

THE TOULOUSE SCHOOL OF ECONOMICS MAGAZINE

# TSE MAG

Living economics



#11  
SUMMER  
2016

*Special issue*

## THE DIGITAL AGE

Preston McAfee  
on Microsoft & the  
digital revolution

Torsten Persson on  
the economics of  
democracy

Vera Zaporozhets  
on EU voting  
powers

Stéphane Gregoir  
on university  
rankings

## Welcome to the digital era!

The meteoric rise of digital platforms such as Google, Amazon, Facebook, but also Booking.com, AirBnB, Uber, or Deezer (to name but a few), is transforming the functioning of markets, unsettling the value chain in the economy and profoundly reshaping almost every sector, including the organisation of work and of labour markets. As this special issue of our mag aims to highlight, our researchers are at the forefront of explaining the economic underpinnings of this digital revolution.



TSE's long-standing position as a leading research centre on digital platforms and two-sided markets was further acknowledged with the creation of the Jean-Jacques Laffont Digital Chair last year under the stewardship of the French Minister of Culture and Communication. More recently, Jacques Crémer was appointed to the French National Digital Council, and Doh-Shin Jeon received the 2016 Award for the Best Korean Economist Abroad for his work on the economics of IT and intellectual property. The contributions of a number of TSE researchers to our understanding of the digital transformation are showcased in this issue.

The interview with Preston McAfee (*pages 25-27*), who became Microsoft's chief economist after a career in academia and later with Yahoo and Google, is a highly readable testimony to the value of economic analysis in tackling the digital revolution. TSE is rapidly expanding its footprint in the area; this year's TSE Forum, our annual flagship event reaching out to a wider audience (previously known as the Tiger Forum), is dedicated to the economics of changing organisations in the digital era. Held on 16 June in Paris and jointly organised with the Digital Chair, the Forum boasts an impressive line-up of high-profile speakers, and crowns our intensive and increasing academic activities devoted to a wide area of issues in the digital economy. Already this year we held four events covering digital books, collective behaviour in the big data area, e-commerce, and the price implications of two-sided markets.

Researchers linked to the Institute for Advanced Study in Toulouse (IAST), our sister organization, further broaden the perspective by looking at the societal consequences of the digital revolution, for example via an upcoming event on freedom and control of expression in social networks and digital media in the wake of last year's terrorist attacks. The digital transformation also plays an increasing role in our education programmes, including the new big data masters course featured in this issue (*pages 28-31*).

To conclude with some faculty news, we are excited about several appointments: Estelle Cantillon from the Université Libre de Bruxelles and René Garcia from the University of Montréal as part-time faculty members, Ana Gazmuri from the Wharton School at the University of Pennsylvania as Assistant Professor, and David Austen-Smith from Northwestern on a Chair of Excellence funded by the French Government. In coming years, TSE will continue to be active in recruiting at the junior and senior levels to consolidate its standing in the highly competitive landscape of the world's top research centres in economics.

Ulrich Hege, TSE Director  
Jean Tirole, TSE Chairman

Our researchers are at the forefront of explaining the economic underpinnings of this digital revolution.

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## Appointments



### Jacques Crémer joins French Digital Council

One of the co-founders of the Digital Chair in 2015, Jacques Crémer has joined the French Digital Council, which issues independent opinions and recommendations on the impact of digital technologies on economy and society. The government can consult the council on new legislation or draft regulations. Crémer also coordinates TNIT, a global network of digital economists.



[tse-fr.eu/people/jacques-cremer](http://tse-fr.eu/people/jacques-cremer)

### Christian Gollier appointed co-editor of the Journal of Risk and Insurance (JRI)

The JRI publishes rigorous, original research in risk management and insurance economics.



### TSE joins Toulouse network to combat neurodegenerative diseases

**Toulouse's NeuroToul has obtained official recognition as a Centre of Excellence in Neurodegenerative Diseases after a national competition.**

TSE will be one of 13 Toulouse-based research institutes that will be contributing to this new research network. Researchers involved are Helmut Crémer (TSE-UTC), Philippe De Donder (CNRS-TSE), Pierre Dubois (TSE-UTC), Frédérique Fève (IDEI-TSE), Catarina Goulao (INRA-TSE), Jean-Marie Lozachmeur (CNRS-TSE) and Emmanuel Thibault (TSE-University of Perpignan).



### Jean Tirole awarded Imperial tribute

The TSE chairman received an honorary degree in May from Imperial College London.

## Newcomers



### Estelle Cantillon

**Université Libre de Bruxelles**

joins TSE as an associate member in the industrial organisation research group. Cantillon's work lies between market design and industrial organization and typically combines theory and data. She has published work on auctions, procurement, competition between exchanges, and assignment problems.

### René Garcia Montreal University

joins TSE as an associate member in the finance research group. His research interests include the valuation of financial assets, portfolio management and risk management. In econometrics, he is interested in nonlinear models, in particular regime-switching models. He is the co-founder and editor-in-chief of the Journal of Financial Econometrics, published by Oxford University Press.

### TSE researchers awarded Europlace Institute of Finance Prize

Bruno Biais (CNRS-TSE), Sophie Moinas (TSE-UTC) and their colleague Thierry Foucault (HEC Paris) have been granted the 2016 EIF Prize for their work on high-frequency trading.

This annual prize, awarded by the EIF alongside French business daily *Les Échos*, rewards excellent research work dealing with finance issues. The EIF supports outstanding economic research in finance.



Bruno Biais

Sophie Moinas

Thierry Foucault

### 30 June: TSE hosts annual Society for Economic Dynamics meeting

Over 600 participants are expected in Toulouse to attend the 27th SED Annual conference, which brings together leading researchers from all fields of economics that make use of dynamic methods, such as macroeconomics, finance, labor economics, public economics, international economics, industrial organization, and economic theory.

The conference will feature theoretical and empirical cutting-edge research work from these fields. Programme chairs are Manuel Amador (Federal Reserve Bank of Minneapolis) and Pierre-Olivier Weill (UCLA). The event is organised at Toulouse School of Economics by Christian Hellwig (TSE-UTC) and Franck Portier (TSE-UTC). Plenary speakers are Fernando Alvarez (University of Chicago), MariaCristina de Nardi (Federal Reserve Bank of Chicago) and Jean-Marc Robin (Science-Po Paris).



[www.economicdynamics.org/2016-sed-meeting/](http://www.economicdynamics.org/2016-sed-meeting/)

# It's book season at TSE

Two of our top researchers, Emmanuelle Auriol (TSE - UTC) and Jean Tirole (TSE) recently published wide-reaching general audience books.

## Emmanuelle Auriol

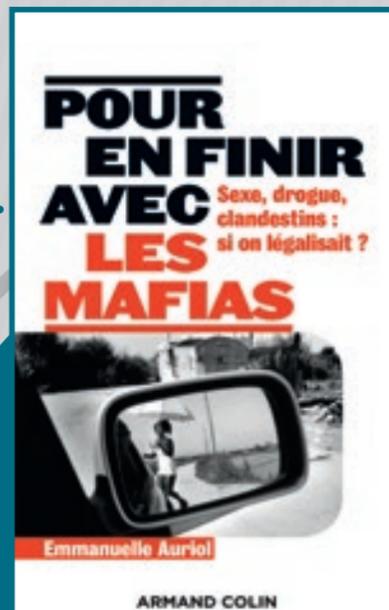
### AN END TO MAFIAS: WHAT IF WE LEGALIZED SEX, DRUGS AND ILLEGAL IMMIGRATION?

Published: 4 May 2016 in French (English version available soon)

Auriol analyses the black markets of drugs, prostitution and immigration and comes up with innovative solutions: legalization, sanctions against customers, selling visas, all combined with strong repressive measures. She explains how the public policies she recommends could considerably reduce criminal activities.

“ Suppressing supply isn't enough to eliminate demand. Whenever people can't legally get what they're looking for, they tend to get it illegally. A prohibition-only policy is clearly not working and fuels organised crime: cannabis in France is a striking example. Combining legalisation with repression of residual criminality and implementing demand management policies seem to lead to much better results. ”

Emmanuelle Auriol



## Jean Tirole

### ECONOMICS FOR THE COMMON GOOD

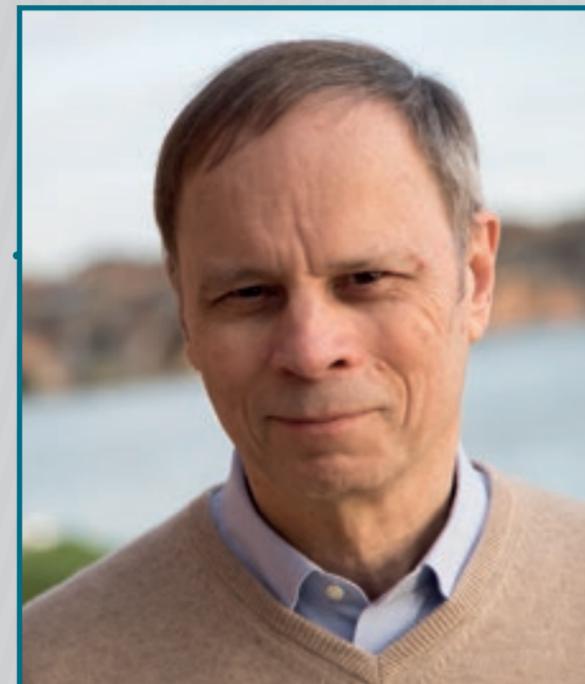
Published: 11 May 2016 in French (English version available soon)

With his first book aimed at the general public, the winner of the 2014 Nobel Prize in Economic Sciences invites us to delve into his passion for his field, sharing his vision of a science that bridges the gap between theory and facts to further the common good.

As we turn the pages, we enter the economist's laboratory and explore the subjects that affect our daily lives: the digital economy, innovation, unemployment, global warming, Europe, state intervention, finance, the market... By offering a broad panorama of his views on today's great economic challenges, Jean Tirole leads us to the very heart of the theories he has fathered.

“ Since receiving the Nobel Prize in 2014, I have been struck by the general public's curiosity about economics. People seem eager to understand the mechanisms of our daily lives, but the language of research is inevitably complex, a closed world to them. For me economics is fascinating and even fun, and I hope that this wide-audience book will go some way towards sharing my passion for economics with society. ”

Jean Tirole



## Save the date

### UPCOMING TOULOUSE EVENTS

- 20-21 JUNE 2016  
Norms Actions and Games Conference 2016
- 22-24 JUNE 2016  
5th French "R" Meeting
- 23 JUNE 2016  
Health Economics Workshop
- 27 JUNE 2016  
Networks, Information and Business: 2016 Innovation, Finance and Law Conference
- 28-29 JUNE 2016  
Recent Advances in Econometrics
- 30 JUNE - 2 JULY 2016  
Society for Economic Dynamics (SED) Congress 2016

Events by invitation only: [tse-fr.eu/events](http://tse-fr.eu/events)

INFLUENCE IN EUROPE

# EU politics: who decides?

**Which countries decide European policies? Who benefits most from the decisions of water regulatory agencies? What impact do lobbyists have on the European Parliament? These are some of the questions addressed by INRA-TSE researcher Vera Zaporozhets in her work on voting power.**

Zaporozhets joined TSE in 2009 from the Catholic University of Leuven. A specialist in political economy, public economics and environmental economics, most of her research analyses the way decisions are made in institutions such as committees, parliaments or assemblies. She has recently published three very well-received articles on related issues.

The first deals with EU budget allocation among member states. Along with Maria García-Valiñas (University of Oviedo) and Sascha Kurz (University of Bayreuth), Zaporozhets investigates whether EU spending is determined by

the “needs” or the political power. The “needs view” states that the budget allocation is determined by the principle of solidarity. According to this hypothesis, the countries with a relatively large agricultural sector and/or a relatively worse economic situation are the major recipients of the EU budget. The second explanation is that the budget allocation across the members reflects the distribution of their political power. Thus, the countries with more power in the allocation process arguably receive larger shares of the budget.

Previous studies (e.g. *Kauppi and Widgren, 2004*) reveal the strong prevalence of political power motives i.e. that political power matters much more than needs when determining the allocation of budget expenditures among EU member states. Zaporozhets and her co-authors challenge this assessment. Looking into an extended data set, taking into account recent budgets and applying alternative econometric specifications, the researchers conclude that both power and needs are significant factors of budget allocation: “Our study shows that political power matters, but not as much as previously thought, and that the solidarity principle in Europe plays an important role.”

Interested by decision-making at the European level, Zaporozhets is currently working on a research project to analyze the influence of lobbies for agriculture protection in Europe. “The influence of lobbies has been studied a great deal in the US where lobbies contribute directly

to political campaigns and expect a return on their investment. A number of empirical studies on the US agricultural protection conclude that the government puts unexpectedly low weight on the lobby contributions as compared to the social welfare. It implies that the interest groups have surprisingly little impact on the government trade policy decision. But there isn’t much literature on agriculture protection in Europe.”

Two other articles by Zaporozhets, one of which is co-written with INRA-TSE researcher Alban Thomas, deal with French water regulatory agencies and the decisions made by the environmental committees. “We saw in the data that there seemed to be excessive differences between the level of tax payments and the subsidies for different water users.” The researchers tested their intuition with theoretical models validated on real-world data and detailed their results in the publication (*Thomas and Zaporozhets, 2016*).

The report from the French Audit Office also claims that the decisions taken by French water agencies systematically favor agricultural water users. Thomas and Zaporozhets built a model to try to understand why such a distortion appears in the data from environmental tax and subsidies. “It seems that agriculture users gets a lot of bargaining power and is also considered a good (“cheap”) partner by other voters.” The researchers tested their model on the available data successfully, confirming the underlying theoretical reasons.

Using different tools and techniques from game theory, political science and welfare economics of voting power, Zaporozhets analyzes decision-making



process within environmental committees (*Zaporozhets, 2015*). In the case of French water agencies, her main public policy conclusion is that the committees’ composition and the voting rules should be reconsidered.

Following the publication of those two articles, Zaporozhets will pursue her work on water issues and is currently working on two papers related to irrigation in France.

## Building better institutions

*Alban Thomas and Vera Zaporozhets are specialists in political economy and use tools and methods to analyze how decisions are made within public institutions. Their analysis is focused on the different voting processes and the impact they can have on the final outcomes. Understanding how our public institutions work and detailing their bias is essential to building better public services.*

[www.tse-fr.eu/fr/people/vera-zaporozhets#publications](http://www.tse-fr.eu/fr/people/vera-zaporozhets#publications)

FISCAL POLICY

# Listen to the noise

**It is 16 years since Patrick Fève left the University of Nantes and the CEPREMAP (Paris) to come to work in Toulouse. He first joined GREMAQ, which specializes in quantitative and mathematical economics and was one of TSE’s three founding research units. Now director of TSE’s doctoral programme, he is currently working on the macroeconomic implications of noise and expectations.**

**You recently published an article on ‘noisy fiscal policy’. Tell us more about it...**

This article, written with Mario Pietrunti (Banca d’Italia), had two objectives. First, we wanted to see if we could quantify the level of noise on fiscal policies and measure its macroeconomic impact. To do so, we started to gather data such as budget projections or surveys of professional forecasters. We had enough data to study three countries: Canada, the United Kingdom and the United States.

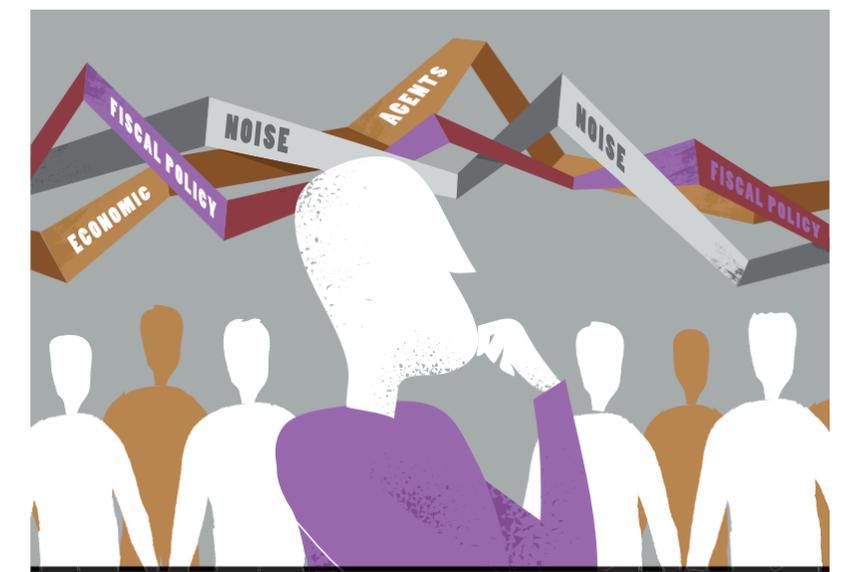
**What exactly is ‘noise’?**

In economic terms, noise is imperfection in the transmission of information between two entities. In the example of governments, noise is the difference between the announced fiscal policy and the one forecasted by economic

agents. The more noise, the less private agents can react accordingly to fiscal policies.

**Where did you get the data for your article?**

Our data come from forecast reports, either from government budget projections or professional forecasters (for example, reports from the US Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia which began in 1968). Thanks to these reports, we have data on economic agents’ expectations of their government’s fiscal policy. These expectations cannot disentangle the actual fiscal policy from noise. Comparing the variance of forecast reports and the variance of the actual fiscal policy allowed us to quantify noise.



...

**What is the level of noise in the countries you analysed?**

Our measures are to be taken with a pinch of salt as there is always a margin of error in this kind of work but you could say that there is a large gap between countries. Our article points to a noise level of 25% to 50% in the US, around 75% in Canada and up to 84% in the UK. We don't know what that level would be in other countries, such as France, because we don't have enough data yet to conduct similar analysis.

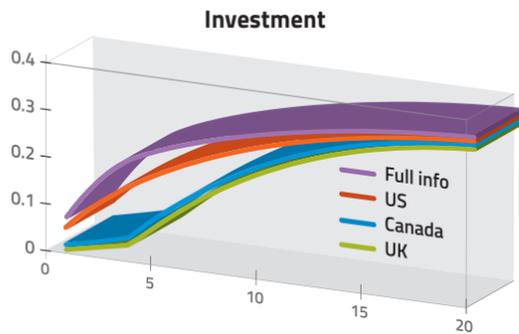
**What are the main findings of your article?**

Our work suggests that the effectiveness of public fiscal policies is proportional to the level of noise because economic

agents won't be able to react accordingly to such policies. To put it simply, noise decreases the impact of fiscal policies. Fiscal stimuli are much less effective in a noisy economic environment. More importantly, our article shows that the impact of noise can be witnessed after a public policy is implemented, meaning that a high noise level will have a long lasting effect on the economy. For example, in the US, where noise is significantly smaller than in Canada or the UK, we measure that noise on a fiscal policy can cause investment to be down 12% more than a year after the policy has been implemented.

**What are your other projects on this topic?**

I am working on a project with Alain Guay (ESG UQAM Montreal) on sentiments in structural vector autoregressions (SVARs), which also focuses on the size of noise and its consequences for aggregate fluctuations. I am also working with Jean-Guillaume Sahuc (Banque de France) on the effects of fiscal policies in the eurozone and with Julien Matheron (Banque de France) on the quantification of the Laffer curve, in an



Fève & Pietrunti show that noisy fiscal policies reduce the response of private investment

incomplete market setup. Finally, I am currently working with Franck Portier (TSE-UTC), Paul Baudry (University of British Columbia) and Alain Guay on an article about the identification of expected shocks in SVARs. ■

**Noise decreases the impact of fiscal policies, making fiscal stimuli much less effective.**

**Measuring fiscal multipliers**

*A fiscal multiplier is the measure of the impact of the money invested by the public sector. For instance, a multiplier equal to 2 means that for every €1 invested in the economy by public institutions, the country will generate €2. It is very difficult to measure multipliers: depending on the theories, models and quantitative techniques, they can vary from 0.5 to 2.5. Patrick Fève and Mario Pietrunti's article shows that noise has a direct decreasing effect on fiscal multipliers.*

[www.tse-fr.eu/people/patrick-feve#publications](http://www.tse-fr.eu/people/patrick-feve#publications)



Patrick Fève  
TSE - UTC researcher



GROWTH, INNOVATION AND MOTIVES

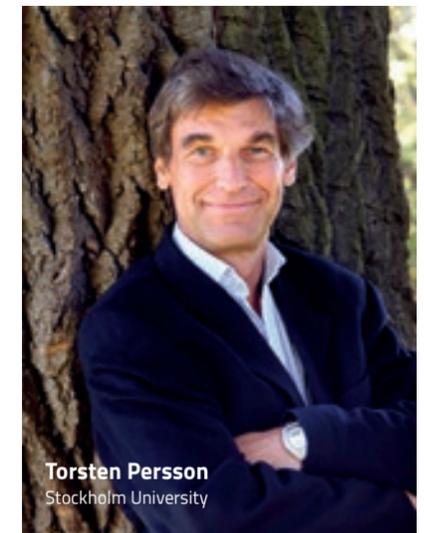
Chinese choices

**T**orsten Persson is a Swedish economist and a specialist in political economy. Professor at the Institute for International Economic Studies in Stockholm, he is a member of the Royal Swedish Academy of Sciences, and a member of TSE's scientific council. His research interests include political systems, electoral cycles, civil war analysis, tax evasion and development clusters. In an interview with TSEconomist – TSE's student magazine – he discusses China's plans to promote innovation and his fondest memories of celebrated mathematician John Nash.

**In 'Forms of Democracy, Policy and Economic Development', you discuss the influence of the form of democracy on growth-promoting structural policies. What differences do you find between countries with a presidential government – like most Latin American countries – and others with a parliamentary government?**

Looking at the size of government, places which have a presidential democracy rather than a parliamentary democracy seem to have spent 5% less of their GDP. Similarly, majoritarian democracies spend on average 5% less than proportional democracies.

**What about growth in autocratic governments? At which point is a system of government detrimental to growth? Some people say autocratic institutions may be conducive to a positive outcome at the first stage of development. Some countries – you mentioned Latin America – are facing a middle-income trap. It is an issue for Chinese leaders, because they plan to transition from being the world's workshop of cheap manufactured goods to a more innovation-oriented economy. Innovators need the legal protection provided by intellectual property rights. Perhaps they also need a different type of finance. Contracts can help investors**



Torsten Persson  
Stockholm University

believe that there are important forces to affirm innovation. China has no truly independent judiciary, because at each level the local government can intervene. So you probably need some political reform as well.

**In your book 'Pillars of Prosperity: The Political Economics of Development Clusters', you state that there must be a correlation of income, absence of conflict and state capacities. Which of those outcomes should developing countries focus on first?**

...

... Taking a broader view on macro development, economists focus on growth of income per capita, which is important for wellbeing. But in developing countries, the state is much weaker: it has difficulty collecting revenues, supporting markets and satisfying demand for public goods such as schooling and health. In many developing countries, there is also no effective system for solving conflicts of interests. The problem is those things are tied together, it is not a monocausal relation where A explains B.

There are various things that can help a country transition from one development cluster to another. After World War II, countries like South Korea, Thailand and Finland were each under threat from a very powerful neighbor. In such cases, the interests of many people align and they invest in security, and to do that you need to pay taxes and reform the tax system. Another driver is the inclusiveness or cohesiveness of political institutions.

**You led the seminar 'Individual vs Social Motives in Identity Choice: Theory and Evidence from China' at the IAST. Could you tell us about the trade-off between material benefits and social status?**

There are many choices we make, where some of our motives are individual or material or intrinsic, and others are social. In China, mixed couples can choose their child to be a minority or to be Han – there are material benefits tied to mixed marriages. There is also a pro-social expectation that the man has his own family name and its ethnic provenance. In our analysis, people trade off those material motives to get some potential benefits: if their child is a minority, they may get higher scores when they go to high school or college; if they marry another minority, they get an exemption of the one-child policy. There is a local connection here with

TSE. The theory behind these projects builds on the work of Jean Tirole and Roland Bénabou. I am expanding that work in a different direction. How do people trade off these individual or social motives? How do they make this choice?

**What is your view of TSE?**

Created by Jean-Jacques Laffont, and strengthened under the stewardship of Jean Tirole, TSE has developed into one of Europe's bastions of economics. It is a great pleasure and a special privilege to chair its scientific council. ■

**A beautiful mind**

*Torsten Persson has met many original thinkers in his work as secretary of the Nobel Prize committee for economics, but one memory stands out. "When John Nash got the Prize in 1994, it was my most rewarding experience while working on the committee. Perhaps you read the book, perhaps you watched the movie: he is someone who dealt with schizophrenia. By the time he arrived in Stockholm he was OK, but still very uncertain how to behave in social situations. During his 10 days in Stockholm, he became more self-confident. By the end, it was easy to pursue a normal conversation."*



**John Forbes Nash, Jr.**  
June 13, 1928 - May 23, 2015

*Avinash Dixit, an economist at Princeton, claimed that when most people get this prize, they get crazy; but Nash got sane. It is so ironic. Mathematicians say that Nash's best work was not on game theory but on partial differential equations. Apparently he was in line to get the Fields Medal in the early 60s, the finest prize for mathematicians. Once schizophrenia struck, they didn't dare give it to him.*

*"My finest memory of Nash's week in Stockholm is from a private dinner. Someone asked how he chose the topic for his PhD thesis [on the Nash Equilibrium] when he arrived in Princeton as a 19-year-old. He said: 'Well, I had two ideas. One was on game theory, so I had a chat with Von Neumann. But he did not like it much. The other idea was on a glitch in the theory of relativity – something about the red-shift – so I had a chat with Einstein. But he did not like it much. In the end, the math of game theory seemed a lot easier, so that's what I chose.'"*

 [tseconomist.com/archives/interview-with-torsten-persson](https://tseconomist.com/archives/interview-with-torsten-persson)

Special issue

# THE DIGITAL AGE

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## Rising to the challenge

The rapid development of digital technology brings new challenges and a fundamental transformation of the everyday life of citizens and organisations, significantly impacting businesses across the world. The need to understand the challenges – and opportunities – of the digital economy is an urgent priority for both the public and private sectors.

Economists in Toulouse have been studying these changes for more than 15 years. This research has been enhanced by our collaboration with private partners. The first IDEI-Microsoft research partnership was signed in 2000, and the first of (so far) nine conferences on the economics of the software and internet industries was held in January 2001. Important theoretical advances in our understanding of new phenomena, such as platforms and multi-sided markets, have been stimulated by the exchange of information and perspectives with our research partners.

To strengthen this fruitful relationship, TSE and the Institute for Advanced Study in Toulouse (IAST) launched the Jean-Jacques Laffont Digital Chair in February last year to promote research on the impact of digital technology in such areas as industrial organisation, competition policy, education, finance, culture and health. This important development has helped to consolidate the research investment of Toulouse economists in this domain. As part of this initiative, the second TSE Digital Forum is taking place this June in Paris. The event will bring together academics, policy-makers and private partners to discuss the big questions that digital technology raises for organisations.

**Jacques Crémer & Paul Seabright**  
TSE-IAST Digital Chair coordinators

JEAN TIROLE ON THE NEW ECONOMY

# Surviving the digital revolution

**H**ow can we build trust in the digital ecosystem or control access to our personal data? Why is information a threat to health insurance? Will intelligent software and robots create mass unemployment? These are just some of the complex issues discussed in 'Economics of the Common Good', a new book by TSE chairman Jean Tirole. To adapt to the digital revolution rather than become its prisoners, he warns, we must anticipate the many challenges ahead.



## Trust

The Internet of Things (smart homes, sensors on watches, smart clothes, Google glasses, etc) will mean we are always online, whether we like it or not. This future is full of hopes and fears. The social acceptability of digitalisation rests on the assurance that the information we provide will not be used against us, that internet platforms respect their contract with us, and that their recommendations are reliable. In short, it is based on trust.



Despite the new opportunities for hackers, we have no say in a company's investment in IT security. Clauses preventing resale of customer data to third parties may also be blurred if, for example, a firm freely transfers this data to subsidiaries. And what happens in case of bankruptcy? As data is a major asset, creditors are eyeing the personal data collected by companies. Another challenge to confidentiality is the complexity of privacy policies. You cannot require users to sift through detailed documents every time they log on.



## Data ownership

In future, added value will mainly be in data processing. Will we control access to our own data? If eBay raises prices or provides a poor service, we do not want to move to another platform without the reputation we have painstakingly built on eBay. It seems natural to distinguish between data that belongs to users of a platform, and the processing of such data, which becomes property of the latter. In practice, the distinction can be unclear.

It is often said that platforms should pay for our data. But because we exchange our data for free ancillary services (such as search engines or online video), or in commercial transactions (in the case of Uber and Airbnb), companies can often claim they have spent money to acquire the data.



## Health

Big data is a great opportunity for health. It will provide more accurate and cheaper diagnoses, strengthening preventative medicine. It may also enable equal access to care. Cheap monitoring

will allow insurers to recommend better lifestyles, and reduce premiums for those who behave responsibly.

The medical profession of tomorrow will be unrecognisable: computer scientists, biotech researchers and neuroscientists will be at the heart of the value chain. As elsewhere, the issue is whether the machine will replace humans.

Technological advances also threaten to create serious health inequalities. Without regulation, those whose genetic tests predict poor health will see insurance costs rocket. Without any access to our medical data, internet platforms can already predict whether we have a medical history, adopt risky behaviour, take drugs or smoke.

## Employment and inequality



A worrying statistic for France is its lack of new businesses on the international stage. To create jobs, we need an entrepreneurial culture and world-class universities, as knowledge, data analysis and creativity become central to the value chain.

Self-employment is on the rise, as new technologies facilitate contact with clients and allow low-cost reputation-building. Digitalisation has also facilitated the division of production into basic tasks and Uber's controversial "surge pricing". Our labor code was designed for factory workers, not part-time students or retirees, freelance journalists or Uber drivers. The dice must not be stacked in anyone's favor.

Digitalisation and robotics breed fears of mass unemployment and inequality. But technological progress destroys jobs and creates others. The real question is:

Will there be enough jobs with decent wages? Those with abstract knowledge, facilitating adaptation to the environment, will adapt best; computers will take over routine tasks.



## Taxation

The intangibility of the internet makes tax avoidance easier. We often no longer know exactly where a business is located. Intellectual property of a book can be established in any country, regardless of the place of consumption. The recent EU agreement allowing the country of the buyer, not the seller, to levy VAT on digital sales, is a step towards eliminating tax competition. But taxation of two-sided platforms like Google is very difficult, as they only charge advertisers, and do not technically sell anything to consumers. ■

**The medical profession of tomorrow will be unrecognisable. Will machines replace humans?**





TSE DIGITAL FORUM

# The future of work

**T**his June, the Jean-Jacques Laffont Digital Chair is bringing together world-class economists, professionals and policy-makers at the TSE Digital Forum in Paris. Under the theme 'Digitalisation and the future of work', TSE faculty Jean Tirole and Augustin Landier will chair debates focused on the impact of recent technological developments on the organization of work, industrial structure and income inequality.

The stellar cast of speakers at Palais Brongniart will include Wouter Dessein (Columbia), Luis Garicano (LSE), Andrei

Hagiu (Harvard), Augustin Landier (TSE), Raffaella Sadun (Harvard), Marshall Van Alstyne (Boston University, MIT)

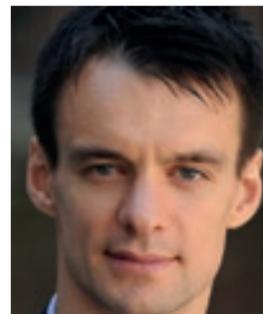
and Jean Tirole (TSE). "The public will be high-level professionals with access to top decision-makers," says TSE organizer Jacques Crémer. "The aim of the Digital Forum is to present results based on the best recent research. We want to convince people that economic thinking has something to bring to the table. We have a great line-up and it should be lots of fun." ■



Wouter Dessein



Luis Garicano



Andrei Hagiu



Augustin Landier



Raffaella Sadun



Jean Tirole



Marshall Van Alstyne

The aim is to present results based on the best recent research. We want to convince people that economic thinking has something to bring to the table.

Jacques Crémer  
Co-organiser of the TSE Digital Forum



## Digitalisation is not business as usual

**M**arshall Van Alstyne is a professor at Boston University and a visiting scholar and research fellow at the MIT Initiative on the Digital Economy. He is a world expert on information economics and his work on two-sided networks is taught in business schools worldwide. Van Alstyne is an adviser to leading executives, a former entrepreneur, and a consultant to startups and Global 100 companies. His presentation at the TSE Digital Forum will focus on how digitalisation is changing the fundamental nature of how firms are organised.

In a recent book, *Platform Revolution*, and series of articles, Van Alstyne and colleagues argue that giant firms like Apple, Alibaba, Facebook and Uber are inevitable. Monopolistic competition in the internet era resembles the monopolistic competition of the industrial era but for the opposite reason. At the turn of the previous century, supply economies of scale allowed firms producing steel, oil, automobiles and rail transport to drive out competition. By increasing volume, they could lower prices, which increased their volume, and lowered prices.

In the current century, firms providing operating systems, search, social networks, and matching markets are also

driving out competition but using the other side of the profit equation. Now firms use demand economies of scale, also called 'network effects'. By increasing volume, firms can increase value, which increases volume, which increases value.

Network effects, however, scale more readily outside the firm than inside the firm. This inverts the functions of the firm, moving value creation from inside to outside. A shift in the source of value drives changes in marketing, human resource management, operations and strategy. Emergence of monopolistic competition also drives changes in regulation and policy. ■



### FORUM THEMES

## Staying ahead of the curve

### Optimal organization

- ▶ How can newcomers build an online marketplace?
- ▶ Centralization vs decentralization
- ▶ Avoiding the pitfalls of multi-sided markets

### Transforming firms

- ▶ How to manage transitions
- ▶ How IT and network effects are changing the way we do business
- ▶ Where will we find the jobs of the future?

### Communication revolution

- ▶ What are the consequences for economic growth, inequality and productivity?
- ▶ Attention allocation and its effect on organizational performance

THE JEAN-JACQUES LAFFONT  
**DIGITAL CHAIR**  
[www.tse-fr.eu/digital-forum](http://www.tse-fr.eu/digital-forum)

# All about platforms



## ISECO PROJECT

# Unlocking e-commerce platforms

**B**runo Jullien recently joined an impressive array of TSE research projects that have won vital funding from the European Research Council. The ERC's advanced grants aim to encourage exceptional research leaders to pursue ground-breaking, high-risk projects that open new directions. As leading thinker on the economics of two-sided markets, Jullien is a worthy recipient of the grant.

His project aims to develop knowledge of the economics of information services by studying the strategic interactions involved in the production and exchange of information. Jullien became interested in information technologies in the late 1990s when working on bypass in telecommunications. Digitalisation has since triggered a massive increase in communications and huge changes in the organization of trade. The consequences have been felt at multiple levels: societal, political, cultural and economic.

Under the title 'Information Services: Competition and Externalities (ISECO)', Jullien's project is organised in four parts:

**1. Development of relevant theory**  
Focusing on two-sided markets\*, network dynamics and contractual externalities\*

**2. Virtual content**  
Studying specific issues such as search engines and other recommendations systems, privacy and online transaction costs

**3. Physical infrastructure**  
Net neutrality - the principle that internet service providers must treat all content equally - and data use will be examined using price theory, accounting for free services

**4. Competition policy**  
Providing decision tools for policy-makers

Jullien plans to build on his pioneering work on two-sided markets\*, which is now a leading paradigm for the analysis of many information services. Much less is known on non-price dimensions such as quality, consumers' information, consumers' heterogeneity, the coordination process between the two sides, the role of exclusivity and design. He will investigate these issues using state-of-the-art techniques such as global games.

Building the digital society will require massive investment in infrastructure, and a crucial factor will be how value is shared between consumers, content producers and infrastructure. Jullien plans to use original dynamic models to analyze the interplay of digital investment and innovation.

### \*Basics

**Externality:** When the action of one party directly influences another, without the latter having a link to the original action. For example: research and development, air pollution.

**Two-sided market:** A platform that ties two distinct groups of users into a network of benefits. The platform incurs costs and can collect revenue from both sides. For example: credit cards, search engines, social media websites.



## TAXING PROBLEMS

# How to make platforms pay

**S**ome digital firms have invented very successful business models, generating immense profits in the process. Yet they often pay very little tax. The challenge for economics is to help tax authorities to respond fairly and efficiently.

TSE researcher Jacques Crémer is a guest editor of the upcoming special issue of the Journal of Public Economic Theory (JPET) on taxation and regulation in the digital economy. Among other things, the issue studies how the tax bill of major internet platforms is often reduced because of the difficulty in locating their activities to specific geographical jurisdictions and because major elements of the revenue-generating chain, such as the use of personal data uploaded by users, do not result in financial transactions.

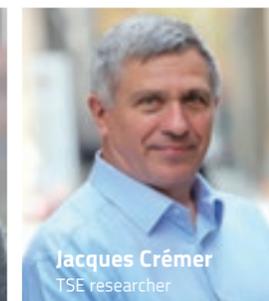
Together with the issue's co-authors, Crémer says tax authorities must adapt to four important features of the digital economy:

1. A blurring of geographical frontiers
2. Large network effects which give monopoly power to platforms because of coordination issues
3. Multi-sided markets, where platforms are used to connect different actors whose pricing strategies are interdependent
4. The collection of user data

For Crémer, the issue is whether the emergence of the digital economy calls for new taxes, for the adaptation of former tax systems, or for fundamental reform of the international framework for corporate taxation. Toulouse economists have already contributed a great deal to our understanding of the new strategies at work but more theoretical and empirical work is needed. In particular, the design of new policies requires a more detailed analysis of the quantitative effects of taxation and of the likely reaction of digital firms to tax changes, as well as a better theory of corporate taxation.



**Bruno Jullien**  
TSE-CNRS researcher



**Jacques Crémer**  
TSE researcher

[www.tse-fr.eu/iseco](http://www.tse-fr.eu/iseco) [www.tse-fr.eu/people/jacques-crermer](http://www.tse-fr.eu/people/jacques-crermer)

# Blockchain: what's it worth?

**B**lockchain, an ingenious distributed ledger technology that supports bitcoin and other digital currencies, has captured the imagination of bankers, economists, consumers and even criminals.

With little consensus about the potential impact of the blockchain for good or ill, it's clear that the subject requires serious analysis. Enter five TSE members – Bruno Biais, Christophe Bisière, Fany Declerck, Bertrand Gobillard and Alexander Guembel – who have set up a working group on the blockchain. The group aims to explain the impact of this technology on financial intermediation (payment systems). Does it promote entry and competition? Does it increase risk? The group is currently in the preliminary stages of studying how the systems work.



## Watch and learn

Susan Athey is member of the Toulouse Network for Information Technology and set to receive the 2016 Jean-Jacques Laffont Prize. In this video she explains how bitcoins work and how they might change the way we pay:

[www.youtube.com/watch?v=JhdM4\\_iRHye](https://www.youtube.com/watch?v=JhdM4_iRHye)

SEARCH ENGINE BIAS

# Digital firms must improve transparency

**A**lexandre de Cornière joined TSE in September as assistant professor after three years as a postdoctoral researcher at Oxford. With papers on search engine bias and online advertising accepted for publication in prestigious journals, he lends a cutting edge to the work of the Digital Chair.

Google has recently been hit with antitrust charges by the EU. What are some of the key concerns about the role of search engines as gatekeepers to the web?

In the search engine market, Google is accused of biasing its results towards affiliate websites (Google Shopping, Maps). In the mobile operating system market, some complain that Google forces Android phone manufacturers to pre-install Google apps. The two cases have a similar logic: Google allegedly uses its dominance in one market to acquire or strengthen its dominance in other markets by making it difficult for consumers to use rival services.

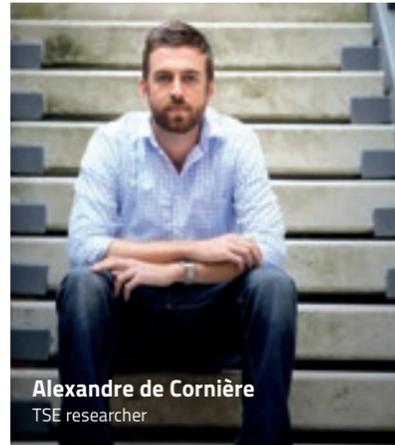
These concerns are related to certain practices by financial intermediaries or price-comparison websites. With Greg Taylor, we study markets with biased intermediaries to provide guidance as to

whether intervention is required, and, if so, which type of policy – such as regulation or antitrust – is more likely to work.

**Should internet platforms be allowed to share personal data about their users?**

The use of personal data, along with improvements in targeting technologies, has helped bring many new products to the market. However, some consumers are legitimately concerned about how their data is used.

The priority should not be to determine which type of data can be shared: some consumers are willing to share data to get free services, and over-regulation would hurt them. But we must increase transparency by educating consumers and having firms disclose straightforward privacy policies. This would allow competition to operate at the privacy level.



Alexandre de Cornière  
TSE researcher

**How has the Digital Chair helped you to develop your research?**

TSE is a great place for any industrial economist. The Chair was a big selling point to me. It allows me to meet many researchers from outside institutions working on related issues, as well as practitioners whose knowledge and questions can trigger interesting research projects.

**We must increase transparency by educating consumers and having firms disclose straightforward privacy policies.**

[www.tse-fr.eu/people/alexandre-corniere-de](http://www.tse-fr.eu/people/alexandre-corniere-de)

GEEKONOMICS

# What drives online behaviour?

**L**ei Xu is a talented PhD candidate at McGill University whose arrival at TSE will energize the Digital Chair's research team.

**What attracted you to Toulouse?**

I chose TSE because of its world-renowned researchers. With close ties to industry and government agencies, it is also a place where research can effectively contribute to the common good. I am also deeply attracted by the French culture.

**Why are you interested in digitalisation?**

The digital economy has changed everyday life profoundly. To researchers, it brings both challenges and opportunities: new economic models are needed to explain many new phenomena; the availability of data helps us to study a wider range of questions. I have written a paper titled 'What Makes Geeks Tick?', which establishes a causal effect of career incentives on people's online behaviour. My future projects include online communities,

online labor market, organization of information, open-source software, as well as the airline and telecommunications industries.

**What digital development are you most excited about?**

Self-driving cars can make commuting a more pleasant experience. However, many full-time drivers would suffer from structural unemployment.

[leixu.org/CCSOC](http://leixu.org/CCSOC)



DIGITAL CHAIR SPECIAL REPORT

# A bridge over disrupted markets

**T**he Jean-Jacques Laffont Digital Chair, launched last year by TSE chairman Jean Tirole and French Minister for Culture and Communication Fleur Pellerin, brings together academics, policy-makers and private partners to discuss digital technologies and their consequences for society. To help this vital work reach a wider audience, the Chair has recruited a distinguished economist to produce a special report on the impact of internet platforms such as Google, Facebook and Amazon.

Professor of economics at the University of Manchester, Diane Coyle was formerly economics editor of The Independent, vice-chair of the BBC Trust and a member of the UK Competition Commission. She wants to help TSE build a "virtuous circle" between the worlds of media, policy and academic research. "The caliber of the research here is fantastic and Jean Tirole's Nobel Prize has attracted people from all over the world. There's a lot of interest in digital economics but the academics are scattered in many places. So having a forum to bring all this together is an amazing opportunity."

From accommodation to taxis, markets face increasing disruption with the spread of innovative digital business models. In her report, to be published this summer, Coyle hopes to inform the responses of all sectors of society. "Internet platforms represent a

very new and distinctive area of competition," she says. "Economists have a very powerful set of tools for systematically analysing these changes. We want to explain what we know already, such as how two-sided market models apply. We also want to set out what we don't know. What should researchers be looking at? How can they address the questions that are coming further down the track?"

Coyle hopes to provide insights tailored to the concerns of people in business, as well as policy-makers. "We should aim to explain what researchers are discovering. Which platforms work and which don't? If you see somebody coming into your market, or if you want to enter a market, what can we tell you about the design, reputation and feedback mechanisms? What have economists learnt that will inform business



Diane Coyle  
University of Manchester

strategy? What can we say systematically about how competition is working, because, say, Google is so dominant in search or because there are new food start-ups all the time?"

Access to data will be a key issue in Coyle's report. "A dominant platform might have very large consumer benefits. Does that make it OK for, say, Facebook to be dominant in social media? Can we rely on the fact that often the disruptor gets disrupted 10-15 years later? Often we don't have the data to address these questions. So one of my recommendations will be that we need to get that data. Possibly it's about the legal framework, the terms of access, because non-digital companies often have a legal requirement to give data to the statistical authorities. With web-based businesses, it's not as obvious."

**There's a lot of interest in digital economics but the academics are scattered in many places. So having a forum to bring all this together is an amazing opportunity.**





COLLECTIVE INTELLIGENCE

# Big data is watching you

**R**esearchers today can analyze staggering amounts of information quickly and cheaply, often capturing behaviour as it happens. In April, TSE hosted a unique interchange between economists, behavioural biologists, social and computer scientists, mathematicians and physicists at a two-day conference on 'Collective Behaviour in the Big Data Era'. Here, we present excerpts from their wide-ranging debate on the unprecedented risks and possibilities of the information age.

## Is privacy dead?

**Matthieu Roy**  
*(computer science, CNRS, Toulouse)*

We want to share real time data from a research project cross-tracking cyclists' movements and pollution indicators, in an open source spirit. But how can we ensure private information can't be traced back to the user? We know that it is difficult to ensure mobile phone data remains anonymous, but we want to avoid malicious use.

**Javier Borge-Holthoefer**  
*(computational social science, IN3, Barcelona)*

Imagine I'm in a car with my lover and that is exposed without my permission. In cities, you are 'sensed' in many ways, even if you are not consciously active on your phone. I was living in Doha and traffic monitoring systems track Bluetooth devices to count passing cars. It means I can trace people's trajectory and say this guy lives here, works there.

**Suzy Moat**  
*(computer science, Warwick)*

As well as negative outcomes, it's important to consider opportunity cost. That's not just what research we can't do but also what decisions can't be improved.

**Diane Coyle**  
*(economics, Manchester)*

Big data analysis may be a fantastic opportunity to deliver services more

effectively to troubled families. But does the 'I come from a troubled family' badge then stick to children in their data for the rest of their lives? In terms of regulation, tech companies like Twitter could be required to have a box of terms and conditions on the screen. Or be told, 'You can collect data, use it to sell ads, but you have to delete it after three months'

**Bruno Gonçalves**  
*(physics, New York)*

Nobody reads those messages, they just look for the 'I accept' button. And what does it mean to delete information? Companies like Facebook, Google and Twitter cannot promise they have deleted information. Because they don't know. Everything lives in the cloud,

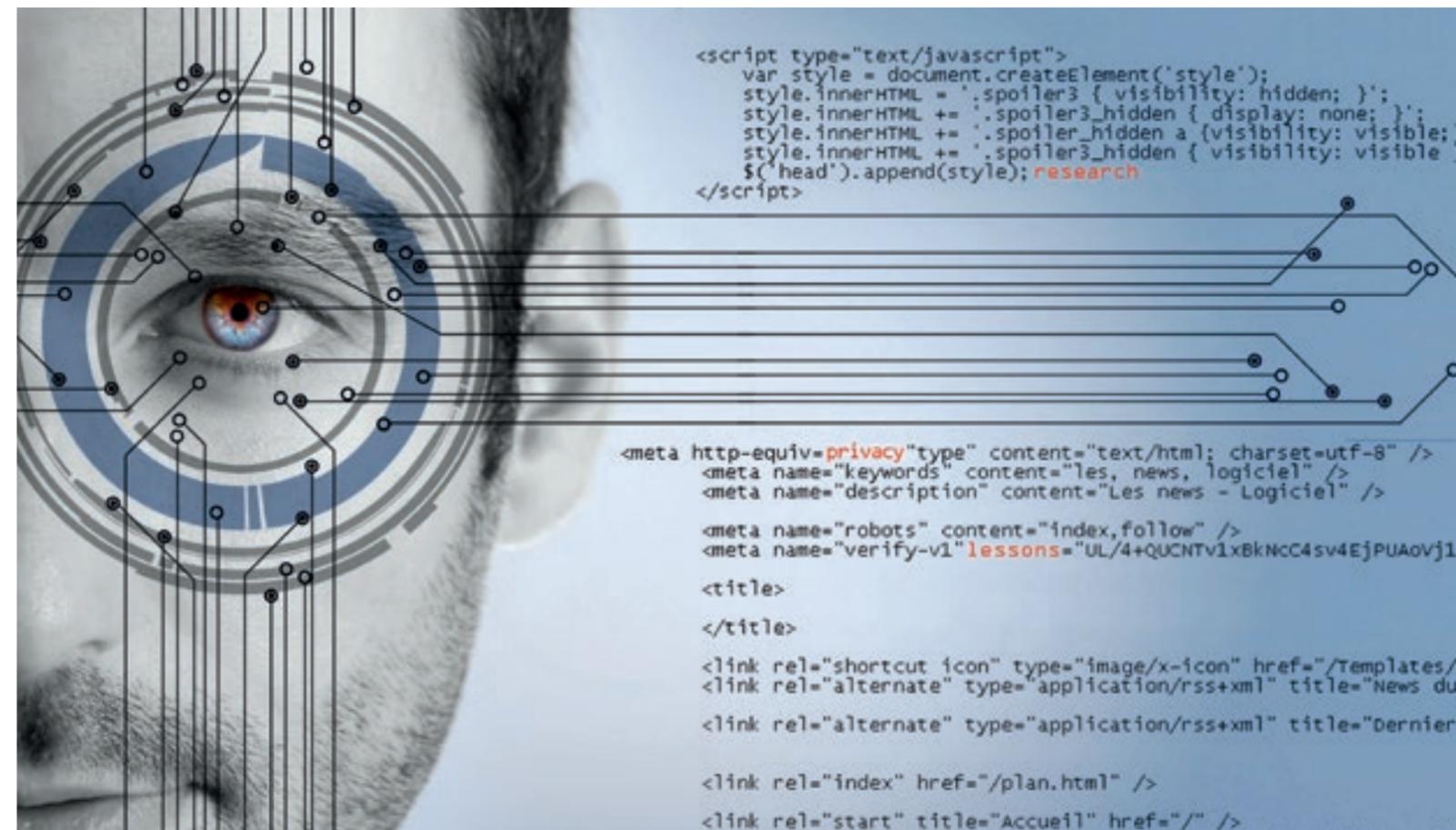
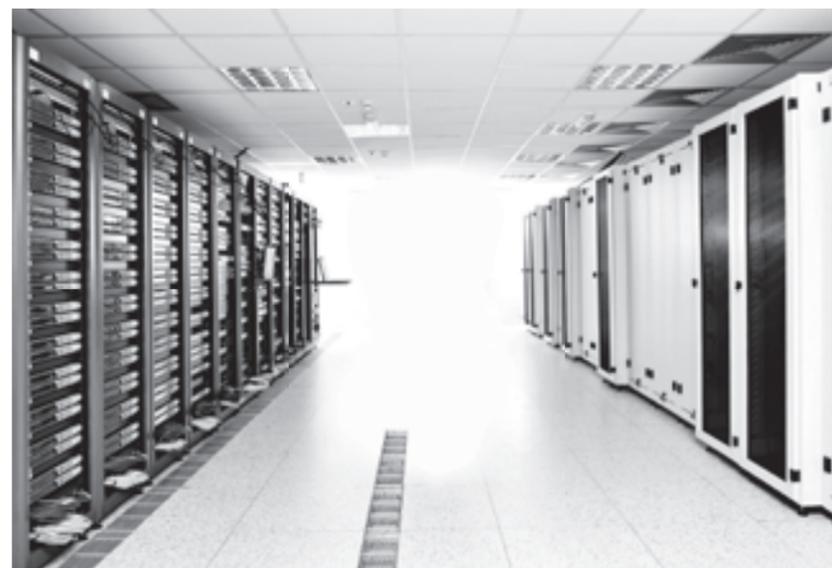
servers come and go, hard drives die. As soon as the information exists, it will be used, and in ways that we can't predict. Instead of killing this data, we're going to realize that privacy, as we imagined it 50 years ago, no longer exists.

**Paul Seabright**  
*(economics, TSE)*

Slavery was one of the consequences of moving from hunter-gathering to agriculture but it didn't become universal. In a digital context, somebody's going to have power over you if you are online. But it doesn't follow that every social arrangement will produce the same degree of digital slavery.

**Francis Heylighen**  
*(cybernetics, VUB, Brussels)*

Data is power, but a gun is also power. There are guns in the world but most of the time they are not used. Criminals who do use them are often punished. We need to define what abuse of data is, then make laws to prevent it.



## Does big data mean better research?

**Derek Ruths**  
*(computer science, McGill, Montreal)*

Online data can provide answers easily and cheaply, but often at the expense of accuracy. We use machine-learning techniques and algorithmic approaches, and it's important to be aware where these can break down. Most social media content is complete gibberish. It's very unstructured and noisy.

**Paul Seabright**  
*(economics, TSE)*

Big data sets remove one constraint and make us more conscious of others. The

constraint used to be either the height or the width of the data. Now, it's the time and scarce attention of researchers, and the gullibility of the public and policy-makers. When you can generate hundreds of correlations by pressing a button, it's tempting not to bother with trying to understand causality.

**Suzy Moat**  
*(computer science, Warwick)*

Big data does not mean all data, there are clearly people missing. In some cases, you can calibrate, but what's exciting is that these new data sources complement traditional sources. It's an extra weapon to understand behaviour.

**Marc Barthelemy**  
*(physics, CEA, Paris)*

I'm interested in good data, not big data.

I don't care about fishing for correlations. I want to understand the parameters, and give scientific advice to policy planners based on data and modelling. With data mining, we wouldn't have the theory of relativity. It's important to believe in the power of gray cells to extract meaningful information and understand the hierarchy of mechanisms.

**Diane Coyle**  
*(economics, Manchester)*

My concern is about sampling and other issues: the data is private, it's owned by the large companies, we don't know what the data generation process is, if it's stable, when it changes, or even whether it's socially influenced.



...

**Lessons for economics**

**Marc Barthelemy**  
(physics, CEA, Paris)

Economics is still in its infancy, the pre-Copernican period, but now we can really push the models and test with data. It's this loop between theory and empirical observation that produces robust models and stronger predictions. Economics needs its scientific revolution, moving far beyond linear regression.

**Diane Coyle**  
(economics, Manchester)

Too many economists don't take data seriously, particularly in macroeconomics.

But there are lots of applied microeconomists working in health, education and social policy who have been doing careful, structured analysis on very large datasets, with solid inference techniques.

**Suzy Moat**  
(computer science, Warwick)

For many years, people were trained to work out a theory before collecting data. Starting from the questions is arguably not the best approach anymore, because the data's already there. Many people in science, business and policy get fixated on a question which can't be answered with available data. But if you looked slightly to the side, there's often a very valuable question that you could answer.



**Rencontres R in Toulouse**

Following the success of previous Rencontres R, the fifth meeting will take place at TSE from June 22 to 24. The purpose of these meetings is to provide a national forum for interaction and sharing ideas on the use of R software in various disciplines (such as visualisation, applied statistics, bioinformatics and biostatistics, Bayesian statistics, data analysis, modeling, machine learning and high performance computing).

A series of tutorials on specific or advanced aspects of R will be offered to participants on Wednesday, June 22.

These meetings are intended for all types of R users: researchers, teachers, students, professionals, etc. They are open to statisticians, computer scientists and all areas of application. Novices and experts are equally welcome.

The official language is French but presentations can be made in English.

[r2016-toulouse.sciencesconf.org](http://r2016-toulouse.sciencesconf.org)

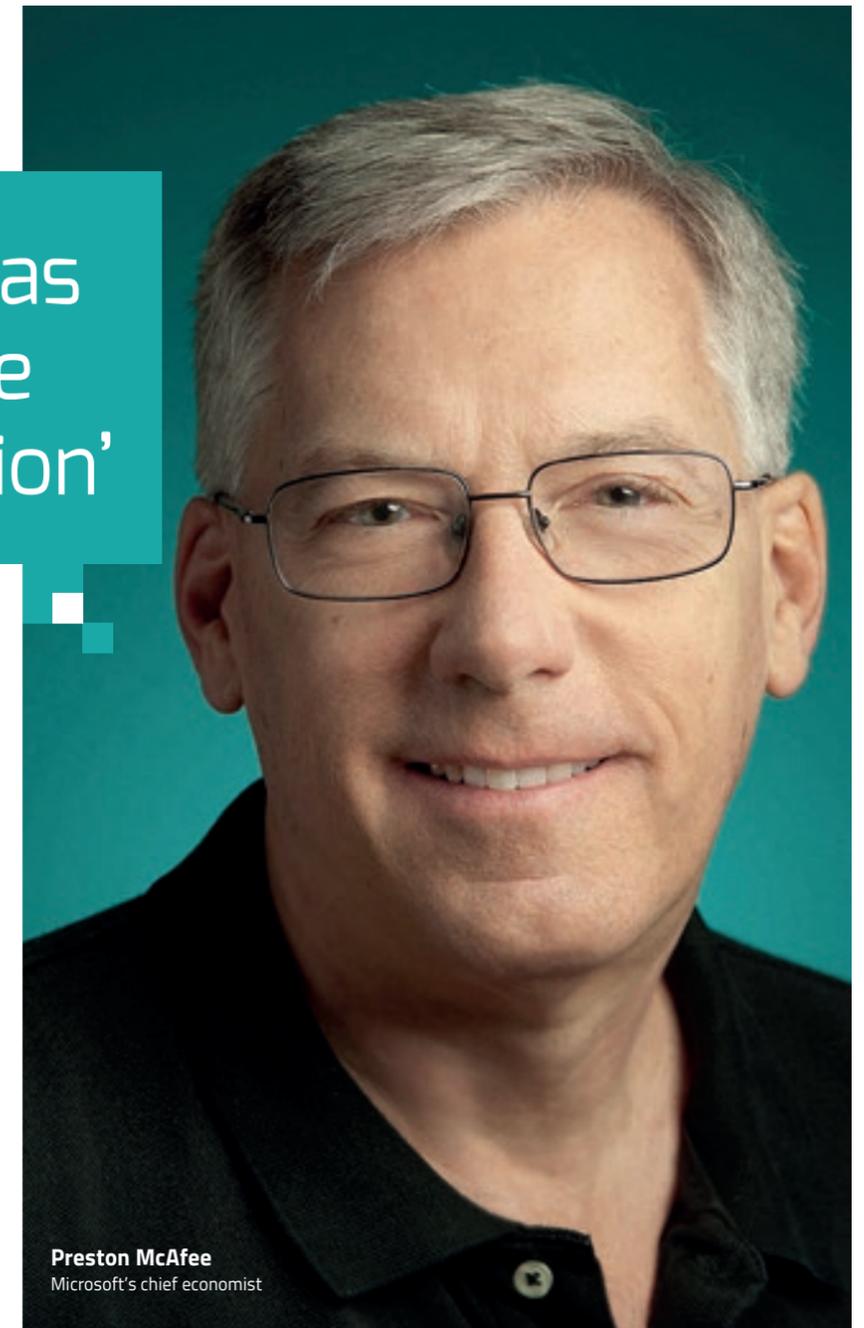
**EXCLUSIVE: MICROSOFT'S CHIEF ECONOMIST TALKS TO TSE MAG**

'France has a culture of innovation'

Since leaving his professorship at Caltech, Preston McAfee has held senior roles at Yahoo and Google, before joining Microsoft as chief economist in 2014. In this exclusive interview with TSE Mag, he offers the keys to the digital future, from unexplored technological frontiers and accelerating business efficiency to lifetime learning strategies and the groundbreaking economic methods.

**How did you end up at Microsoft?**  
To quote the Grateful Dead, "What a long, strange trip it's been." The short answer is that I've followed my interests in mathematics, especially in the theory of algorithms, in mathematical economics, in applied economics, especially on making governments and businesses more efficient by harnessing market forces. This led naturally to auctions and, through three or four more steps, to being chief economist of Yahoo, which in turn led naturally to Microsoft via a brief detour to Google.

**What is the role of economics in business decision-making at Microsoft?**  
One of the biggest advantages of economics training and analysis is that economists have lots in common with marketing, including language like net present value



**Preston McAfee**  
Microsoft's chief economist

and return on investment; and lots in common with engineering, such as techniques and a culture of optimization. As a result, my team engages frequently in work on pricing, collaborating with both marketing and engineering.

This engagement can work either after the fact – estimating demand models to guide pricing – or at the product design

stage, where we help understand the value in market segmentation created by multiple product versions. Our approach of using data to support decisions, with only a modest use of theory, is very well received within Microsoft. We also contribute to business models for new types of engagements, especially between Microsoft Research (MSR) and customers.

**Dream team**

Advances in digital tracking and other technologies are encouraging economics and other social and behavioral sciences to become 'big-data sciences', says TSE researcher Adrien Blanchet, who organised the conference in partnership with CNRS researchers Matthieu Roy, Clément Sire and Guy Théraulaz. "We set up the event to promote cross-disciplinary interactions between world-class researchers from various communities: quantitative ethology, social sciences, economics, information technologies and statistical physics," says Blanchet.

"Our hope was that this approach would provide important insights into some of the big questions confronted by modern research into collective behaviour. We want to understand how interactions between individuals can be modified to improve coordination or collaboration at a group level. There are so many exciting avenues of research. Computational analysis of digital traces may allow us to build predictive models of decision-making. We hope that quantitative analysis of behaviour will be able to reveal the information required to coordinate individuals' actions in a group or to help them to make efficient decisions."



Adrien Blanchet Matthieu Roy Clément Sire Guy Théraulaz

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**How can France and other countries foster a culture of innovation to rival that of the US high-technology sector?**

First, France has a culture of innovation, especially visible in the Millau Viaduct. France produces fantastic mathematicians, scientists and engineers, and has a well-educated, capable workforce. Second, there is a tendency to look at Silicon Valley with envy, not just in Europe but around the world. Success, I think, comes not from copying Silicon Valley but finding the technological frontier that doesn't have an epicenter. In this period of great technological flux, there are many candidates – drones, design of new materials, 3D printing, silicon photonics, cyber security, micro-satellites, industrial automation, nano-machines, genomics, and solar, wind or tidal energy. Any of these technological developments are large enough to spawn a substantial technology ecosystem and none currently has an epicenter. Finally, the key to US innovation is the willingness to fail. Making it easy to try and fail – fail fast – is necessary.

**How will Microsoft and its competitors shape the future? What are some of the opportunities and dangers of the digital economy?**

There are huge opportunities. Cheap sensors – the Internet of Things – mean that much of the physical world can be tracked and monitored. Machine learning on top of that data means the efficiency of processes, even very

**Microsoft is in the midst of a massive transition from shrink wrapped software to online services.**



1 / The new Microsoft Flagship Store at Westfield Sydney, 2015.  
 2 / At the Microsoft Flagship Store in New York before the launch of "Halo 5".  
 3 / The Microsoft Flagship Store on Fifth Ave and 53rd St in New York, 2015.  
 4 / E2 presentations for educators.

complex processes like supply chains, can be improved, with both falling costs and increased resilience. Businesses currently have very little insight into their human resources, but that is about to change, as the digitization of employee behaviour, both communications and physical actions, permit a great improvement in management visibility into the workforce. We are not far from a day when machines can help remove blockages, bring together employees who need to coordinate, reduce duplicated efforts, identify and provide relevant resources, and even choose team-members to improve efficiency, and reduce time-to-market. On the dangers, we need to be careful to respect privacy, and use the new insight to empower employees, and help them to grow.

**How do we get the balance right in this new gold rush? Who are the losers? And what can public and private actors do to help them?**

For the past 10,000 years, there has been an increasing favoritism of brains over brawn, of intellectual strength over physical strength. I don't see the next decades as anything but more of the same in this trend. Moreover, the acceleration in the pace of technologies means that, where my parents could expect to hold one job for an entire career, workers will have to be substantially retrained, to learn new tools, perhaps every five to 10 years. The winners are people who can and are able to adopt a lifetime learning strategy. Government and companies will need to invest in frequent retraining and encouraging skill acquisition, as most major corporations already do.



**How do economists need to adapt to the digital revolution? What can we do to prepare the economists of the future?**

The digital revolution has enabled three important new methods for economists. The first is big data. The flow of data is staggering and regressions are run with more than a billion right-hand-side variables and a trillion observations. Standard techniques break down – the variance-covariance matrix has  $10^{18}$  elements and is not invertible. Moreover, these data are often non-quantitative: text, audio, images, video. The richness of the data is striking as we can now measure economic activity at a very micro level. I have heard of analysts setting up cameras to track trucks leaving a firm to estimate output. New statistical methods are needed.

Second, problems of image recognition, voice to text, language translation and video extraction have fallen to a new machine-learning technology of deep neural nets. This technology, unlike earlier machine-learning approaches, appears to solve a variety of problems that were considered intractable previously,

especially where inputs are not numbers but images, unstructured text or audio. These techniques open new approaches to economic modeling, ones which will resist our standard "comparative statics" approach.

Finally, as so much of the real economy moves online, a whole new approach to economic analysis becomes available, one pioneered by John List and David Reiley: the field experiment. It becomes possible to intervene in markets in a much less removed way, actually testing theories in the economy itself.

**How do you and your team interact with TSE faculty?**

I'm old friends with several TSE faculty. Most of our non-social interaction comes in the form of consumption of their published work. TSE is one of the very top economics faculty and is incredibly strong

in the areas of mechanism and market design. As much of my work at Microsoft is guided by market design research, my team are frequent consumers of this work.

**What is the most exciting thing about working at Microsoft?**

Microsoft is in the midst of a massive transition from shrink-wrapped software to online services. This transformation requires not only a change in products, but changes in update cycles (days instead of years), testing methods, product development, pricing and organization. As a result, there is an explosion of new ideas and products. It is an incredibly exciting time to be at Microsoft. In the past two months alone, I've consulted extensively with the Royal Court of Saudi Arabia, a fashion company, and the Panama Canal Authority, and in all cases helping them by adding good economics to engineering and data issues. It is fascinating. ■

**French connection**

*For more than a decade, TSE researchers and Microsoft have been working together in an extremely productive collaboration. The Toulouse Network for Information Technology (TNIT) was created in 2005 to stimulate high-quality economic research on the software industry, the development and role of the internet, and intellectual property. The network is funded by Microsoft, and managed by the Institute of Industrial Economics (IDEI), a partnership-oriented research centre that draws on the skills of TSE researchers to work alongside businesses and the public sector on economic questions and to accompany them in strategic decisions.*

*TNIT aims to engage some of the best economists in the world in the issues generated by digitalisation. The resulting body of*

*work already spans a huge variety of topics, and has helped further our understanding of these critically important markets.*

*Members commit themselves to active research in the network's interest, and to discuss each other's research and engage in dialogue with high-level practitioners at a yearly meeting. To meet TNIT's expectation of world-class research, members enjoy complete academic independence in their work.*



Jacques Crémer, TNIT scientific coordinator



TSE DIGITAL COURSES

# Cutting big data down to size

**A**t the heart of the digital revolution, big data is transforming research, business opportunities and our daily lives. To give students a flying start in this ever-changing environment, TSE researchers Anne Ruiz-Gazen and Sébastien Gadat teach cutting-edge courses that draw on the skills of TSE's innovative team of statisticians and computer scientists. In particular, their masters programme offers 30 hours of big data classes, as well as the chance to become proficient in machine learning, database management, web mining and statistical languages.

**What exactly is big data?**

**Sébastien Gadat (SG):** Big data is the science of data, at the crossroads of computing, statistics, optimization and modelling. What is really new is using those different fields together. To describe big data, we often refer to the three "V"s: variety, volume and velocity. Variety stands for the analysis of many types of information, usually with complex structures (graphs, temporal series, 3D pictures, social networks, etc) which are saved in non-standard ways (unsynchronized or in blocks). Volume refers to the gigantic quantity of data analysed. Velocity is perhaps the most crucial element given the need to process data almost instantly. Firms need algorithms which can answer complex questions in a split second.

**What are the fields of application?**

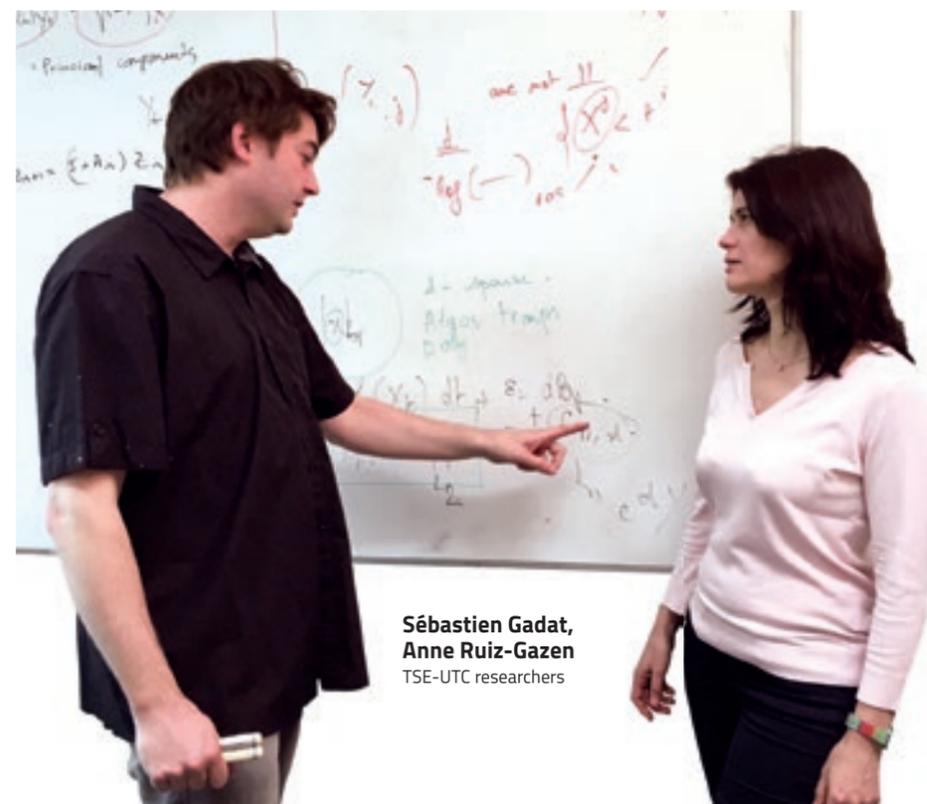
**Anne Ruiz-Gazen (ARG):** There are multiple applications for firms and researchers. Companies such as Waze, which relies on the real-time positions of their users to better evaluate road

traffic, or BlaBlaCar, which depends on a community and the sharing economy, are good examples. Marketing departments are also using big data to make use of information they gather from their customers; the recommendations system of Netflix is one example among many. In medical research, biologists are now able to work with data volumes they couldn't process before. Finance is another field of application, particularly high-frequency trading.

**SG:** Sometimes the value of applications is less clear. Surveillance and analysis of information sharing on social networks is still not understood, for example, and Google Flu Trends has failed in the past, significantly overestimating the real number of sick people.

**What is the expertise of TSE researchers on the subject?**

**ARG:** We have a team of 10 statisticians working on complex data who are very useful when it comes to big data. Sébastien joined us two years ago, bringing his expertise at the crossroads of statistical learning and optimization. Statistical learning (or machine learning) allows algorithms to become smarter by comparing their predictions to real results. Our courses also draw on the skills of researchers



Sébastien Gadat, Anne Ruiz-Gazen  
TSE-UTC researchers

To describe big data, we often refer to the three "V"s: variety, volume and velocity.



SOCIAL MEDIA



CLOUD COMPUTING



SEARCH OPTIMIZATION



TECHNICAL SERVICE



DATA ANALYSIS



WEB OPTIMIZATION

in computer science, more precisely in database management, web mining and statistical languages.

**How long has big data been taught at TSE?**

**ARG:** Two years ago, when Sébastien joined us, 30 hours of big data classes were integrated into the Statistics and Econometrics master.

**What is unique about TSE's approach to big data?**

**SG:** We focus our teaching on the understanding of theoretical tools, in order to master basic statistical and mathematical methods, and on the direct management of databases on computers. Our programme also emphasizes project-based learning through group work. Our students participate in data science challenges every year in Toulouse and across France, competing with other schools to find the best and fastest way to develop a

prediction method on a given database. Together with other Toulouse universities, TSE is also participating in annual "big data days" in Toulouse. The last two meetings were held at University Paul Sabatier but this year's event will take place at TSE.

**ARG:** We always try to implement a progression system in our programmes from the first year to the masters. So students in the first and second year are taught the basic ways to crunch data on one or two variables before, in their third year, being introduced to statistical methods for more variables. More complex structures are presented in the masters.

**What are the key issues for companies and why is it important to master big data skills?**

**SG:** The main challenge is to innovate in the way we use and analyze data in order to propose new services. Recent successful start-ups ask themselves

three important questions: What data is available? What new and interesting problem can we solve? What innovative technology can we use?

**ARG:** Because big data is very important for companies, it isn't surprising to see the number of internships and jobs related to these issues going through the roof. It's an exceptional opportunity for our students to master these new skills and boost their career plans. It should also be noted that recruitment methods are evolving fast and companies filter job candidates using statistical learning projects. Our teaching, directly related to these methods, is an ideal preparation for our students.

The number of big-data related internships and jobs is going through the roof.



HOW SHOULD WE GRADE UNIVERSITIES?

# The trouble with rankings

**N**umerous university rankings are now produced by the specialist press or academic institutions. Shanghai, Times Higher Education, QS, the FT, RePeC... these and other grading systems provide information for future students and their parents, higher education institutions, academic staff and public authorities. But Stéphane Gregoir, TSE's Dean, warns that rankings can be misleading, due to the nature of the data and the methods chosen to compile it.

Over the past few decades, globalisation has increased mobility, particularly among students. But it is difficult for students to compare the pros and cons of different universities, due to the variety of ways in which they are organised and

financed. The cost of compiling information and the multiplicity of factors make the choice of a particular institution very difficult. In Europe, efforts have been made to harmonise degrees so that students will find it easier to compare them and to move between different academic programmes. However, more needs to be done. National or international accreditation bodies produce detailed reports, but these are often difficult to understand.

University rankings may be easy to read, but they are not always easy to interpret. Rankings are presented in a

way that suggests scientific accuracy, but they are far from robust statistical practice. It would seem more reasonable to group similar institutions. Higher education institutions are involved in a wide range of activities: from education at various levels of qualification and in a variety of disciplines, to academic or applied research, through library services, and career advice or support. Not all of these dimensions are necessarily covered by a single institution; they are not homogeneous and comparable. The production of a unidimensional ranking can only be the result of subjective choices as to the importance of these different dimensions. Some criteria therefore have greater impact than others on the rankings.

In these conditions, differences occur in rankings, reflecting choices which have not been made explicit. The rankings do not necessarily respond to the needs of

their readers, whose priorities or interests may be different. They thus can be misleading. Some of them, for example, adopt a general approach to economic efficiency without taking into account the economic principles that might be relevant to higher education institutions, such as club theory and the local public good. Using fragile approximations, some others offer retrospective analyses from an economic perspective in terms of return on investment in training. In this

**University rankings tend to be retrospective, short-termist and self-fulfilling**

case, they might not take into account the relevance of course content to anticipated developments in market requirements for a given country, wages not earned during training or the impact of social security on pay. Data might be omitted because it is difficult to source or because of the complexity of the corrections required. Other rankings estimate the scientific quality of teaching staff using measurements taken from a backward-looking, cumulative process.



While they have encouraged some institutions to invest in neglected fields, university rankings are retrospective and short-termist. They tend to be self-fulfilling, reinforcing the reputational dimension on which they tend to rest. Certain rankings collect opinions on the reputation of institutions. These opinions, taken from professionally qualified persons, can themselves be influenced by previous rankings (Bowman and Bastedo, 2009; Bastedo and Bowman 2010). It would be prudent to only give credence to rankings that are clear about their underlying assumptions, when these are deemed to be relevant. It would also be advisable to not just refer to one ranking, but to combine several for a multi-faceted assessment.

Given the complex reality of higher education, it is important for a young institution with an original project, such as TSE, to disregard rankings when making strategic choices or investments. A ranking should be the result of a strategy based on convictions, values and a concern for the interests of graduates – not vice versa. It is important to try to understand and explain our ranking to the people interested in our project, in relation to the objectives of the institution. This is not always possible, and remains costly. Above all, joining a higher education institution must be an outstanding intellectual experience, enriching our lives through the people, learning and values we encounter. ■



Stéphane Gregoir  
Dean of TSE

**A ranking should be the result of convictions, values and a concern for graduates - not vice versa.**

## WILL INTELLIGENT SOFTWARE AND ROBOTS CREATE MASS UNEMPLOYMENT?



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### RECENT POLL RESULTS FROM TSE DEBATE:

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of our readers think the fall of oil prices a good news for the global economy

**52%**

of our readers had anticipated the COP21 agreement

**71%**

of our readers don't see "uberisation" as an economic threat