equilibrium. But what happens when the sellers and buyers only know their own valuations (cost or willingness to pay) and have to make offers to buy and sell? The details make some difference, but the classic result obtained by Vernon Smith was that prices and quantities exchanged do indeed converge toward the theoretical competitive equilibrium when there are enough buyers and sellers.¹²

12. This is not necessarily true if the contract between sellers and buyers is incomplete; an important condition is that the terms of exchange are clearly specified. Laboratory experiments have been conducted in which there is an excess of “workers” with respect to the number of “jobs.” If the effort to be expended on the task is specified in the contract, then Smith’s result is verified. If, on the other hand, the effort expended is partly at the employee’s discretion, employers try to appeal to the employee’s reciprocity (see chapter 5) and offer higher salaries than the one

Finally, many lab experiments seek to measure the effectiveness of public policies or business strategies, while others seek to test whether real-world behaviors conform to those that are predicted by economic theory: For example, do the bidders really understand what strategy they should adopt in different auction mechanisms?¹³

Laboratory experiments – which are also randomized – can more easily be replicated and allow us greater control over the agents’ environment than an experiment conducted in the field. They are like the tests engineers conduct in wind tunnels. The drawback is that the environment is more artificial than in a field experiment.

Experiments conducted both in laboratories and in the field are not just used in economics and psychology, but also in other human and social sciences, notably political science, where they are helping to improve the understanding of executive decision making.

Is economics a science?

The field of economics is scientific in the following sense.¹⁴ Its hypotheses are explicit, meaning they are open to criticism, and its conclusions and their scope follow from logical reasoning, the application of the deductive method. These conclusions can then be tested using the tools of statistics. On the other hand, economics is not an exact science, as its predictions are far from having the precision of, for example, those of celestial mechanics.

they need to offer to attract the employee. See for example Ernst Fehr and Armin Falk, “Wage Rigidity in a Competitive Incomplete Contract Market,” *Journal of Political Economy*, 1999, no. 107, pp. 106–134.

13. For an overview, see Steven Levitt and John List, “Field Experiments in Economics: The Past, the Present, and the Future,” *European Economic Review*, 2009, vol. 53, pp. 1–18.

14. For recent reflections on the scientific status of economics, I recommend Dani Rodrik, *Economics Rules: The Rights and Wrongs of the Dismal Science* (New York: Norton, 2016).

Like seismologists studying earthquakes or physicians worrying about the possibility of a patient having a heart attack, economists who try to predict a banking or exchange-rate crisis are more comfortable identifying factors that might lead to this event than they are trying to specify the date it will happen – or even whether it will happen at all. I will return on several occasions to the question of prediction, but it is useful to emphasize here that there are two obstacles to predictability. The first is common to most of science: a lack of data or a partial comprehension of the phenomenon. For example, economists can have only partial knowledge of a bank's true balance sheet or of the banking regulator's competence and true objectives; they can understand that mutual exposures among banks and other financial institutions may give rise to a domino effect and a systemic crisis following the failure of one of them without really grasping the complex dynamics that would propagate such a crisis.

The second obstacle to predictability is specific to the social and human sciences. In certain circumstances, even if they have all the relevant information and understand the situation perfectly, economists can still find prediction difficult. The fact that my choices will depend on your choices creates “strategic uncertainty” – that is, a difficulty in predicting how each will behave – for an observer. This is the world of “self-fulfilling prophecies” and “multiple equilibria,” of which there will be more examples later in this book,¹⁵ and which can produce a run on a bank or an attack on a currency. For now we should note that a recurrent theme in economic policy is that citizens may wish to coordinate their choices and form pressure groups to influence political decision making. If I, acting alone, were to decide to build my house near an airport, that would not be enough to prevent a future expansion of the airport, so I would

15. Beginning with the discussion of game theory in this chapter. See also chapters 10 and 11.

have no interest in building there. If, on the other hand, many people built homes near the airport, a powerful lobby would be able to prevent its expansion, and so I now would have an incentive to build my house there. Predicting collective behavior thus requires us to understand how people will find ways to coordinate.

THE MICROCOSM OF ACADEMIC ECONOMICS

The validation and challenging of knowledge

As in all scientific disciplines, research is a process of cocreation through debates with colleagues, at seminars and conferences, and in publications. These debates are intense. Indeed, the essence of research is to focus on the phenomena that are not well understood, and about which divergences of opinion are likely to be sharpest. The dominant trends in research change according to how solid the theories are and whether there is evidence to support them. Thus, behavioral economics was a relatively unknown field twenty-five or thirty years ago. Some research centers, such as those at Cal Tech or Carnegie Mellon, made a smart bet on this neglected area, and since then behavioral economics has become part of the mainstream. The great universities have experimental laboratories in this discipline and researchers who devote themselves to it.

Macroeconomics offers another example of the debate and evolution of knowledge in economics.¹⁶ Until the mid-1970s this field was completely dominated by Keynesian theory. Was this a sign that economics was monolithic? No, because in some

16. Of course, I could also take examples bearing on microeconomics.

American universities, mainly in the Midwest, a movement emerged to challenge it.¹⁷ A minority questioned both the empirical scope of existing theories and their very foundations. For example, according to Keynesian theory, an increase in government spending financed by printing new money raises the demand for labor and reduces unemployment. Firms must compete for workers by raising nominal wages. Higher wage costs are passed through to consumers in the form of higher prices, i.e., inflation. This inverse relationship between the rates of unemployment and of inflation within an economy is called the Phillips curve. The stimulus and the concomitant surprise surge in inflation thus lowers real salaries and raises employment in an economy with unemployment and rigidity in nominal salaries (that is, salaries not indexed to the cost of living); it also gives borrowers a shot in the arm by diminishing their real-terms indebtedness, as their debt is usually expressed in nominal terms. It is not hard to appreciate, however, that the systematic creation of inflation would not fool consumers, creditors, or employees for long. They would adapt: either savers would hold fewer assets that are not indexed to inflation, or else they would ask for much higher rates of interest. Similarly, employees would demand that their salaries be indexed to inflation (this was, in reality, a tough nut to crack for many governments around the world). Nor in the 1970s did the facts seem to justify Keynesian theory, because of stagflation (the combination of sluggish growth and high inflation).¹⁸

17. This challenge is often called the “rational expectations revolution.” Precursors were Columbia’s Edmund Phelps and Chicago’s Milton Friedman, who argued that well-informed, rational employers and workers would care only about real wages.

18. The conventional wisdom at the time held that economies faced either inflation or unemployment, but not both at the same time.

Relatedly, an old-style Keynesian would assume that expectations were entirely adaptive or “backward looking”: economic agents would extrapolate the trends observed in the past, but their expectations were not “forward looking.” But consider the case of a financial bubble, that is, an asset that is overvalued with respect to its fundamental value.¹⁹ Someone choosing to buy an overvalued asset will do so only if they intend to resell it, and think they can get the timing right. Therefore they must ask themselves whether other agents will remain invested in this asset in the future and for how long. Similarly, asset managers who have to choose the maturity (called the duration) of a bond portfolio, or who have to decide whether to hedge against fluctuations in interest rates, have to anticipate the way in which the central bank will react to the state of the economy. Or again, a company that decides to invest abroad or repatriate its revenues has to consider the factors that will cause exchange rates to evolve in the short and long run. The absence of a role for forward-looking expectations in Keynesian theory was paradoxical because Keynes himself evoked the “animal spirits” that he argued reflected optimistic expectations liable to destabilize the economy.

Economists challenging the Keynesian consensus refined the models, making them more dynamic, and also developed time series econometrics, statistical tools tailored to macroeconomic data. These economists became dominant in their turn. But their models also had their limits: many of these “neo-Keynesian” macroeconomic models suffered from the quasi-absence of a financial system (a remarkable omission, as macroeconomics had always emphasized the mechanism of monetary transmission by the banking and financial system) and paid little attention to

19. See chapter 11.

financial bubbles or to the problems of a shortage of liquidity in the economy.

Today, whether they are Keynesians or not, macroeconomists are working to improve their models by trying to synthesize the points of view of the different schools, so as to improve our understanding of macroeconomic management.

The evaluation of research

How research is evaluated can determine the allocation of funds among researchers, laboratories, or universities, can indicate whether a research group is functioning well or not, and can help students make choices. How should we evaluate the quality of research in economics and other scientific disciplines? Put simply, there are two approaches to this problem. One approach, roughly, is based on statistics, the other on peer review.

The general public knows about the statistical approach through the Academic Ranking of World Universities (ARWU), better known as the Shanghai Ranking. Every year, universities all over the world feverishly wait to see how the team at Jiao Tong University has rated them. But is this classification an appropriate way to rank universities globally? The Shanghai Ranking has its defects. For example, in measuring productivity, it does not properly take into account the quality of the scientific journals in which scholarly articles are published. In addition, the ranking favors universities that have a Nobel laureate or Fields Medal winner among their alumni; but what do these dignitaries contribute to a university if they are not present on its campus or no longer do research and advise students?

What then, are the criteria and the types of analyses that a good measure ought to include? First of all, there must be rankings for each discipline, which is the level most relevant for students choosing a university, or for university presidents seeking to steer their institutions. The Shanghai Ranking breaks down its ranking by discipline to some extent, but not enough. On the other hand, students who have not yet chosen a subject need a ranking at the university level so they can compare alternative institutions. Thus, we need worldwide rankings by both discipline and by university.

Measuring the productivity of researchers is a complex task. One way to measure a researcher's academic productivity is by number of publications. But publications are not all equal; publication in a mediocre journal is not equivalent to publication in *Nature* or *Science*. To reflect the differing quality of academic journals, the best approach is to weight the number of publications by the quality of the journals (itself measured either by the journal's influence or impact factor – this is calculated by an algorithm based on citations, similar to the one Google uses for search results – or by committees of experts). The best rankings also give less credit to a researcher whose published article was written in collaboration with many others. But the limitations of this exercise are clear. The journal is a sign of quality, but articles of greatly differing importance may appear in the same journal. Furthermore, the number of published articles, even when weighted by the quality of the journal, is anyway only an approximate measure of the significance of the research. Gérard Debreu, an American of French origin who won the Nobel Prize in 1983, was not very “productive,” but the articles he produced every three to five years were very influential.

The second approach to measuring research productivity counts citations, and may also weight the citations according to the importance

of the source (once again, measured by citations of the person doing the citing – a problem that mathematicians will recognize as being a fixed-point problem). By this measure, Maurice Allais, the last great non-English speaking economist writing in his native language and the first French winner of the Nobel Prize for economics (1987), would not have looked so good. More importantly, some fields are more often cited than others, and citations in themselves are not a measure of quality: controversial or media-friendly subjects are more often cited than others. To take an extreme case, Holocaust-denying historians will be frequently commented upon and therefore often cited, but that does not mean that they are great scholars! Surveys of the literature on a subject, and books synthesizing research done by other scholars – though very useful because they allow a nonspecialist to quickly gain familiarity – are naturally often cited, but usually do not represent notable advances in knowledge. Finally, citations appear only after some delay. This can disadvantage young researchers.

So rankings have many defects on which I shall not dwell further. And yet, even though I am one of the harshest critics of these rankings, I would vigorously defend their use. Is that a paradox? Not really: in a country like the United States, where the governance of universities and funding agencies is entirely focused on excellence, the use of these objective measures remains limited (though it is has increased). In contrast, the measures are an indispensable tool for identifying centers of excellence in many European countries. For instance, unlike its principal competitors in research and innovation, France does not have the culture of academic evaluation that could expose the significant differences in creativity between French research groups or between those groups and the best institutions globally.

Therefore it is often difficult for students and decision makers to identify the most innovative and internationally high-profile French research institutions. Rankings are important when there is a shortage of other relevant information.

This leads me to peer evaluation and the good governance of academic research. Well-managed funding agencies distribute research budgets on a competitive basis through independent panels composed of the best experts. The European Research Council (ERC) does this in Europe, for example, and in the United States it is the National Science Foundation and the National Institutes of Health. But to do so they must persuade the best people, who are always much in demand elsewhere, to undertake the evaluation. To be truly effective, this approach requires a procedure that is not too time consuming, plus a guarantee that decisions made by the peer reviewers will be implemented by the funding agency.

Peer evaluation is also crucial in the process of appointing professors. In the countries on the research frontier, professors are increasingly often recruited in the following way: First, the department discusses potential recruits, both internal and external, whether the academics concerned have applied or not. The department professors have (in principle) read the candidates' key articles. A vigorous (and confidential) debate about the candidates' relative merits ensues. And then – this is the essential point – the administration acts as a “quality champion.” Appointments to every permanent (i.e., tenured) position are subjected to more than a dozen comparative evaluations by experts outside the university, which are analyzed by the university's president, provost, or relevant dean. External referees are asked to compare the quality of the preferred

candidate with a list of researchers working elsewhere in the same area. This allows the president, provost, or dean, who may not be specialists in the discipline, to find out more. Thus the idea is to reduce the asymmetry of information between the university's administration and the department, and thus to check the quality of the recruits the department has proposed. Other countries, especially those not at the research frontier, would do well to adopt similarly rigorous academic governance.

Weaknesses and abuses of academic evaluation

The process by which peers read and assess one another's articles is at the heart of academic evaluation. Academic articles are submitted to the editors of a journal. Other scholars review them anonymously to decide if they are suitable for publication. On the basis of the reviewers' reports, as well as their own conclusions, the journal editors decide whether to accept the article (usually after some requests for improvements) or to reject it. Careful evaluation of articles is essential if the research community is to function properly, and for the accumulation of scientific knowledge: researchers cannot possibly read the thousands of articles that are written in their field or even subfield each year, let alone go through them in any great detail. Academic journals have the task of verifying the quality of an article's data and the integrity of its statistical analysis, the logical coherence and interest of its theory, and the extent to which the article contributes something new to the field.

We should not, however, be naive or take an overly utopian view of this process. The system has its weaknesses.

One is the herd behavior of researchers, which means that one subject may hog the attention of the scientific community while equally important subjects are neglected. Another is the bias toward publishing work with "impact." Thus an empirical study carefully replicating an already published result has less chance of attracting the attention of the academic community, and therefore the interest of a journal editor, than the initial experiment, especially if it produced a surprising result. Another issue is the lack of replication of some empirical results – when other researchers cannot reproduce the conclusions of earlier studies, even well-known ones, when they try.²⁰ Sometimes reviewers simply "free ride." Although they are supposed to spend time evaluating other people's research and thus contributing to the common good, they may fail to reflect in sufficient depth on the quality, originality, and relevance of the contribution.

Finally, of course, in all academic fields there are inevitably cases of straightforward fraud. Usually these involve fabricated data or, exceptionally, hacking the website of an academic journal to change the referees' reports. Sometimes in the case of journals that make the mistake of asking the author to suggest reviewers, it involves false e-mail addresses directing requests for reviews to a friend, rather than to the intended reviewer!

In my opinion, the only solution to these problems is to be aware of them and try to limit them as much as possible. Recently there

20. See in particular the site retraction watch.com. For discussions of the reproducibility of results, see (in psychology, for example) the article in *Science* (Sciencemag) on August 28, 2015: "Estimating the Reproducibility of Psychological Science"; in medicine, the article in *PLOS One*, "Does Publication Bias Inflate the Apparent Efficacy of Psychological Treatment for Major Depressive Disorder? A Systematic Review and Meta-Analysis of US National Institutes of Health-Funded Trials," September 30, 2015; in economics, Andrew Chang and Phillip Li's article, "Is Economics Research Replicable? Sixty Published Papers from Thirteen Journals Say 'Usually Not,'" (Federal Reserve Board, 2015).

has been increased transparency in some respects, requiring that data be made public and possible conflicts of interest be stated. It is tempting to say that, like democracy, the system of peer review is the worst system except for all the others. Internal evaluation, one of these alternative systems, tends to be captured by the institutions' corporate interest, and so external evaluation and peer review have become the cornerstones of academic assessment.

A relative consensus and American domination of economics

A common criticism of economics concerns the relatively high degree of consensus among economists, something that tends to astonish other social scientists. There are, of course, different sensibilities – to take only one example, economics at MIT is traditionally more liberal and Keynesian than it is at the University of Chicago, whose economics department is more conservative and monetarist. There is, nevertheless, a consensus about the way research should be conducted. As Paul Samuelson, the figurehead of MIT economics, explained, there wasn't a hair's breadth of difference between him and his counterpart at Chicago, Milton Friedman, concerning what constituted good research. They both agreed that a quantitative approach was essential (formal theories and empirical tests of these theories), agreed on the importance of analyzing causality, and emphasized the normative aspect of economics as a discipline whose purpose is to serve decision making.

This methodological consensus does not mean, of course, that all economic research is incremental, mechanically plowing the furrows already marked out by the profession. On the contrary,

as Robert Solow – another MIT figurehead – emphasized, researchers most often make a name for themselves by challenging current beliefs and plowing new furrows.²¹ Now economics draws on several new fields of analysis: price rigidity, incentive problems, imperfect competition, incorrect expectations, behavioral biases, and so on. To repeat, there are fierce debates in seminar rooms, journals, and conferences, and so much the better: the head-on clash of ideas and criticisms between peers allows everyone to move forward.

It is essential that different approaches enrich each other, which requires mobility. Nothing is worse than a school of thought in which disciples limit themselves to interpreting the works of their “masters.” An Anglo-Saxon custom that is very useful in this regard is the ban on endogamy: upon gaining their PhD, students have to get a job at a different university (they can return later). As well as promoting better relations between professors (who no longer fight to place “their” students in their own departments), the ban forces the students to learn new ideas and approaches, and their home departments to appoint new lecturers who are cast in a different mold.

Another criticism leveled at economics is the dominance of American departments in the subject. Without going into details, the ten top economics departments are roughly all American, as are, moreover, a great many of the top one hundred universities in the field. I regret this. But for non-Americans, rather than being indignant, it is better to roll up their sleeves. To cite Robert Solow once again, it is not surprising that the United States ranks first: it trains an enormous number of students in the discipline. The strong competition between universities to attract the best professors and students creates an excellent research environment, and above all, the academic system rewards merit rather than hierarchy.

21. Interview in *Le Monde*, January 3, 2001.

The impact of teaching economics on individual behavior

Economists have carried out experiments in the laboratory and in the field to study the behavior of their students. Faced with choices involving a trade-off between their own well-being and that of others, students taking courses in economics tend to behave more selfishly than other students.²² For example, when they register, students at the University of Zurich are offered an opportunity to give seven Swiss francs to finance student loans, and five Swiss francs to help foreigners studying at the university. Only 61.8 percent of students in economics and business contribute to at least one of these funds, as opposed to 68.7 percent students in other disciplines.²³ Other experiments confirm this conclusion. An important question is whether this is due to self-selection (students are more likely to major in economics or business if they are more selfish) or to indoctrination (students become selfish as a result of studying economics). If the former, studying economics is harmless (you can carry on reading this book, it's not contagious); if the latter, economics could be “performative,” that is, exposure to economics could shape our worldview and lead us to view the world through a distorting lens.

Unfortunately, our understanding of this question is incomplete. The Zurich study also examines the evolution of generosity during students' university careers, and concludes that there is no evidence of indoctrination (at least as far as economics students are concerned). This means self-selection appears to be the sole

22. The great majority of these students will not become economists, but will instead continue their studies in management, law, or another discipline, or enter professional life.

23. Bruno Frey and Stephan Meier, “Selfish and Indoctrinated Economists?” *European Journal of Law and Economics*, 2005, vol. 19, pp. 165–171.

explanatory factor. Some studies support this conclusion, while others disagree. For example, law students at Yale are initially assigned randomly to certain courses.²⁴ Those who are assigned to courses overlapping with economics (law of civil liability, for instance) and who are taught by professors with training in economics behave in the short run more selfishly than those assigned to less economics-oriented courses (such as constitutional law) and exposed to professors trained in the humanities. Since assignment is random, this cannot be due to self-selection.

The possibility that training in economics might change a person's state of mind must be taken seriously. But to assess its consequences, we would have to understand the channel through which this change in mentality might occur. One hypothesis (at this stage it is only a hypothesis) is based on the fragility of altruism. As we will see in some detail in the following chapter, altruism is greatly reduced when we are able to justify acting selfishly with an excuse, however feeble.²⁵

During their training, economics students study, for example, competitive strategies in a market (suggesting that the world is pitiless); they learn that self-interested behavior can give rise to social harmony in the allocation of resources²⁶ (suggesting that it is reasonable to be selfish); they read empirical studies drawing attention to behavior that is dysfunctional for society when

24. Raymond Fisman, Shachar Kariv, and Daniel Markovits, “Exposure to Ideology and Distributional Preferences,” 2009, unpublished paper.

25. For a study of the impact of narratives on behavior, see my article with Armin Falk and Roland Bénabou, “Narratives, Imperatives, and Moral Reasoning,” unpublished paper.

26. Recall Adam Smith's famous formula: “It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from regard to their own interest. We address ourselves, not to their humanity but to their self-love.” Of course, Smith also wrote a great deal about the necessity of pro-social behaviors and on the necessity of regulation (recommending state intervention to overcome poverty, to prevent usurious lending, and to subsidize education), contrary to the simplistic image of him often given.

incentives are inappropriate (suggesting that we cannot always trust economic or political agents). All these influences create narratives that, however valid empirically, provide (weak) excuses for less ethical behavior.

Even if this hypothesis turns out to be correct, the students' later professional lives or personal relationships may provide alternative narratives with a different but equally strong impact. The experiments above only speak to the immediate impact of studying economics; we do not have much information about whether economists working for the state, the private sector, or universities are worse or better citizens than other people in terms of their donations or their behaviors regarding public goods, pollution, or voting. Whatever the answer to this question, we would also like to know whether the difference between economists and noneconomists, if any, is due to self-selection or to indoctrination. In other words, beyond understanding the short-run effects of a training in economics, the long-term impact of studying the subject is the key research question.

ECONOMISTS: FOXES OR HEDGEHOGS?

The British philosopher Isaiah Berlin begins his little book *The Hedgehog and the Fox* by quoting a fragment attributed to the Greek poet Archilochus: “The fox knows many things, but the hedgehog knows one big thing.”²⁷

Forty years ago, almost all economists were hedgehogs. In short (perhaps slightly unfairly), we could say that they knew the

27. Isaiah Berlin, *The Hedgehog and the Fox: An Essay on Tolstoy's View of History* (London: Weidenfeld & Nicolson, 1953).

model of competitive markets, the most intellectually complete paradigm in the discipline, like the back of their hands. They were, of course, aware of the limits of this model, and they were pursuing other possibilities, but without having an adequate intellectual framework for doing so. A kind of theory of ideal gases for economics, the competitive model was applied to a wide range of situations: the volatility of markets, finance, or international trade, for instance.

The competitive market paradigm

In this paradigm, buyers and sellers are small relative to the markets in which they trade, and therefore cannot make prices rise by limiting supply or make them fall by reducing demand: their individual impact on market prices is negligible. They are also assumed to have perfect knowledge of products' price and quality, and behave rationally according to their own free choice. Buyers maximize their gains from trade and sellers maximize their profits. Without necessarily being able to predict the future with precision, agents have rational expectations about every future event.

This model was used to explain how supply and demand are balanced across markets, which makes it possible to study the phenomenon of “general equilibrium.” For example, a change in supply in one market may affect other markets through two channels. On the one hand, products might be complementary (if I book a flight to a city, I may also rent a car or book a hotel room there) or could be substituted for one another (I may substitute a high-speed train trip for a flight). On the other hand, it operates through income effects (a change in prices in this market affects how much of the product a buyer

consumes, and also the income available to spend on other products, even if those other products have no direct relation to the market affected – so, for example, if the cost of renting their apartment goes up, people buy fewer of the other goods they usually consume).

General equilibrium was an important stage in the development of economic theory, but one that has two intrinsic limitations. First, its implications for economic policy are not obvious: the absence of friction (because there is always competition, symmetric information, and rational behavior) would mean that these markets are efficient, so the only public policy to consider would be the implementation of income taxes. If that were the case, most ministries, independent authorities, and local government would be useless! Second, and relatedly, this model describes almost none of the situations I discuss in this book.

Since then, economic theory has been greatly refined. It has learned how to analyze imperfect competition in a market that has a small number of sellers or buyers, and so how to deduce rules for regulating competition. It can incorporate asymmetries of information about prices and the quality of goods (or even a lack of knowledge concerning possible trading partners) in order to predict market failures and suggest remedies for them. It has learned how to account for observed deviations from rational decision making. It can now analyze the implications of the separation within a firm between property rights (belonging to investors) and real control (often in the hands of the managers, whose interests may differ from those of the investors). The introduction of these “frictions” into the old model is hard work, but it has borne fruit. The models have become less parsimonious

(meaning they take into account more considerations), but they allow the study of new questions essential for public policy and business strategy.

Even in the world of foxes that prevails today, some economists tend to be more foxlike, and others more hedgehoglike. Hedgehogs are guided throughout their lives by a single idea, and often try to convince their protégés to take the same path. They take an admirable risk in defending a paradigm that they have judged to be important, even all encompassing. Foxes, on the other hand, regard universal theories with suspicion and are often engaged in a variety of approaches. They move from one line of research to another when they think they have arrived at a point of diminishing returns in the first.

Neither of the two styles is superior to the other. Science needs hedgehogs, who keep pushing an idea, even when unpopular, and keep digging in a certain direction when other researchers reckon such intensive research has reached strongly decreasing returns; science also needs foxes, who bring together disparate pieces of knowledge and open new areas of research. Moreover, experience seems to show that the world of research rewards both.²⁸

In public debates, is it better to be a fox or a hedgehog economist? We know little about this subject, but the work of Philip Tetlock, a psychologist at the University of Pennsylvania, on experts in political science is fascinating.²⁹ Tetlock offers two answers to this question. The first concerns the reception of ideas in public debate. Hedgehogs irritate only the people who

28. As well as writers, who were the subject of Isaiah Berlin's essay. This is just a personal impression, which would have to be confirmed more rigorously by an empirical study similar to Tetlock's, described below.

29. See his books *Expert Political Judgment: How Good Is It? How Can We Know?* (Princeton: Princeton University Press, 2005), and with Dan Gardner, *Superforecasting* (New York: Crown, 2015).

disagree with them, while foxes annoy everyone – by deploying various ideas, they spare no one’s sensitivities. The foxes, taking more parameters into account, often undermine their own recommendations. This tries the patience of their audience, who wants certainties. So foxes do not get invited into the television studios (in fact, pushing hard on a fox can produce a long list of recommendations; foxes sometimes have to force themselves to pick just one). The media prefers hedgehogs.

Secondly, Tetlock studied the predictions of 284 experts in political science for almost twenty years. In total, he asked them to make twenty-eight thousand predictions: for instance, regarding the fall of the Soviet Union, the probability that a nation-state would disintegrate, the war in Iraq, and the decline of powerful political parties. Based on fourteen criteria, he divided these experts into foxes and hedgehogs.³⁰ Tetlock also classified experts according to their political opinions. This dimension was not entirely independent of their cognitive style. Somewhat unsurprisingly, foxes were less likely than hedgehogs to be at the extremes of the political spectrum. But their exact politics had little effect on their error rate. For example, in the 1980s, experts on the left were blinded by a low opinion of Reagan’s intellect, while those on the right were obsessed by the Soviet threat. The richest lessons concern cognitive style. Foxes produce far better predictions. They are more aware of the probability (not negligible) that they are wrong. Conversely, Tetlock selects Marx and libertarians³¹ as examples of hedgehogs who stick to a

30. Tetlock uses factorial analysis. Some examples of questions might be: “Do you think the most common error in judging situations is to exaggerate the complexity of the world?” or: “Do you think that a classic error in decision making is to abandon a good idea too quickly?” Positive responses to these questions signal a hedgehog cognitive style.

31. Advocates of a minimal state, who see its main role as providing law and order, including court enforcement of contracts and the protection of private property.

simple worldview and whose grand predictions never materialize. It is not easy to draw definitive conclusions from this innovative research, even though it is based on a large sample. We will need other studies in different domains of expertise.

THE ROLE OF MATHEMATICS

Among the social sciences and humanities, economics is the one that makes the most use of mathematics – more than political science, law (including the subfield of law and economics), even evolutionary biology, and certainly much more than sociology, psychology, anthropology, or history. For this reason critics often accuse economics of being too formalized and abstract. The mathematization of economics is relatively recent, even though mathematical economists of the nineteenth century (such as Antoine-Augustin Cournot, Jules Dupuit, and Joseph Bertrand in France, Léon Walras and Vilfredo Pareto in Lausanne, Johann Heinrich von Thünen in Germany, Francis Edgeworth at Oxford, and William Stanley Jevons at University College London) did not hesitate to formalize their work. Economics was gradually mathematicized during the twentieth century, a trend that accelerated in the 1940s and 1950s. The works of the great economists of that period, such as Kenneth Arrow, Gérard Debreu and Paul Samuelson, were to economics as the works of Bourbaki³² were to mathematics. In formalizing economic thought, they organized it. Even more importantly they formalized and validated

32. Nicolas Bourbaki was an imaginary mathematician. A group of talented French mathematicians (including five Fields Medal winners) met from 1934 to 1968 to write treatises (published under the name of Bourbaki) reconstructing mathematics in a more rigorous, abstract, and unified way.

(or invalidated) the logic of the insights, innovative but imprecise, of the great classical economists from Adam Smith to Alfred Marshall and John Maynard Keynes. The mathematization of economics was an essential foundation on which later studies could be build, but the subject had to keep progressing.

The need for mathematics

As in the physical or engineering sciences, mathematics has contributed to economics on two levels: theoretical modeling, and empirical verification. The need to use econometrics (statistics applied to economics) to analyze data is not particularly controversial, as identifying causal effects is a prerequisite for decision making. Correlation and causality are two different things. As the French comedian Coluche joked, “When you’re sick, above all you should avoid going to the hospital: the probability of dying in a hospital bed is ten times greater than in your own bed at home” – which is clearly complete nonsense, even if you count the chances of getting an infection in the hospital. There is a correlation but not a causal relationship between hospitals and death (otherwise we would have to do away with hospitals). Or consider a diagram showing that hotel occupancy increases with hotel prices; hopefully few would conclude from this observation that raising prices will attract more customers (except perhaps for some upscale hotels, which may allow the client to display his wealth and status); understanding this covariation between price and occupancy requires one to bring in a piece of theory: that hotel managers lower prices when demand (and therefore occupancy) is low. Only an empirical strategy based on

econometrics will allow us to identify a causal impact and thus to make recommendations about economic decisions.

Mathematical models used to represent the essence of a problem may be more controversial. As I have explained, every model is a simplified – sometimes outrageously simplified – representation of reality, even if subsequent research makes it possible to enrich it and to fill in the gaps. As Robert Solow put it in the first lines of a famous article on growth (which won him the Nobel Prize):

All theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive. A “crucial” assumption is one on which the conclusions do depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.

Despite its defects, I regard modeling as indispensable for several reasons. First of all models are a language and thereby facilitate communication among economists. As in any other field of research, economists benefit from using commonly known paradigms that researchers can refer to without having to enter into long explanations about what is assumed and delivered. While completely arcane to noneconomists, phrases like “vector auto regressions (VAR),” “the Arrow-Debreu model of perfect competition,” or “Akerlof’s lemons model” immediately brings a ready reference point to the discussion for an economics audience.

Secondly, modeling forces researchers to state their assumptions clearly. Explicit assumptions can be criticized and subjected to common-sense tests. A realism filter must be applied to critical

assumptions, those that actually drive results.³³ The same holds true for the logic of the argument. Taken together, modeling can contribute to transparency. As Dani Rodrik, an economist at Harvard, notes in his recent book, there is no need for the endless debates about what Samuelson or Arrow had in mind, unlike for earlier authors such as Keynes, Marx, or Schumpeter.³⁴

Thirdly, using mathematics also forces economists to check the logic of their arguments, since intuition can sometimes be deceptive. Dani Rodrik puts it very well:

We need the math to make sure that we think straight – to ensure that our conclusions follow from our premises and that we haven't left loose ends hanging in our argument. In other words, we use math not because we're smart, but because we aren't smart enough. We are just smart enough to recognize that we are not smart enough. And this recognition, I tell our students, will set them apart from a lot of people out there with very strong opinions about what to do about poverty and underdevelopment.

Fourth, writing and solving a model makes researchers think about other ideas. (If the hypotheses lead to conclusions that prove to be false, are they inappropriate, or is something missing in the model?)

Fifth, models guide empirical research. For sure, “model-free analysis” can be useful. The identification of correlations may still be useful for prediction. Indeed, Big Data (which so

33. Incidentally, I disagree with Milton Friedman's (1953) view that the realism of assumptions is irrelevant and only predictions matter. Firstly, when data are scarce, looking at the realism of assumptions brings extra information. Second, the exact mechanism at work in general needs to be described in order to conduct policy.

34. Economics Rules: The Rights and Wrongs of the Dismal Science (New York: Norton, 2016). See also “Why We Use Math in Economics,” Dani Rodrik's Weblog, September 4, 2007.

far has focused on the identification of such correlations) does wonders when it comes to a search engine's ability to predict what I am searching for, or an Internet-based company's ability to recommend books or movies I might enjoy. Supervised machine learning of the kind used today – for instance in clinical medicine, the analysis of political bias in texts, criminal justice, or the measurement of consumer churn – takes as inputs “training” data sets by which it makes predictions on new data.³⁵ But without a model to test, data reveal little that is useful for economic policy. The model is what makes it possible to analyze well-being and therefore economic policy.

Finally, theoretical models are the main game in town when there is a shortage of data. This happens with new technologies, for which data have not yet accumulated (consider a competition authority's decision as to whether to allow the acquisition of an Internet start-up by an incumbent firm or the formation of a patent pool – see Chapter 16); when contemplating abrupt institutional changes (as was the case in the 1990s for both the deregulation of network industries – see Chapter 17 – and the transition of Soviet economies toward a market economy); or when adjusting regulations to institutional or

35. A good discussion of machine learning viewed from an economist's viewpoint is Susan Athey's “Beyond Prediction: Using Big Data for Policy Problems,” *Science* 355, 483 – 485 (2017). A focus on correlations has several limitations. First, even if the predictions are credible, making predictions at all requires that the environment be stable. However, it may be unstable because of exogenous or endogenous causes of instability. To grasp the notion of endogenous instability, note that the covariations being analyzed are presumably not just for the sake of pure knowledge; rather, they inform policies. These policies in turn often alter behaviors (although this need not be the case: the fact that my portfolio of book or movie choices is used by Amazon and Netflix for recommendations to others and to myself does not alter these choices). Relatedly, large players must not be able to manipulate the environment. If they are, they will modify their behavior to affect learning and therefore policy. Second, the focus on correlations ignores the issue of causality, which is the bread and butter of the economics profession. Machine learning experts have started working on causality, but it was traditionally absent from their analysis.

product innovations (think of the prudential treatment of new financial instruments). Empirical analysis meets its limitations when entering a “new world”: the impact of climate change on migration, the effects of the disintegration of the European Union, or the consequences of a large OECD country’s default on its sovereign debt are not easily extrapolated from previous events.

On a related point, data may exist, but if they are “local” they will not be very informative when it comes to assessing the consequences of a potential new policy that changes the economic environment significantly. Macroeconomists were dumbfounded by the end of the Great Moderation (the observed reduction in the volatility of business cycle fluctuations starting in the mid-1980s, attributed to stabilization policies) and by the skewedness of the distribution of financial returns in the 2008 financial crisis when the assumption of normally distributed returns had previously done a good job. In microeconomics, an accurate, but local measurement of demand may provide misleading estimates of what would happen if a contemplated merger moved prices far away from their current values.³⁶

The cost of mathematization

Nonetheless, mathematization has its costs. First, it is sometimes difficult, and initial attempts to study a topic are often rough and

36. Goods can be complements at low prices and substitutes at high prices, or the opposite. Similarly, products and their usage change over time; the current pattern of complementarity/substitutability, even well estimated, will not be the same tomorrow. Two drugs covered by two pharmaceutical patents may be combined to cure a disease, but may also be substitutes to combat another disease. A browser can be a complement to an operating system, but with additional code may become a competitor to that operating system.

ready. Patience is required, even though economists are often expected to make instant economic policy recommendations. Forty years ago we had little idea how to model expectations, interactions between firms, or asymmetric information, so whole areas of economics were then difficult to formalize.

Secondly, economists are sometimes inclined to look for something “under the lamp post” – a phrase used to describe looking for an object where the light happens to be, rather than in the dark corner where it is more likely to have been lost. For example, macroeconomists have for a long time referred to a “representative agent” (in other words, they assumed that all consumers were identical), simply because that made the model easier to analyze. Nowadays, they increasingly abandon this assumption because consumers differ in many ways (tastes, wealth, income, access to loans, sociodemographic variables, and so on). Greater precision though, comes at the price of increased complexity. The more hypotheses are refined and the greater the complexity of the description of economic agents, the greater the need for mathematics to ensure that the reasoning is complete.

Thirdly, the teaching of economics is often too abstract, a tendency that the use of mathematics sometimes accentuates. Mathematics itself, however, is not to blame because teachers are free to choose how to teach. The teaching material must be compatible with the knowledge emerging from research, but it can be communicated in a different way. English-language textbooks for undergraduates usually do not make extensive use of mathematics, but the easy way for a teacher to convey research is to use its existing form rather than to make it more accessible.

Finally, the research community in economics is often reproached for being too concerned with aesthetics. Mathematics is said to have become less an instrument than a goal, because using it to construct elegant and coherent models is seen as a signal of scientific quality. No doubt this flaw exists, but we also must remember that, as in other scientific disciplines, articles that are clever but superficial may enjoy their heyday, but they are later forgotten – unless they represent a true methodological advance that makes applied research possible.

GAME THEORY AND INFORMATION THEORY

Game theory and information theory have revolutionized all areas of economics, where they are widely used – just as they are in evolutionary biology, political science, law, and occasionally in sociology, psychology, and history.

Game theory

Modern microeconomics is based on game theory, which represents and predicts the strategies of agents who have their own goals and are interdependent, and information theory, which models their strategic use of private information.

Game theory allows us to conceptualize the strategic choices made by agents when they have different interests. Thus, game theory does not only apply to economics, but also politics, law, sociology, and even (as we shall see later) psychology. It was initially developed by

mathematicians: in France by Émile Borel in 1921; in the United States by John von Neumann, in a paper published in 1928 and a book written with Oskar Morgenstern, published in 1944; and by John Nash,³⁷ in a paper published in 1950. More recent developments in game theory have been motivated by applications in the social sciences, and the great majority of these developments have been due to economists, although biologists and mathematicians have also contributed.

From Individual Behavior to Collective Behavior

The social and human sciences suggest the importance of our expectations of what others will do, either concurrently or in reaction to one's own actions. These expectations are rational if the agent understands the incentives of other agents and anticipates their strategy, at least “on average,” and accordingly acts to the best of his interests. Strategies are then said to be in equilibrium (in 1950, John Nash developed the general theory of this equilibrium, referred to as a “Nash equilibrium”). Understanding the likely behavior of others may result from either reasoning (agents imagine what they would do if they were in the other person's shoes) or, if the game is familiar, from past experience.

A person who does not leave a wallet on the café table or a bicycle unsupervised on the street, or who does not step onto a pedestrian crossing without looking (in a country where drivers do not stop for pedestrians) is solving elementary problems in game theory, in as much as he or she correctly anticipates how others are likely to behave. The example of the pedestrian crossing also illustrates

37. Nash, who won the Nobel Prize in 1994, died with his wife in a car accident in May 2015 after his return from Oslo where he had just received the Abel Prize, the most prestigious prize in mathematics (along with the Fields Medal). His life inspired Ron Howard's 2002 film *A Beautiful Mind*, in which his role was played by Russell Crowe.

that multiple equilibria are possible: drivers who do not slow down as they approach pay no cost (other than psychological) as a result of their behavior, as long as there is no pedestrian crossing the street (or intending to cross) as the car approaches. Conversely, drivers who anticipate that pedestrians will cross will slow down as they approach, while pedestrians will be able to cross if they expect civilized behavior from drivers.

Like Monsieur Jourdain (in Moliere's *Le Bourgeois Gentilhomme*), surprised to find he has been speaking in prose, we are all experts in game theory without knowing it, because every day we participate in hundreds or thousands of "games". We are involved in situations in which we need to anticipate the way others will behave, which encompasses their reaction to the way we act. Of course, we are far more expert in some games that we play repeatedly throughout our lives (for example, those associated with personal and social relations) than in others that we play only now and then. Thus, few people will instantly hit on the right strategy at an auction where each person has private information concerning the actual value of the object up for sale, such as a mining license or shares in a firm going public. Most people, unlike professionals, tend to bid too optimistically, because they fail to put themselves in the place of other potential buyers and to understand that the latter will bid lower if they have negative information about the asset. This phenomenon is called the "winner's curse," because people tend to make a winning bid precisely when the object has little value.

How people behave often depends on what others do. If other car drivers or subway users leave for work at 8 a.m., it may be to my advantage to leave at 6 a.m., even if that is really too early from my point of view. In equilibrium, flows stabilize so that

each person makes the best trade-off between their ideal schedule and the congestion they will suffer on their commute. In making such choices, agents seek to differentiate their behavior from that of others. On other occasions agents have a problem with coordination. They would like to choose to behave the same way as others. For example, if most of my fellow citizens did not pay their parking tickets, there would be (unfortunately) strong pressure for an amnesty for such offenders, which would reduce my incentive to pay my parking tickets too. As in the pedestrian-driver game, there may be multiple equilibria, so that two otherwise identical societies may adopt different behavioral patterns. "Predicting on average" reflects the fact that an equilibrium is sometimes based on a "mixed strategy": in soccer, a good goalkeeper must avoid getting a reputation for diving more to the left than to the right, or for remaining in the middle when facing a penalty kick; and the same goes for the player who is taking the kick. Studies of professional players (amateurs are more predictable) clearly show that their behavior is unpredictable: a good goalkeeper, for instance, has the same probability of preventing a goal (about 25 percent) from each of the three options.³⁸

It may also be impossible to predict other people's actions perfectly because we don't know everything about them. At best we can make a conditional prediction: "In their place, in these circumstances, I would do this." For example, in the auction mentioned earlier, we can predict a high bid if the other person receives good news about the value of the object put up for auction (and a low bid if the news is bad).

38. Ignacio Palacios-Huerta, "Professionals Play Minimax," *Review of Economic Studies*, 2003, no. 70, pp. 395–415.

To illustrate the power and limits of game theory, let's consider a situation called "the prisoner's dilemma," a strategic framework that enables the description and analysis of many conflicts. Its name refers to the following situation: two prisoners are correctly suspected of having committed a crime together, but a confession is required. They are put in separate cells and asked to confess their crime. If one confesses, he or she will be punished more leniently, but if both confess, both are punished. Collectively, they are better off if neither of them confesses but, individually, they each have an incentive to confess. The equilibrium is that both confess.

This simple situation is shown in Figure 4.1, which involves two players: Player 1 (in bold) and Player 2. Each player has a choice between two actions: cooperating with the other player or deviating from the agreement by behaving opportunistically. Cooperating is denoted by *C*, and deviating by *D*. In the table, Player 1's scores are shown first in bold, then Player 2's. For example, if Player 1 cooperates and Player 2 deviates, Player 1 scores zero and Player 2 scores 20 points. Each player knows all the information shown in the table, but

		Player 2	
		<i>C</i>	<i>D</i>
Player 1	<i>C</i>	15, 15	0, 20
	<i>D</i>	20, 0	5, 5

Figure 4.1. The prisoner's dilemma.

has to make his decision without knowing what decision the other has made. Collectively the two players are better off cooperating (i.e., both choosing *C*) since they score 15 each, for a total of 30, a higher total than would be obtained in any of

the three other possible outcomes of the game (which is 20 if their choices differ, 10 if both deviate). But individually, they have an interest in opportunistic behavior. The equilibrium of the game is that each person deviates and receives only 5 points. To see this, note that Player 2 always gets more points by deviating, no matter what Player 1 does: if Player 1 chooses to cooperate, Player 2 gets 20 points by deviating, but only 15 from cooperating; if Player 1 chooses to deviate, Player 2 scores 5 points by deviating and zero by cooperating. Exactly the same incentives apply to Player 1.

Thus, this game is particularly easy to analyze because it has a "dominant strategy." That is, to make a decision, a player does not actually need to anticipate what the other one will do: whether the other prisoner chooses *C* or *D*, each player is better off choosing strategy *D*.

From this we can conclude that, faced with this situation, every rational individual should choose the opportunistic strategy. However, in practice, under laboratory conditions,³⁹ not all players deviate: 15 to 20 percent of players choose to cooperate. Chapter 5 returns to this phenomenon, which will lead us to question not game theory, but the assumption that economic agents behave selfishly.

Despite its simplicity, the prisoner's dilemma game allows us to represent very important strategic situations. For example, before the OPEC oil cartel was established, each petroleum-exporting country had an interest in increasing its production (strategy *D*) rather than decreasing its production and cooperating with other countries to limit supply (strategy *C*). The introduction of quotas (and sanctions

39. An important clarification: laboratory experiments are usually constructed in such a way as to respect anonymity. Individual choices are made on a computer. For example, if I choose a deviant behavior in the prisoner's dilemma, the person I am playing against will register his loss, but will not know who caused it (and in theory the experimenter doesn't know that, either).

if quotas were exceeded) permitted OPEC to increase its members' revenues by forcing them to play *C*. In a situation of this kind, we can understand why the players (individuals, enterprises, or states) might have an interest in creating a cartel, cemented by an agreement and the threat of reprisals for deviant behavior on the part of any of the participants.

This game has also inspired competition authorities to introduce a form of plea bargaining to fight the formation of cartels. This "leniency program," which has long been in effect in the United States, has recently been introduced in Europe, where it is bearing fruit. The system guarantees quasi-immunity for any firm revealing to the competition authorities the existence of a cartel of which it is a member; the authorities then punish the other firms. The program destabilizes the cartel by recreating the prisoner's dilemma neutralized by the internal cartel agreement.

The battle against global warming studied in chapter 8 is another example of the application of the prisoner's dilemma. Individually, each country has an interest in not reducing its greenhouse gas emissions, but the collective consequences of this selfish attitude are disastrous. Garrett Hardin describes this "tragedy of commons" in an article published in 1968 in the journal *Science*. It explains the failure of the Kyoto and Copenhagen agreements on climate change. To avoid this tragedy we would need an agreement that would force all countries to choose strategy *C*. In practice, they all choose strategy *D*.

The Dynamics of Interactions

The theory of dynamic games is based on the idea that an agent's current decisions have an impact on the future actions of other agents, so every agent needs to understand how his or her decisions will influence the future strategies of others. For example, a state working on a new

law or regulation must expect consumers and enterprises to react to the new institutional context by changing their behavior; to that end, the state must imagine itself in their place and anticipate what they will do. This kind of equilibrium is called, in the (not particularly appropriate) jargon of economics, "perfect equilibrium." In a perfect equilibrium, each agent is aware of the effects of their actions on the future behaviors of other agents and acts accordingly.

An agent's behavior often reveals information that they alone possess. For example, investors who buy shares in a company reveal that their information, or their knowledge of the situation, makes them optimistic about the value of the company; revealing this information tends to drive up the price of shares in the company, thereby reducing the buyers' profits. Consequently, stock investors try to make large purchases discreetly by dividing up their buy orders or using intermediaries. Another example is when a friend or a supplier behaves in an opportunistic way and betrays the trust placed in him or her. This act reveals information concerning the character of the person in question, who will therefore think twice before endangering his or her reputation. These situations are studied by using the concept of perfect Bayesian equilibrium, which combines perfect equilibrium with rational information processing in the sense of Bayes's theorem. Which brings me to information theory.

Information theory

The second unifying framework of modern economics is information theory, which is also known as incentive theory, contract theory, signaling theory, or principal-agent theory, depending on the use to which it is put. This theory concerns the strategic role of the private

information that decision makers possess. A good understanding of human or economic relations needs to acknowledge that agents do not all have the same information and will use their private information to achieve their goals.

Information theory was developed by Kenneth Arrow (who won the Nobel Prize in 1972), George Akerlof, Michael Spence, and Joseph Stiglitz (who shared a Nobel Prize in 2001), James Mirrlees and William Vickrey (Nobel Prize, 1996), Leonid Hurwicz, Eric Maskin, and Roger Myerson (who shared a Nobel Prize in 2007), Bengt Holmström (who won the 2016 Nobel Prize jointly with Oliver Hart, who investigated the consequences of contracts that are incomplete), Jean-Jacques Laffont, and Paul Milgrom, among others.

Information theory is constructed on two basic concepts. The term *moral hazard* refers to the fact that someone's behavior may not be observable by the counterparty who will be affected by it (this counterparty is the "principal"), or by a court of law that has to enforce the terms of a contract in the event of a suit. Take for example a sharecropping contract between a "principal" (the landowner) and an "agent" (the farmer). The farmer might not pay enough attention to his choice of crop or when best to sow his seeds, or he might not devote enough effort to ensuring an abundant, high-quality harvest: in this case, we say that there may be a "moral hazard" on the part of the farmer. A bad harvest might be either the result of some exogenous shock to supply, such as the weather, or might be the result of the farmer's (the "agent's") lack of effort, reflecting the incentives he faces.

Given that the principal cannot observe the effort made by the agent (or prove to a court that this effort is insufficient), and knowing that the result depends not only on the farmer's effort but also on events outside his control, who should bear the risk inherent in the activity, the principal or the agent? Sharecropping is a rural lease in

which the landowner, the lessor, entrusts the cultivation of a parcel of land to a farmer in exchange for part of the harvest. A sharecropping arrangement in which the farmer hands over half the harvest to the landowner assigns less responsibility and offers less incentive for effort than a standard farm tenancy in which the farmer pays a fixed sum (a rent) to the landowner and receives all the proceeds of his labor above this amount. A tenancy of this kind, which makes the farmer bear all the risk, including climatic or other hazards over which he has no control, proves to be costly if he is risk-averse and wants a predictable income.⁴⁰ If, on the other hand, a risky income does not scare the farmer, then this kind of lease is optimal, because the farmer will then be fully responsible for his work and will consequently choose how much effort he wants to put in. If all or part of the risk were borne by the landowner, the farmer would not try as hard. The arrangement that offers the least incentive for the farmer to work hard is one in which he receives a fixed salary and therefore does not benefit at all from putting in more effort.

Adverse selection refers to the possibility that the agent has private information when the contract between the two parties is signed. To stay with the example of sharecropping, only the farmer knows how much time he will put into cultivating the land, his skill as a farmer, and his desire to work. Conversely, the landowner can have private information about how fertile the land is. Adverse selection affects contracts because people will be suspicious about their counterparties. To illustrate this idea, suppose the landowner knows how fertile his land is, but the farmer does not. Even if the farmer does not care about risks to his income (and so a tenancy

40. A person is risk averse if he prefers a guaranteed income to an income that is equivalent on average but subject to risks (for example, receiving twenty dollars, rather than thirty dollars with a probability of 50 percent or ten dollars with a probability of 50 percent). The more risk averse a person is, the more he will ask that a contract transfer the risk to the principal.

agreement in which he pays a fixed sum and receives all the remaining profit would be, a priori, optimal), he will be suspicious if the landlord proposes a lease of this kind: he will think that the landowner knows the land is not very productive and is just trying to reduce his own risk. So the farmer might prefer a sharecropping agreement with the landowner as a demonstration that the land is actually productive.

It is immediately obvious that this framework for analyzing institutions in terms of moral hazard and adverse selection is also applicable to the regulation of network industries and banks (the regulator has imperfect information regarding a company's technology and its effort to reduce its costs, or the exact risk involved in a bank's portfolio), to the governance and financing of firms (shareholders, creditors, and other stakeholders are imperfectly informed about the management's choices or their consequences), to the sociology of organizations (divisions or work groups strategically retain information for their own purposes), and so on.

The developments in information theory during the last three decades have allowed the definition of principles essential for understanding the mechanisms of negotiation and supervision. These principles mean that a few simple rules should govern the drawing up and execution of any contract. For example, the party that draws up the contract must accept the idea that if the other party has some private information, he will have to make concessions to induce the counterparty to reveal it.

A formal contract is based on quantifiable elements that are observable and verifiable, an idea that plays an important part in our analyses of employment policies and of the fight against global warming in chapters 8 and 9. The contract then has to be founded on a set of credible rewards and punishments. It also

needs to be flexible enough to reflect changing information, notably because things will inevitably occur that could not be predicted at the time the contract was signed. Thus, methods for renegotiating or even breaking the contract must be provided, notably exit options and rules for calculating indemnities. Finally, in the absence of such formal incentive mechanisms, trade must rely on a more informal relationship between the two parties, in which the repetition of poor performance by one makes the other suspicious and leads to a loss of confidence and cooperation.

These examples are only a brief introduction to information theory, but they clearly show how agents have incentives to use their informational advantage to take advantage of others, and how institutions must account for the presence of asymmetric information.

AN ECONOMIST AT WORK: METHODOLOGICAL CONTRIBUTIONS

In many academic disciplines, upstream, fundamental research develops new techniques and ideas, which can then be employed in downstream, more applied research. That is the case in economics. Many studies do not have a specific application, nor do they try to solve a particular economic problem. Rather, they focus on methodology enabling other theoretical work to model specific phenomena, or they provide a conceptual framework for empirical studies.

For example, econometricians adapt statistics or construct their own techniques in order to allow applied economists to measure economic phenomena with greater precision, and to

attribute causality (does a variable influence another variable or is it simply correlated with it?). This is a sine qua non when applying empirical analysis to public policy. Similarly, theorists may work on frameworks that have no direct application. The following remarks are both abstract and self-indulgent (because they describe the subject of my own research, for which I ask reader's pardon). Their main purpose is to help the reader grasp the diversity of the work done more generally by researchers in economics. I hope they will also make readers realize how much even theoretical research depends on teamwork. I could not have done this work without the close collaboration of the people I mention, as well as that of many others.

My studies on *pure game theory* have dealt with dynamic games, that is, conflict situations that take place over time and in which the players (the agents) react to choices made by other players. The first step was defining (with Eric Maskin, my PhD supervisor at MIT, now a professor at Harvard) the notion of a "Markov perfect equilibrium." According to this concept, for any game developing over time we can identify unambiguously a summary of the past (called a "state variable") conditioning future strategies. This summary, which synthesizes every instant of the game up to that point, captures everything the players need to know about the impact of future strategies on the players' future gains. For example, in an oligopolistic market, the current level of productive capacities can, if the mode and the timing of the acquisition of these capacities are not relevant, sum up the industry's past. This notion is useful in what is called structural industrial economics, now the dominant approach in empirical industrial economics: the notion of a Markov perfect equilibrium is now routinely used

in econometrics to analyze and measure the dynamic behavior of firms in competition with one another.

With Drew Fudenberg, now a professor at MIT (and like me one of Eric Maskin's first students), I refined the notion of "perfect Bayesian equilibrium."⁴¹ This concept combines the notion of a Bayesian equilibrium which makes it possible to study games involving asymmetric information, with the notion of perfect equilibrium, which describes equilibria in a dynamic context. Again with Drew Fudenberg, I defined a methodology for studying games involving preemption (or more generally, games in which the agents' strategy consists in choosing the moment to act) in continuous time.

My work on the pure theory of contracts has consisted in extending the analytical framework in four directions : *Dynamics*. A contractual relation is often repeated. In addition, it can be renegotiated while it is being executed. My studies on this subject written with Jean-Jacques Laffont, Oliver Hart, and Drew Fudenberg (as well as earlier works written with Roger Guesnerie and Xavier Freixas) have developed a dynamic and evolving view of contracts. For instance, in the context of adverse selection (in which the agent has information that the principal does not have), the agent's performance reveals information about his or her characteristics or those of his or her environment (the difficulty of his or her task, talent, or taste for hard work) and so influences future contracts. To return to the farming example, the landowner who observes an abundant harvest can infer that the land is fertile or that the farmer is efficient. The landowner will then tend to offer more onerous contracts in the future; for example, the landowner will demand a higher price for a farming lease or will set more ambitious goals for the harvest. If the

41. Defined by David Kreps and Bob Wilson, researchers at Stanford, and the Nobel Prize winner Reinhardt Selten.

farmer anticipates this “ratchet effect,” he in turn will be encouraged to reduce his effort (or to hide part of his harvest!).

Hierarchies. Contracts often involve more than two parties (a principal and an agent). For example, in a sharecropping lease in which the landowner and the farmer each receive half the harvest, the landowner may delegate the measuring/supervision of the harvest to an intermediary. In fact, we see intermediaries like this everywhere in the economy: financial intermediaries (banks, investment funds, venture capitalists), company foremen and directors, regulators, and so on. When there are more than two agents, collusion between a subset of these agents and other agents in the organization is possible. My research consists in connecting this danger of collusion in “cliques” (to use a sociological term) with the structure of information (its distribution within the organization), and in studying the consequences of the threat of collusion for the design of organizations. Intuitively, collusion is easier to achieve in groups endowed with the same information; “clusters of information” therefore give rise to cliques that threaten organizational efficiency.

The “informed principal” theory. These studies (written in collaboration with Eric Maskin) have provided conceptual tools for modeling the choice of contract offered to an agent by a principal who has information the agent does not have. For example, an entrepreneur (the principal) who is raising funds on the financial markets by selling shares for assets may either have a real need of cash to finance a good project, or be seeking to sell before bad news concerning the company (or the assets) becomes public. The quantity issued, as well as its mode (stocks or bonds) will be interpreted by investors (the agents) as signals.

The internal organization of business enterprises and the state. With Mathias Dewatripont (of the Université libre de Bruxelles), I have

analyzed ways of structuring organizations to create a greater sense of responsibility within them; thus we showed how an adversarial procedure that has advocates (rather than more neutral representatives) on each side can help a judge, or more generally a neutral decision maker, to obtain more information, and can do so even when these advocates keep silent about information unfavorable to their cause. We have also examined the missions that can be assigned to government officials and agencies, and showed when specific, clear missions can be superior to a more all-encompassing approach (“grasp all, lose all”).

This chapter has sought to present the principal characteristics of research in economics: the back and forth between theory and experience and between methodological research and applied research, how research is evaluated, the character of academic debate and the evolving consensus as understanding advances, and finally the role of mathematics and new conceptual tools. As in any science, the advancement of knowledge in economics goes hand in hand with a specialization of the researchers that sometimes amounts to fragmentation, because it is becoming increasingly difficult to master the different approaches, domains, and available tools. Interdisciplinary research, however, remains an important source of progress in economics, as well as between the social sciences and humanities, which are the subject of the following chapter.

Jean Tirole, *Economics for the Common Good*, Copyright © 2017 by Princeton University Press.



Jean Tirole receives the Bank of Sweden Prize in economic science in memory of Alfred Nobel, 8th Decembre 2014, in Stockholm. He was rewarded for his "analysis of the power of the market and its regulation".

THE SPEECH MADE BY JEAN TIROLE AT THE NOBEL BANQUET, 10 DECEMBER 2014

The great economist John Maynard Keynes once wrote: “If economists could manage to get themselves thought of as humble, competent people, on a level with dentists, that would be splendid.” Eighty-three years and much research later, we would perhaps aspire to be compared with meteorologists or doctors, whose scientific achievements have been remarkable and yet have had to face challenges that are rather down-to-earth.

Our failure to foresee, or prevent, the financial crisis is a sore reminder of the dangers of hubris. True enough, we had worked on most of its ingredients. But like a virus that keeps mutating, new dangers emerged when we thought we had understood and avoided the existing ones. The need to be humble applies also to the field that was rewarded by the Prize.

Recognising that industries are different from each other and evolve rapidly, researchers in industrial economics, have patiently built a body of knowledge that has helped regulators to better understand the power of the market and the effects of policy interventions and helped firms to formulate their strategies. They have thereby contributed to making this world a better world, the economist’s first mission. Yet, there is so much we still have to learn and our understanding does not always keep up with a rapidly changing world.

Humility is not easy to preserve when receiving such a prestigious award. Albert Camus in his acceptance speech, wondered how “a man, who was still almost young, rich only in his doubts and his work still in progress, accustomed to living in the solitude of his work, or the refuge of friendships, would not have learned in a panic, as if struck, alone and delivered unto himself, at the centre of a glaring light.” His answer was that he could not live without his art. The great French scientist Henri Poincaré described the unmatched pleasure of discovery: “Thought is only a flash in the middle of a long night. But this flash means everything.” Wisdom therefore encourages me to return as soon as possible to my lab, to the colleagues to whom I am indebted for the Prize, in short to the wonderful life of a researcher. But I shall be profoundly and permanently grateful to the Committee for the immense honour it has bestowed upon me, and to the Nobel Foundation and Sweden for their astounding mission of drawing attention to Science year after year.

THE PRIZE IN ECONOMIC SCIENCES 2014

Market power and regulation

Jean Tirole is one of the most influential economists of our time. He has made important theoretical research contributions in a number of areas, but most of all he has clarified how to understand and regulate industries dominated by a few powerful firms. Tirole was awarded this year's prize for his analysis of market power and regulation.

Regulation is difficult

Which activities should be conducted as public services and which should be left to private firms, is a question that is always relevant. Many governments have opened up public monopolies to private stakeholders. This has applied to industries such as railways, highways, water, post and telecommunications – but also to the provision of schooling and healthcare. The experiences resulting from these privatisations have been mixed and it has often been more difficult than anticipated to get private firms to behave in the desired way.

There are two main difficulties. First, many markets are dominated by a few firms which all influence prices, volumes and quality. Traditional economic theory does not deal with this case, known as an oligopoly, instead it presupposes a single monopoly or what is known as perfect competition. The second difficulty is that the regulatory authority lacks information about the firms' costs and the quality of the goods and services they deliver. This lack of knowledge often provides regulated firms with a natural advantage.

Before Jean Tirole

In the 1980s, before Tirole published his first work, research into regulation was relatively sparse, mostly dealing with how the government can intervene and control pricing in the two extremes of monopoly and perfect competition.

At this time, researchers and decision-makers were still looking for general principles that would apply to every industry. They advocated simple rules for regulatory policies, such as capping prices for monopolists and prohibiting cooperation between competitors in the same market, while permitting cooperation between firms at different positions in the value chain. Tirole's research would come to show that such rules work well in some conditions, but that they do more harm than good in others. Price caps can provide dominant firms with strong motives to reduce costs – a good thing for society – but may also permit excessive profits – a bad thing for society. Cooperation on price setting within a market is usually harmful, but cooperation regarding patent pools can benefit everyone involved. The merger of a firm and its supplier may lead to more rapid innovation, but it may also distort competition.

To arrive at these results, a new theory was needed for oligopoly markets, because not even extensive privatisation creates enough space for more than a small number of firms. There was also a need for a new theory of regulation in situations of asymmetric information, because regulators often have poor knowledge of firms' conditions.

New theoretical tools

Tirole's research would come to build upon new scientific methods, particularly in game theory and contract theory and there were great hopes that these methods would contribute to practical policy. Game theory would aid the systematic study of

how firms react to different conditions and to each other's behavior. The next step would be to propose appropriate regulation based on the new theory of incentive contracts between parties with different information. However, even though many people could see the research questions, they were difficult to solve.

Jean Tirole began his research on regulation and oligopoly in the early 1980s. He had already received degrees in engineering from the École Polytechnique and the École Nationale des Ponts et Chaussées in Paris and in mathematics from the Université Paris-Dauphine. In 1981, he was awarded a Ph.D. in economics by the Massachusetts Institute of Technology in Cambridge, USA. The new tools of economic theory and deep insights into the production conditions of a number of regulated industries, gave Tirole an exceptionally good foundation on which to renew and deepen the analysis of regulation and market power.

The regulator's information problems

In 1986, Tirole and his now deceased colleague Jean-Jacques Laffont, made an important contribution to the theory of regulation. They demonstrated how a clever set of production contracts can circumvent the problem of asymmetric information in a market where the regulatory authority lacks complete knowledge of a monopoly's costs and choices of production techniques.

The central problem is to provide compensation, that is high enough for production to be worthwhile, without using tax money to create unnecessarily high profits. Laffont and Tirole demonstrated how the regulatory authority can solve this dilemma. The elegant result is that the authority can compensate for its lack of information about the firm's conditions, by allowing it to choose from a menu of ingeniously constructed contracts. Regardless of the

type of producer, they will choose the right kind of contract purely out of self-interest. A producer with high costs, that are difficult to influence, will choose a contract with relatively high compensation for its costs – and thus have little motivation to reduce them. A producer that has greater opportunities to reduce its costs will choose a contract with relatively low compensation for its costs, but with a higher price for the services it delivers – and thus have a strong incentive to reduce costs. A single contract that strikes a compromise between these aspects would result in unnecessarily large profits if it is easy for the firm to cut its costs.

During the 1980s and 1990s, Laffont and Tirole applied their theory to a range of issues. They summarised the results in a book on public procurement and regulation, published in 1993, which has greatly influenced regulatory practice. The theoretical results, of how different types of regulation might work, have also received convincing support in empirical studies of individual industries.

The dynamics of regulation

In many cases, questions arise about the time frame for regulation: for what period should the first set of regulations be designed and how should it be reviewed and renewed? Laffont and Tirole analysed these questions in two significant articles from 1988 and 1990, which were based on work carried out by Freixas, Laffont and Tirole in 1985.

Assume that the regulator and the producer cannot sign a long-term contract, but only a series of short-term contracts. This means that the producer's current actions may affect its future regulation. If a low-cost producer works hard and thus achieves large profits during the first contract period, the regulatory authority may tighten the demands of the next contract, in order to reduce the profit potential. The risk is that the producer predicts

this ratchet effect and thus works less hard, disadvantaging the business. If the authority cannot draw up long-term contracts, it is impossible to get the producer to choose the appropriate effort at a reasonable cost and thus indirectly reveal its cost conditions. Instead, the authority should choose to use weaker incentives and gradually learn these cost conditions – this will happen quickly if the business is complex and unprofitable, and more slowly if it is simpler and more profitable.

The regulator's independence

In most countries the framework for regulation is first decided at a higher level (the government) and a public authority is then tasked with designing the precise terms of the regulation. In 1986, Tirole had analysed the optimal reward system in a similar hierarchical relationship, studying a more general case with one principal (owner), one supervisor (foreman) and one agent (worker). The primary problem is that the authority and the firm have more information about the business than the government. A poorly designed framework means that there is a risk of the two colluding to hide this information from the government, to the benefit of the business: the authority becomes the firm's advocate. In 1991, Laffont and Tirole examined how regulation should be designed to minimise this risk.

The main result of their analysis was, that the government should establish a framework that explicitly considers the risk of the regulator hiding information and colluding with the regulated firm. Even with a well-designed framework, a regulator will sometimes appear to be an advocate of the firm, but despite this they will nevertheless not allow themselves to be bribed or actively withhold information.

Competition and strategic investments

It is not only monopolies that require regulation, oligopoly markets do too. Along with his coauthors, Tirole has provided a number of important contributions to theories of competition law, such as analyses of the competitive effects of patents, technical advances and strategic investments.

Patents can provide firms with a strategic advantage. In 1983 Tirole, working with Drew Fudenberg, Richard Gilbert and Joseph Stiglitz (one of the 2001 Economics Laureates), analysed the conditions for patent races between firms. They predicted intense races in areas where several companies are at roughly the same level, but lower levels of investment in research and development when one of the companies is far ahead.

In an article from 1984, Fudenberg and Tirole used game theory to analyse how a firm can influence its competitors strategically. A strategic investment has long-term effects on the firm's profitability. One vital question is, whether the investments make the firm more (or less) aggressive in future competition. One example is an investment that reduces the firm's marginal costs. The next question is the way in which competing firms best deal with such competition. In some markets aggressive investments will bring rewards, as competitors will abstain from market shares??. In other markets such investments are unprofitable, as they will in turn be met with aggressive behavior.

In-depth understanding of the particular conditions of a specific industry is therefore necessary to determine what type of strategy is most profitable for firms in that industry. These are important insights for both practitioners and competition authorities. Practitioners may make mistakes, if they uncritically

try to transfer lessons learned in one market to another one and the authorities may make mistakes if they regulate firms without taking specific market conditions into account.

Competition in specific markets

There are no simple, standard solutions for regulation and competition policy, as the most appropriate ones will vary from one market to another. Jean Tirole has therefore also studied the conditions of specific markets and contributed new theoretical perspectives. Traditionally, undercutting prices has been disciplined under competition law, because setting prices below production costs is one way of getting rid of competitors. However, this is not necessarily true of all markets. Consider the newspaper market, for example, where giving away papers for free can be a way of attracting readers and thus new advertisers to cover the losses due to production and distribution. In this case, it is doubtful whether undercutting should be banned. Along with Jean-Charles Rochet, Tirole has increased our understanding of these platform markets, where there is a strong link between players on different sides of a technical platform, such as readers and advertisers in the case of newspapers. Other examples of similar platforms are credit/debit cards, search engines and social media.

Competition and vertical restraints

What happens when someone has a monopoly in an area that is an important link in a production chain? This classic problem is illustrated by a modern phenomenon: a particular firm's software or operating system becomes dominant in its area. Formerly, the belief was that such companies may well make monopoly profits in their own area, but that competition prevents them from benefitting from their position in the next link of the production chain. In two studies

– one with Patrick Rey in 1986, one with Oliver Hart in 1990 – Tirole demonstrated that this belief is not justified; mastering one link of a chain can allow a monopolist to make profits in the market of the next link. In reality, it is often by distorting competition in a neighboring market that a monopolist is able to make a profit. One example is the producer of a cost-reducing, patented innovation. If the firms that are potential purchasers of this innovation operate in a market with stiff competition, the producer will find it difficult to earn a lot of money if he sells to all the firms at the same time; market competition produces low profits, even after the reduction in costs, so the producer must maintain a low price. However, if the innovation is sold to only one firm, this firm makes a high profit because it becomes more efficient than its competitors. The producer can then set his price considerably higher

However, it is far from clear that the producer can commit to selling to only one firm. Once the sale has taken place, it is worthwhile for the producer to sell to additional firms, but if the first customer realises this risk, his willingness to pay significantly diminishes. The producer must therefore promise not to make any more sales. In order for this promise to be credible, it is necessary to either sign some form of exclusive contract, or actually merge the two firms. Competition law therefore has to weigh these two considerations against each other: on the one hand, vertical contracts can limit competition but, on the other hand, they encourage innovation. This type of reasoning has provided a new and robust foundation for legislation and legal usage concerning vertical contracts and mergers. So, this is yet another example of the same general result: desirable competition policies are different from market to market.

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Overall contribution

Jean Tirole's research contributions are characterised by thorough studies, respect for the peculiarities of different markets and the skilful use of new analytical methods in economics. He has penetrated deep into the most central issues of oligopolies and asymmetric information, but he has also managed to bring together his own and other's results, into a coherent framework for teaching, practical application and continued research. Tirole's emphasis on normative theories of regulation and competition policy, has given his contributions great practical significance.

Links and further reading

Additional information on this year's prizes, including a scientific background article in English, are available on the website of the Royal Swedish Academy of Sciences, <http://kva.se>, and at <http://nobelprize.org>. They also include web-TV versions of the press conferences at which the awards were announced. Information on exhibitions and activities related to the Nobel Prizes and the Prize in Economic Sciences may be found at www.nobelmuseum.se.

Books

Dewatripont, M., Rochet, J. and Tirole, J. (2010) *Balancing the Banks: Global Lessons from the Financial Crisis*, Princeton University Press
 Laffont, J.-J. and Tirole, J. (1999) *Competition in Telecommunications*, MIT Press
 Laffont, J.-J. and Tirole, J. (1993) *A Theory of Incentives in Procurement and Regulation*, MIT Press
 Tirole, J. (1988) *The Theory of Industrial Organization*, MIT Press

Lecture

Tirole, J. (2013) Two-sided markets, www.ut-capitole.ubicast.tv/videos/jean-tirole-two-sided-markets-feb-26-2013-part-1/

References

Ainslie G. (1992) : *Picoeconomics*, Cambridge University Press, Cambridge.
 Baron D. (1985) : "Non-Cooperative Regulation of a Non-Localized Externality", *Rand Journal of Economics*, 16, pp. 269-282.
 Bernheim D. et M. Whinston (1986) : "Common Agency", *Econometrica*, 54, pp. 923-943.
 Boyer M. et J.-J. Laffont (1999a) : "Toward a Political Theory of the Emergence of Environmental Incentive Regulation", *Rand Journal of Economics*, 30, pp. 137-157.
 Boyer M. et J.-J. Laffont (1999b) : *Competition and the Reform of Incentive Schemes in the Public Sector*, Mimeo, CIRANO-IDEI.
 Buchanan J. (1987) : "The Constitution of Economic Policy", *American Economic Review*, pp. 243-250.
 Buchanan J. et G. Tullock (1965) : *The Calculus of Consent*, University of Michigan Press, Ann Arbor.
 Crémer J. (1995) : "Arm's Length Relationships", *Quarterly Journal of Economics*, 110, pp. 275-295.
 Crémer J. et R. McLean (1988) : "Full Extraction of the Surplus in Bayesian and Dominant Strategy Auctions", *Econometrica*, 56, pp. 1247-1258.
 Dewatripont M. (1989) : "Renegotiation and Information Revelation over Time", *Quarterly Journal of Economics*, 103, pp. 589-620.
 Dewatripont M. et E. Maskin (1995) : "Credit and Efficiency in Centralized and Decentralized Economies", *Review of Economic Studies*, 62, pp. 541-555.
 Dewatripont M. et J. Tirole (1996) : "Biased Principals as a Discipline Device", *Japan and the World Economy*, 8, pp. 195-206.

Dewatripont M. et J. Tirole (1999) : “Advocates”, *Journal of Political Economy*, 107, pp. 1-39.

Dewatripont M., I. Jewitt et J. Tirole (1999) : “The Economics of Career Concerns. Part II : Applications to Missions and Accountability of Government Agencies”, *Review of Economic Studies*, 66, pp. 199-217.

Dixit A. (1996) : *The Making of Economic Policy : A Transaction Cost Politics Perspective*, MIT Press, Cambridge.

Downs A. (1957) : *An Economic Theory of Democracy*, Harper and Row, New York.

Estache A. et D. Martimort (1999) : “Politics, Transaction Costs, and the Design of Regulatory Institutions”, *The World Bank Policy Research Working Paper*, n° 2073.

Faure-Grimaud A. et D. Martimort (1999) : *Political Stabilization by an Independent Bureaucracy*, Mimeo, IDEI.

Frisch R. (1970) : *Nobel Lecture*, The Nobel Foundation, Stockholm.

Frison-Roche M.-A. (2000) : “L’Évolution du droit comme instrument étatique d’une organisation économique”, in *État et gestion publique*, rapport du CAE n° 24, La Documentation française, Paris.

Grossman H. et E. Helpman (1994) : “Protection for Sale”, *American Economic Review*, 84, pp. 833-850.

Grossman S. et O. Hart (1986) : “The Costs and Benefits of Ownership : A Theory of Lateral and Vertical Integration”, *Journal of Political Economy*, 94, pp. 691-719.

Guesnerie R. et J.-J. Laffont (1984) : “A Complete Solution to a Class of Principal-Agent Problems with an Application to the Control of a Self-Managed Firm”, *Journal of Public Economics*, 25, pp. 329-369.

Holmstrom B. et P. Milgrom (1991) : “Multitask Principal-Agent Analysis : Incentive Contracts, Asset Ownership and Job Design”, *Journal of Law, Economics and Organization*, 7, pp. 26-52.

Jenkins K., K. Caines et A. Jackson (1998) : *Improving Management in Government : The Next Steps*, report to the Prime Minister, London.

Johansen L. (1981) : “Review and Comments : Jerry R. Green and Jean-Jacques Laffont”, *Incentives in Public Decision Making*, *Journal of Public Economics*, 16, pp. 123-128.

Kydland D. et E. Prescott (1977) : “Rules Rather than Discretion : The Inconsistency of Optimal Plans”, *Journal of Political Economy*, 85, pp. 473-491.

Laffont J.-J. (1993) : “À propos de l’émergence de la théorie des incitations”, *Revue française de gestion*, 96, pp. 13-19.

Laffont J.-J. (1999) : *Incentives and Political Economy*, Oxford University Press, Oxford.

Laffont J.-J. et D. Martimort (1999a) : “Collusion and Delegation”, *Rand Journal of Economics*, 29, pp. 280-305.

Laffont J.-J. et D. Martimort (1999b) : “Separation of Regulators Against Collusive Behavior”, *Rand Journal of Economics*, 30, pp. 232-262.

Laffont J.-J. et D. Martimort (1999c) : “Collusion and Correlation”, *Econometrica*.

Laffont J.-J. et M. Meleu (1997) : “Reciprocal Supervision, Collusion and Organizational Design”, *Scandinavian Journal of Economics*, 99, pp. 519-540.

Laffont J.-J. et J. Pouyet (1999) : *The Subsidiarity Bias in Regulation*, Mimeo, Toulouse.

Laffont J.-J. et Y. Qian (1999) : “The Dynamics of Reform and Development in China : A Political Economy Perspective”, *European Economic Review*, 43, pp. 1105-1114.

Laffont J.-J. et J. Tirole (1988) : “The Dynamics of Incentive Contracts”, *Econometrica*, 56, pp. 1153-1175.

Laffont J.-J. et J. Tirole (1990) : “Adverse Selection and Renegotiation in Procurement”, *Review of Economic Studies*, 75, pp. 597-626.

Laffont J.-J. et J. Tirole (1991a) : “The Politics of Government Decision Making : A Theory of Capture”, *Quarterly Journal of Economics*, 106, pp. 1089-1127.

Laffont J.-J. et J. Tirole (1991b) : “Provision of Quality and Power of Incentive Schemes in Regulated Industries”, in *Equilibrium Theory and Applications*, Gabszewicz et Mas-Colell (eds), Cambridge University Press, Cambridge.

Laffont J.-J. et J. Tirole (1991c) : “Privatization and Incentives”, *Journal of Law, Economics and Organization*, 6, pp. 1-32.

Laffont J.-J. et J. Tirole (1992) : “Should Government Commit ?”, *European Economic Review*, 36, pp. 345-353.

Lavialle C. (1999) : *Modernisation, économie et droit administratifs*, Mimeo.

Mailath G. et A. Postlewaite (1990) : “Asymmetric Information Bargaining Problems with Many Agents”, *Review of Economic Studies*, 57, pp. 351-368.

Martimort D. (1992) : “Multi-principaux avec antisélection”, *Annales d'économie et statistique*, 28, pp. 1-38.

Martimort D. (1999a) : “The Life Cycle of Regulatory Agencies : Dynamic Capture and Transaction Costs”, *Review of Economic Studies*, 66, pp. 929-948.

Martimort D. (1999b) : “Renegotiation Design with Multiple Regulators”, *Journal of Economic Theory*, 88, pp. 261-294.

Mirrlees J. (1971) : “An Exploration of the Theory of Optimum Income Taxation”, *Review of Economic Studies*, 38, pp. 175-208.

Montesquieu (1748) : *De l'esprit des lois*, in *Œuvres complètes*, Seuil (éd. 1964), Paris.

Osborne D. et T. Gaebler (1992) : *Reinventing Government : How the Entrepreneurial Spirit is Transforming the Public Sector*, Plume, New York.

Osborne D. et P. Plastrik (1997) : *Banishing Bureaucracy : The Five Strategies for Reinventing Government*, Addison-Wesley, Reading.

Rob R. (1989) : “Pollution Claim Settlements under Private Information”, *Journal of Economic Theory*, 47, pp. 307-333.

Rousseau J.-J. (1762) : *Du contrat social*.

Sah R. et J. Stiglitz (1985) : “Human Fallibility and Economic Organization”, *American Economic Review*, 72, pp. 292-297.

Sah R. et J. Stiglitz (1986) : “The Architecture of Economic Systems : Hierarchies and Polyarchies”, *American Economic Review*, 76, pp. 716-727.

Sah R. et J. Stiglitz (1991) : “Quality of Managers in Centralized Versus Decentralized Economic Systems”, *Quarterly Journal of Economics*, 106, pp. 289-296.

Santel G. (1998) : *La Modernisation de l'administration territoriale de l'État*, rapport au ministre de la Fonction publique, de la Réforme de l'État et de la Décentralisation.

Sappington D. et J. Stiglitz (1987) : “Privatization, Information and Incentives”, *Journal of Policy Analysis and Management*, 6, pp. 567-582.

Schmidt K. (1990) : “The Cost and Benefits of Privatization”, *DP A-330*, University of Bonn.

Schumpeter J. (1950) : *Capitalism, Socialism and Democracy*, Harper and Brothers, New York.

Seabright P. (1996) : “Accountability and Decentralization in Government : An Incomplete Contracts Model”, *European Economic Review*, 40, pp. 61-90.

Shapiro C. et R. Willig (1990) : “Economic Rationales for the Scope of Privatization”, *DP 41*, Princeton University.

Shleifer A. (1985) : “A Theory of Yardstick Competition”, *Rand Journal of Economics*, 16, pp. 319-327.

Stole L. (1990) : *Mechanism Design under Common Agency*, Mimeo, University of Chicago.

Tirole J. (1986) : “Hierarchies and Bureaucracies : On the Role of Collusion in Organizations”, *Journal of Law, Economics and Organization*, 2, pp. 181-214.

Tirole J. (1994) : “The Internal Organization of Government”, *Oxford Economic Papers*, 46, pp. 1-26.

Trosa S. (1995) : *Moderniser l'administration. Comment font les autres ?*, Éditions d'Organisation, Paris.

Williamson O. (1975) : *Markets and Hierarchies*, Free Press, New York.

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