TSE Digital Center

Toulouse
School of
Economics

Impact

2021

Annual digest of our
research and activities
in digital economics

Economics for the Common Good

Editorial

2021 was the third anniversary since the inauguration of the TSE Digital Center. This has been an exciting year, offering a whole range of subjects to work on, such as platform competition and liability, algorithmic collusion, or mobile payments and interoperability, to name just a few. This has also been a challenging year, with a pandemic, after a short period of relief, still disrupting our normal operations. The Center has continued to adapt its organization, relying more on digital infrastructure to favor online meetings and conferences.

There is little doubt that 2022 will show that research in digital economics is more relevant than ever. Digital platforms are still growing in all forms and varieties, from e-commerce sites to app stores, or business data-sharing platforms, raising many fascinating questions about competition, innovation, intellectual property, or privacy. FinTech, including mobile payment, smart contacts, or robo-advising, are growing both as an opportunity and a challenge to traditional finance. Artificial intelligence is heading for ubiquity, raising economic and moral questions, and begging for the development of self-explaining AI methods and suitable optimization techniques.

The past two years have been marked by the debate over the regulation of large digital platforms and anti-trust. As the world reorganizes for a post-Covid economy, there is a pressing need to design regulation based on sound economic reasoning. The TSE Digital Center is an active participant in the debate, and several articles and reports by TSE members have been influential. The session of the TSE Common Good Summit devoted to this issue was an engaging, lively event. Other illustrations are the paper by Yassine Lefouili on platform liability or the contribution of Doh-Shin Jeon to the Expert Group of the EU Observatory on the Online Platform Economy. We are also proud of the success of the inaugural conference of the FIT IN Initiative, which is devoted to the promotion of financial inclusion through digital technologies. We hope this to be a useful contribution to the common good.

Christophe Bisière

Last but not least, another milestone last year was the appointment of Yassine Lefouili, former director of the TSE Digital Center, as director of TSE Partnership (TSE-P). We warmly thank both Yassine and his predecessor Sébastien Pouget for their invaluable contributions to the development of TSE-P.

We hope you will enjoy reading this report. It provides an overview of the Center's activities in 2021 as well as a glance at TSE's initial training and Executive Education programs in which our faculty are closely involved.

Bruno Jullien

Christophe Bisière & Bruno Jullien *Codirectors of the TSE Digital Center*

About the Digital Center

The rapid development of digital technology is generating new challenges and a fundamental transformation in the daily lives of citizens and organizations, with a significant impact on individuals, governments and businesses around the world. TSE undertakes research that helps public and private-sector organizations understand the opportunities and risks of the digital economy.

TSE Digital Center was created four years ago, as a continuation of the Jean-Jacques Laffont Digital Chair. It brings together the research expertise of TSE faculty, as well as financial support and knowledge of private and public partners. Our ambition is to establish one of the best digital economics research centers in Europe and to exercise intellectual leadership in this field.

Scientific production

- Development of new knowledge resulting in academic publications
- Organization of scientific conferences and seminars

Dissemination of economic knowledge

- Production of outreach materials and organization of events tailor-made to inform practitioners, policy makers or a wider audience
- Participation of researchers in the public debate in France and internationally

Key numbers for 2021

10 partners

61 researchers

3 policy papers

14 working papers

23 articles in peer-reviewed journals

4 international conferences

13 digital workshops

19 seminars on the economics of platforms

5 competition policy seminars on digital topics

Highlights

FIT IN Initiative inaugural conference

Everyone deserves access to decent financial services, especially the most vulnerable. That's why in November 2020, the Toulouse School of Economics launched the FIT IN (Financial Inclusion Through INteroperability) Initiative.

This project, developed jointly by TSE's Digital Center, Sustainable Finance Center and Infrastructure & Network Center, seeks to catalyze new research that can constructively influence the design and regulation of interoperable digital payment systems in developing countries.

How can policymakers promote financial inclusion?

In December 2021, the inaugural FIT IN Initiative conference featured two lively sessions showcasing some of the latest economic analysis in digital finance. Bringing together eight experts on the topic, the conference was intended to inform policymakers and facilitate connections between researchers, regulators, commercial providers and practitioners.

Mobile money and financial inclusion

Digital financial services, and mobile money in particular, have generated considerable enthusiasm and hope for a reduction in remittance fees for the rural poor. **Jenny Aker** *(Tufts University)* emphasized that this is especially the case in Sub-Saharan Africa, where remittances account for 2.5% of the region's GDP and transfer costs are among the highest in the world. Analyzing data from Niger, Jenny and her co-authors show that demand for sending and receiving remittances is substantial. Nevertheless, fewer than 3% of households use mobile money despite high rates of mobile phone ownership and the comparable costs of other transfer services. While rural households are willing to pay mobile-money transfer costs, there is significant variation by region, primarily correlated with access to agents. This suggests that one of the primary barriers to mobile-money adoption could be the agent network.

" In Sub-Saharan Africa, where remittances account for 2.5% of GDP and transfer costs are among the highest in the world, few households use mobile money despite high rates of mobile phone ownership

Jenny Aker *(Tufts University)*

What is the economic impact of introducing mobile money in rural areas with limited access to financial services? A study by **Catia Batista** *(Nova School of Business and Economics)* and Pedro Vicente is the first to use a randomized controlled trial to answer this question. Following a sample of rural communities in Mozambique, their results show that the availability of mobile money translated into high adoption of these services. Mobile money improved consumption smoothing by treated households, reducing their vulnerability to adverse weather and self-reported shocks. However, mobile money also led to reduced investment, especially in agriculture. The number of migrants in a household and the migrant remittances received by rural households both increased, particularly in presence of adverse shocks, while there are no clear effects on savings. These results suggest that, by drastically reducing transaction costs for remittances and improving insurance possibilities, mobile money can accelerate migration to urban areas.

To examine how best to inform and encourage use of mobile banking services, **Emma Riley** *(University of Washington)* and Abu Shonchoy also conducted a randomized controlled trial. They offered training on mobile banking to 400 female microfinance clients in rural Ghana, along with small incentives to encourage adoption of mobile banking services. Individual incentives increased the use of mobile banking by 16 percentage points, double the control mean of 15%. However, incentives to encourage others in the same microfinance group resulted in significantly higher use of 36 percentage points, along with increases in the value and number of mobile banking transactions. Incentives to encourage others resulted in large increases in knowledge about mobile banking, frequency of knowledge sharing with peers, and confidence in safely conducting digital transactions. Women in microfinance groups where the group leader had already used mobile banking saw significantly larger treatment effects. These findings highlight the importance of thinking about technology adoption within peer networks.

Digital payments and financial services

In the second FIT IN Initiative session, researchers discussed their investigation of the new relationships emerging between banks, Big Tech platforms, fintech payment providers, and consumers. **Uday Rajan** *(University of Michigan)* underlined how competition for standalone payments disrupts the historical banking model because payment flows are informative about credit risk. Using a model in which processing payments allows providers to learn about customers' creditworthiness, he and his coauthors find that competition from fintechs affects a bank's price for payment services and its loan offers. This competition promotes financial inclusion, may hurt
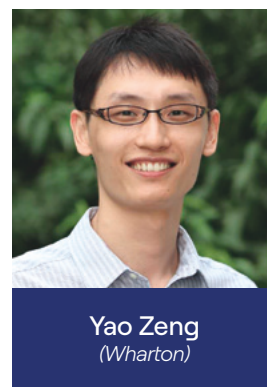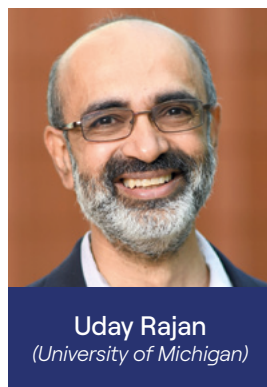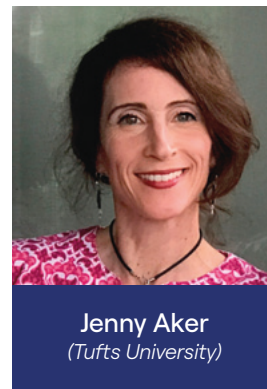
consumers with a strong bank preference, and has an ambiguous effect on the loan market. Both fintech data sales and consumer data portability increase bank lending, but the effects on consumer welfare are ambiguous. Under mild conditions, consumer welfare is higher under data sales than with data portability.

Yao Zeng *(Wharton)* proposed that there is an informational synergy between fintech lending and cashless payments. Theoretically, fintech lenders screen borrowers more efficiently when borrowers use cashless payments that produce transferable and verifiable information. In turn, a strategic consideration to stand out from non-adopting borrowers pushes borrowers to adopt cashless payments. Empirically, he and his coauthors provide evidence that larger use of cashless payments predicts a higher likelihood of loan approval, a lower interest rate, and a higher loan amount, especially for firms of higher credit quality. This synergy provides an economic rationale for open banking, and more broadly for data sharing and a lending model without traditional banking relationships.

> **Sharing data with a digital platform benefits a consumer through improved matching efficiency with normal consumption goods at the expense of exposing those with self-control issues to temptation goods**
>
> Michael Sockin *(University of Texas)*

The EU's General Data Privacy Regulation and California's Consumer Privacy Act aim to protect vulnerable consumers from exploitation by firms. Research by **Michael Sockin** *(University of Texas)* investigates how such policies might affect the welfare of consumers who differ in their ability to resist temptation. Sharing data with a digital platform benefits a consumer through improved matching efficiency with normal consumption goods at the expense of exposing those with self-control issues to temptation goods. Michael's analysis highlights the limitations of GDPR and CCPA regulations because of nuanced externalities induced by consumers' active and default choices. He and his coauthors find that CCPA-type policies, where the default choice is to opt-in for data sharing, give the highest social welfare if temptation is low. On the other hand, when temptation is high, no data sharing gives the highest welfare. However, GDPR-type policies where the default choice is opt-out, may still yield the highest social welfare when temptation is in the intermediate range.

Jenny Aker
(Tufts University)

Catia Batista
(Nova School of Business and Economics)

Emma Riley
(University of Washington)

Uday Rajan
(University of Michigan)

Yao Zeng
(Wharton)

Michael Sockin
(University of Texas)

Do central banks need their own digital currency?

Jean-Charles Rochet

Will the traditional banking structure survive in the digital era? Given his fundamental contributions to our understanding of banking economics, financial stability, two-sided markets and digital payments, TSE's Jean-Charles Rochet is well placed to investigate such questions.

As one of the keynote speakers at the Sustainable Finance Center Conference in December, he presented his preliminary research with Jon Frost and Hyun Song Shin (BIS) and Marianne Verdier (University of Paris) on the future of payment systems and the impact of a central bank digital currency (CBDC).

Jean-Charles Rochet

'Are banks dead or are the reports greatly exaggerated?'

J.C. Rochet: This was the fantastic title of a paper by Boyd and Gertler (1994) showing that banks were able to survive competition from financial markets. In the traditional "two-tier" structure, commercial banks manage the retail accounts of consumers, providing financial services to the public; meanwhile, the central bank – the banker of the banks – manages the reserve accounts of the banks. This structure has been in place for at least two or three centuries. Today, it is jeopardized by both fintech innovation, which allows the "unbundling" of deposits and credit; and Big Tech platforms, which are "rebundling" financial services with their core services. The threat to the traditional model from cryptocurrencies and other digital innovations is even more serious because it may apply to banks and central banks.

Are the (old) scope economies between deposits and credits still relevant?

In my banking 101 courses, I have always taught that the traditional role of banks is to provide deposits and credits simultaneously. This is argued to be good for the allocation of resources, creating economies of scope because banks learn about the creditworthiness of customers by managing deposits. However, this business model can be disrupted by fintech.

The European Commission and proponents of open banking hope that the introduction of fintech lending, allowing borrowers/consumers to give access to their data to third-party providers, will stimulate competition. But there may be unintended consequences. Parlour, Rajan and Zhu (2020) show that the entry of fintech stimulates competition with traditional banks for payment services but may reduce bank lending because it makes the funding of the banks more costly. When you allow fintech to sell payment data to the lenders, bank lending increases but the impact on consumer welfare is ambiguous.

Vallée, Ghosh and Zeng (2021) suggest that data on cashless payments allows fintech lenders to evaluate creditworthiness better than banks. They say that open banking is going to revolutionize banking thanks to the data-sharing synergy between cashless payments and credit. I slightly disagree because this synergy underlies the traditional business model. The authors focus on the idea that the bank produces soft information over several relationship periods; and this is opposed to the use of big data on payments, which is hard information produced outside the banks. But currently there is no level playing field because banks contribute by producing this data but they cannot benefit from it.

> **The traditional banking structure has been in place for at least two or three centuries. Today, it is jeopardized by both fintech innovation, which allows the 'unbundling' of deposits and credit; and Big Tech platforms, which are 'rebundling' financial services with their core services**

Big Tech, not fintech, platforms may pose the most serious threat to traditional synergies and fintech, once a level playing field has been restored. After all, banks can buy fintechs; companies can use fintech technology and artificial intelligence. Berg et al (2020) show that digital footprints predict consumer defaults better than traditional credit scores. Similarly, Frost et al (2020) show that small Argentine firms that use Big Tech credit perform better than their competitors.

Is the traditional two-tier structure efficient in a digital economy? A simple alternative is already in place in countries like Switzerland, the UK and Mexico: a real-time payment system accessible to everyone including non-bank service providers and large corporations. This question is also related to a fundamental change in the structure of the industry, moving to a payment-centric model. It seems that banks are no longer at the center, mediating between different consumers, offering different services. Instead, it is the platform that provides access to services and lending activity is outsourced.

What are the consequences of the (new) scope economies between payments and core platform activities?

The Big Tech giants, such as Ant Group or Facebook/Meta, view themselves as "lifestyle platforms" or a "metaverse" where users can spend their entire lives: chat with friends, watch videos, order meals, buy goods, book sports events, etc., and pay bills. Why would you need a bank account when your platform can offer you all the financial services that you can dream of?

The scope economies between e-commerce and payments started by using a very simple escrow account to build confidence between the buyer and the seller. Alibaba realized that it was very easy to add many other financial services to this app. Ant Group is an incredible conglomeration of different activities: its revenue was initially concentrated on payments, but is now much more diversified and includes credit, insurance and asset management.

There was a regulatory backlash in November 2020. The Chinese authorities restructured Ant Group, subjecting it to prudential regulation and supervision by the Bank of China, stripped the Alipay platform from financial products, consolidated lending operations into a single entity, and downsized Yu'e Bao which was a huge money market fund that grew from the simple escrow account used by Alibaba customers. The official motivations were the protection of consumer rights and privacy, limitation of market power, and promoting a level playing field between all kinds of competitors.

How do you model 21st-century payment systems?

Our model has two types of activities: some goods are bought online; other purchases are at the physical point of sale in brick-and-mortar shops. There are three payment instruments: Central bank money, which is initially physical cash until replaced with electronic cash or a central bank digital currency (CBDC); Digital bank transfers, which are essentially deposits or classical private money; and a stablecoin currency issued by the platform (it could be a social network but for simplicity I will focus on e-commerce).

There are two types of transactions. For online payments, bank transfers (via card or mobile payments, or checks) competes with the stablecoin. If created, a CBDC could also be used for online transactions. For physical, point-of-sale payments, the trade-off is between bank transfers and central bank money.

Physical cash payments guarantee anonymity but the banks bundle payments with credit services; for example, using a bank account may allow you to benefit from a credit line or overdraft. In contrast, the platform bundles payments with matching services: for example, a platform can use the information collected on your behavior, in particular your payments, to find you the best product. This improves the allocation of resources but presumably the platform will collect the majority of the surplus so it's not necessarily good for consumer welfare.

Why and how should cryptocurrencies be regulated?

In the old debate about the "denationalization of money" (Hayek 1976), it's suggested that competing forms of money would be more efficient than government monopoly. But if you look at the facts, competition between private currencies doesn't work well because of the complexity: there are exchange rate risks, transaction costs, risks of runs, etc. These questions about the extent to which money should be private or public are being re-examined in the light of technological innovations.

Stablecoins, the value of which is pegged to one official currency, are more promising payment instruments than Bitcoin, which is more of a vehicle for speculation. They are similar to money market funds that provide payment services. In our model, we first analyze the laissez-faire situation where there is no intervention by the government. Even if you use the same currency peg everywhere and prohibit transfer fees, the payment system is fragmented in the sense that the users need at least two accounts or two types of tokens. So it's not clear if many cryptocurrencies can survive in the long run. But regulation could help by promoting interoperability; for example, between stablecoins and bank deposits.

In our model, we don't allow for public provision of services, we look at the government as a regulator and not as an operator. The first thing the regulators could do is to look at prudential regulation. The financial assets of the platform that issues the stablecoin must be safe or over collateralized. To avoid the risk of destabilizing runs, the platform must be considered to some extent as a "narrow bank", even if it doesn't have credit activities. In Janet Yellen's introduction to a US President's Working Group report (November 2021), she says stablecoins can support beneficial payment options but current oversight is inconsistent and fragmented. The report recommends that stablecoin issuers should be regulated financial institutions like banks, perhaps imposing capital and liquidity requirements. Similarly, other intermediaries including custodial wallet providers should be appropriately supervised.

> **Competition between private currencies doesn't work well because of the complexity: there are exchange rate risks, transaction costs, risks of runs, etc. These questions about the extent to which money should be private or public are being re-examined in the light of technological innovations**

> **It is hoped that a central bank digital currency can stimulate competition for payments and credit services and eliminate the risk of domination by a limited number of platforms. But it's difficult to preserve competitive neutrality if the central bank is both supervisor and operator**

Another aspect of regulation is antitrust. The platform may use its market power to oblige consumers and merchants to use its stablecoins for online payments, and to accept higher fees for doing so. Similarly, market power may allow the platform to leverage the use of its stablecoin on the physical market. There is also this question of a level playing field between banks and non-bank payment service providers.

What other incentives exist for platforms to issue their own money?

We are accustomed to the use of stamps, air miles, and other tokens to encourage customer loyalty. It's also a way to exert market power by locking in consumers. Interestingly, You and Rogoff (2019) show that the platforms make more profit if their tokens are non-tradable (that is, they have to be exclusively used for buying items on the platforms). So platforms do not want to issue general-purpose money.

In contrast, Brunnermeier and Payne (2021) consider digital tokens as "smart bills of exchange" that act as a programmable money for smart contracts and other things, competing with traditional currencies because they can be both a means of payment and store value. But there is a trade-off between seignorage revenue and the cost of maintaining the reputation needed to store value and avoid runs.

Sockin and Xiong (2020) argue that tokenization might be a commitment device to prevent a platform from abusing its users. It's a more appealing funding scheme for platforms with weak fundamentals but probably not a means of payment. You have to draw the line between cryptoassets and cryptocurrencies.

What is the impact of payment methods on privacy and data markets?

If physical cash is replaced by digital currencies, there is presumably a loss of privacy. That's why it's still used a lot in countries like Switzerland. For digital monies, depending on their design, the use of data can be a mixed blessing. It generates huge network effects that can drive greater financial inclusion, better services and lower costs. But it may also encourage further market concentration. In China, for example, TenCent and Alipay have 85% or more of the payments market.

Kirpalani and Philippon (2020) show how platforms gather data about users and may sell it to merchants. Externalities imply that data sharing may be socially excessive. In Liu, Sockin and Xiong (2020), platforms' extensive access to user data may allow them to take advantage of users' vulnerability. There is also research that suggests that data on previous purchases allows firms to price discriminate. Choi, Jeon and Kim (2019) find that individuals do not fully internalize the cost of losing privacy when consumer tastes are correlated with observable characteristics. Garrett and coauthors (2021) rightly point out that when payment data provides information about consumer tastes, in the long run the only stable outcomes of those models are data monopolies. This is a tipping phenomenon: ultimately, only one big platform survives. They argue that electronic cash (CBDC) may be a way to "monetize privacy" and avoid the use of market power by the data monopolies.

Why create a CBDC? And how should it be designed?

In the euro area and many other countries, the share of cash and daily transactions is falling. It is argued that the central bank has a mandate to provide legal tender to all in a convenient form; so if people don't want cash anymore, it should provide digital cash.

Regulators are also fed up with the huge costs for merchants through the manipulation of interchange fees on credit cards, and even debit cards. Even if digital payments are more efficient than cash, they are often very expensive; so the idea is to stimulate competition. However, there is the tradeoff between low transaction costs and the risk of a digital run. If it's very easy for a consumer to transfer all their money, it's a possible vehicle for instability. A CBDC may be more efficient but it will also crowd bank deposits, raise banks' funding costs and decrease investment. Some observers suggest that the central bank could "recycle" the funds by lending to the banks but this may increase counterparty risk and favoritism.

It is hoped that a CBDC can stimulate competition for payments and credit services but also eliminate the risk of domination by a limited number of platforms. But it's difficult to preserve competitive neutrality if the central bank is both supervisor and operator. A mixed solution already exists in most developed countries because, for large-value interbank payments, a private system run by the banks coexists with a public system run by the central bank.

Böhme (2021) and others defend the idea of a "minimally invasive" CBDC that maintains the two-tier structure with commercial banks and a central bank. The idea is that the CBDC could have a very limited financial system footprint, like cash today. To make the CBDC available to the general economy, there are different possibilities depending on the level of anonymity required, including account-based or token-based CBDCs.

For cross-border payments, CBDCs could significantly improve the quality of service. There are extremely high fees for cross-border payments, especially for retail users. If most countries agreed to create CBDCs connected through a more efficient system, it could improve considerably the functioning and costs of the foreign exchange market. This should be good for the economy, although some intermediaries might lose out.

SUMMING UP

- The payment system is a vital element of the economy. For centuries, it has been organized as a public-private partnership between the central bank and commercial banks. Digitalization has provoked calls to redefine this partnership, with pressure by central banks and regulators to implement CBDCs.

- It is not clear whether a CBDC is necessary for a socially optimal payment system. Maybe a fast payment system with an appropriate set of regulation could suffice. In any case, a one-size-fits-all solution is unlikely to be optimal.

- The pros and cons of a CBDC depend on countries' specifics, such as a users' preference for physical cash and anonymity, the degree of financial inclusion, and the intensity of bank competition and data governance arrangements.

Research

Research focuses
& scientific projects

Scientific team, visitors

Grants & scholarships

RESEARCH FOCUSES & SCIENTIFIC PROJECTS

TSE research focuses on five main themes of interest in the field of digital economics. This section presents these themes along with a selection of scientific projects (one example for each of our five research focuses).

- Analytics and economics of Big Data
- Artificial intelligence and society
- Digital platforms
- Financial technologies and digital markets
- Intellectual property in the digital economy

Analytics and economics of Big Data

Objective: Develop, with the help of mathematicians, optimization techniques, applied econometric tools and game theory concepts to help to handle high-dimensional random phenomena. Study data-related issues such as privacy protection, the markets for data, and the impact of data on competition.

Program leader: Sébastien Gadat works on applied mathematics involved in machine learning and artificial intelligence, with an emphasis on statistics and stochastic on-line optimization algorithms.

Scientific project

On the ability of artificial intelligence to extract and use information of financial texts

Sébastien Gadat *(TSE)* - **Stéphane Villeneuve** *(TSE)* - Anh Dung Le *(TSE)*

In the past two decades, artificial intelligence generated an impressive blast over many industrial, academic and financial fields thanks to several breakthroughs in optimization, statistics and computer science. Financial datasets are usually considered through longitudinal time series evolution and popular approaches consist in predicting quantitative outputs with old-fashioned statistical tools involving AR regressions. However, with modern machine learning tools, it has become possible to push forward the ability of data analysis and in particular to make quantitative use of texts (financial reports and articles among other) that are an almost unlimited source of information in Finance.

"Text analysis for financial data inference is a very challenging and exciting subject of research. However, texts are vectors of financial information that are complex to handle as they are described by a huge dictionary of words. Our work uses some modern text mining tools (non-negative matrix factorization and latent Dirichlet allocation) that induce fundamental (and unavoidable) dimensionality reduction, generate quantitative outputs, and decompose texts thanks to sparse dictionary learning. Texts are then broken down into a reduced set of coordinates over some profiles of texts, that may be used in a machine learning pipeline.

Our analysis then makes use of "kernelized Wasserstein regression" with output produced by our matrix factorization methods, allowing us to generate quantitative predictors, text clusters, and many other possible indicators of prime interest for understanding financial markets."

Artificial intelligence and society

Objective: Investigate the ethical expectations that citizens and consumers hold for artificial intelligence to smooth the transition to the new AI society. Conduct research in the high-stakes domain of algorithmic justice. Study areas in which AI and powerful algorithms can redesign the social fabric.

Program leader: Jean-François Bonnefon works on decision-making and moral preferences. He explores the kind of ethics people want for self-driving cars and other machines.

Scientific project

Is justice really blind? And is it also deaf?

Daniel L. Chen *(TSE, CNRS)*
Manoj Kuma - Vishal Motwani - Philip Yeres
(New York University)

The natural audio presentation of natural language has many various sources beyond simply the choice of words. Characteristics of a speech act such as pitch, diction, and intonation may be significant even though they do not affect the semantic content of what has been spoken.

There is a significant body of scholarship that examines this type of speech variation, e.g., in mate selection, leader selection, housing choices, consumer purchases, and even stock market outcomes, but there is relatively little quantitative empirical evidence that speech variation beyond lexical choices matters for real-world behavior. Speech variation from identical utterances of 'Hello' affect personality ratings but linking these ratings to downstream behavior is challenging. Nevertheless, oral advocacy classes are taught at law schools and skilled oral advocacy is a highly sought-after professional trait.

"In our paper, we take up the question of the practical relevance of speech variation by showing that vocal cues in the first three seconds of speech are predictive in high-stakes policy-making settings such as the U.S. Supreme Court."

Digital platforms
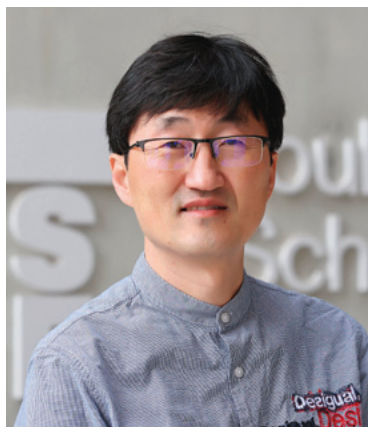
Objective: Understand the business models of platforms and their impact on society and welfare. Produce research that sheds light on the functioning of platform markets and offers policy recommendations to public authorities regarding the regulation of such markets.

Program leader: Doh-Shin Jeon works on industrial organization, IT, intellectual property, economics of science.

Scientific project

Platform design when sellers use pricing algorithms

Andrew Rhodes *(TSE, CEPR)*
Justin Johnson *(Cornell University)* - Matthijs Wildenbeest *(Indiana University, CEPR)*

Many products and services are traded through platforms, and sellers on those platforms increasingly delegate pricing decisions to algorithms. This shift towards algorithmic pricing has generated significant debate about whether algorithms might lead to more or less competitive outcomes. For example, research by Emilio Calvano (TSE associate member) and co-authors has shown through simulations that algorithms can learn to support supra-competitive outcomes through reward and punishment strategies. Meanwhile, research by Daniel Ershov (TSE faculty) and co-authors has shown empirically that adoption of algorithmic pricing software can soften competition.

"Our contribution in our paper is to focus on the role that platforms might have in shaping how algorithms price. In particular, platforms set the rules that govern how buyers and sellers interact, and these rules can have important implications for competition. A leading example is rules that determine how different sellers are ranked or displayed on the platform. We consider a setting where symmetric firms sell differentiated products, and we focus on two different platform rules. One rule selects, at each point in time, a subset of the cheapest sellers and displays only those sellers. The other rule is a more subtle dynamic policy, whereby a seller is more likely to be displayed in the current period if its price in recent periods was relatively low.

We then examine the impact of these policies, using both economic theory and experiments with (reinforcement-learning) algorithms. Our theory results suggest that the first policy works well if firms play competitively. Although consumers only see a restricted set of sellers, those sellers compete more aggressively than usual in order to be amongst the displayed sellers, and this price-variety trade-off is typically favorable for consumers. However, our theory results also suggest that when firms collude, the more subtle dynamic policy is better for consumers. Our experiments show that the algorithms typically respond strongly to the platform rules by lowering their prices; the dynamic policy is particularly successful in this regard, leading to potentially large gains for consumers. We also show, both in theory and in the experiments, that depending on its revenue model the two policies can raise platform profits."

Financial technologies and digital markets

Objective: Analyze the implications of key features of FinTech and cryptocurrencies, and their impact on social welfare. Study the way markets, institutions and regulations should be designed to mitigate problems such as coordination issues, information asymmetries and other market failures.

Program leader: Christophe Bisière works on FinTech, blockchain and cryptocurrencies.

Scientific project

Augmenting investment decisions with robo-advice

Milo Bianchi *(TSE, UT1)*
Marie Brière *(Amundi, Paris Dauphine University, Université Libre de Bruxelles)*

A growing interest in automated financial advisors, often called robo-advisors, has emerged both in academia and in the industry. Yet, even if a robot may be devised to reduce transaction costs and agency conflicts, the fundamental aspect is how much investors would be willing to rely on automated recommendations, for example when defining their portfolio allocations or when advised to rebalance their portfolio in a given direction even if tempted to do otherwise. Trust is key for financial advice, and mistrust in algorithms seems particularly severe in the context of financial services. As shown in other domains, one way to build trust is to let humans and robots interact, with the robot proposing some advice and the human as the ultimate decision-maker.

"In our research paper, we study the introduction of robo-advising on a large representative sample of Employee Saving Plans. Unlike many services that fully automate portfolio decisions, our robo-advisor proposes investment and rebalancing strategies, leaving investors free to follow or ignore them. We focus on the resulting human-robot interactions and show that, with the robo-service, investors increase their attention to the portfolio, their investment in the plan, and their equity exposure. They experience higher risk-adjusted returns, mostly by changing their rebalancing and staying closer to the target. We discuss how automated advice can promote financial inclusion, and how human-robot interactions can improve financial capability."

Intellectual property in the digital economy

Objective: Offer a better understanding of intellectual property protection and transfer in the digital economy. Analyze patent litigation involving IoT players and the licensing of intellectual property to manufacturers of connected devices. Assess the economic effects of making platforms liable for intellectual property infringements by third parties operating on them.

Program leader: Yassine Lefouili works on the law and economics of intellectual property, competition policy and digital economics.

Scientific project

Do standard-essential patent owners behave opportunistically? Evidence from U.S. district dockets

Yassine Lefouili *(TSE)*
Brian Love *(Santa Clara University)* - Christian Helmers *(Santa Clara University)*

How should patent owners be compensated when they obtain patent rights that cover some aspect of a widely used technology standard? Perhaps no issue has drawn more attention from the international patent community in the last decade. However, despite years of scholarly debate, multi-national litigation, and scrutiny from competition regulators, no consensus answer has emerged.

"In our paper, we investigate whether owners of standard-essential patents (SEPs) "hold up" companies that produce standard-compliant products. To explore this question, we use detailed information from the dockets of all U.S. patent cases filed in 2010-2019 that assert or challenge SEPs to construct measures of opportunistic conduct by SEP licensors, including actions that took place before the lawsuit was filed. We find evidence of opportunistic behavior by the SEP enforcer in at least 75% of SEP assertions in court, and we analyze various factors that determine which opportunistic behaviors SEP enforcers rely on. We also show that opportunistic behavior can affect case outcomes, although the effect on settlement is ambiguous. Some behaviors increase the likelihood of a settlement, while others decrease it."

Digital dystopia

Jean Tirole's research on how Big Brother would use Big Data illustrated the "Artificial Intelligence and Society" Research Focus in last year's report. It has since progressed well.

Published in the June edition of *American Economic Review,* his new paper entitled 'Digital Dystopia' sees the Nobel laureate conduct a ground-breaking foray into '(social) science fiction' to examine the risks of unchecked data integration.

How transparent should our life be to others?

J. Tirole: Connected objects, social networks, ratings, artificial intelligence, facial recognition, cheap computer power and various other innovations make it increasingly easy to collect, store and analyze personal data. These developments hold the promise of a more civilized society, in which incivilities, corruption, fraud, and more generally non-compliance with essential laws and norms are a memory of the pre-Big Data past. On the other hand, citizens and human rights courts fret over mass surveillance by powerful platforms and governments. My paper attempts to shed light on the two sides of the argument, emphasizing the excesses that may result from an unfettered data integration.

Will China's 'social credit' system create a data-driven dystopia?

The details of China's ratings system are not yet known. Current pilots suggest that individuals will be assigned social scores based on a variety of criteria: credit history, tax compliance, good deeds, environmentally friendly behavior, traffic violations, fraudulent behavior, the spreading of "fake news" and "inappropriate posts", the individual's social graph, personal traits, political or religious opinions, etc. As well as incurring social sanctions and stigmatization, a bad rating may restrict access to discounts, jobs, transport, visas, schools, and universities. Companies will have powerful incentives to alter their terms and conditions according to a customer's social score.

The ideas and technology required for such a system are not a specifically Chinese phenomenon. Social scoring is likely to tempt other governments and many of us are familiar with, for instance, credit checks, criminal records, or user ratings on Ebay, Airbnb and Uber. Instead, social ratings are part of a global stampede toward the aggregation of data for behavioral analysis. Rather than documenting existing events, my paper tries to describe what might happen in the absence of proper legal and constitutional safeguards.

How might governments abuse the power of social ratings?

Using mathematical models to predict citizens' actions, my results suggest that unscrupulous governments will implement a score that combines information about behavior that is useful to other citizens (such as the individual's record of keeping promises, or respecting others) with information that more closely reflects the interests of the state (such as political or religious views). Bundling together these two types of information is crucial to prevent those who learn an individual's score from focusing just on prosocial behavior, and to pressure individuals to follow the government line.

Another key insight is that social ratings have more impact in a society of strangers. When relationships are transient, as on online platforms or in big cities, the state's ability to enforce compliance is much higher than in a tight-knit society of strong, stable relationships. To tighten its grip, the state can assign ratings to businesses and administrations to oblige them to discriminate against low-scoring citizens.

> **At the same time, an effective social score depends on transparency/citizens' awareness about the way it is computed, together with opaqueness about its components.**

A repressive state must also eliminate competition from independently provided social ratings. Private platforms would remove information about political views from their own rating systems and the government's social score would be ignored. At the same time, an effective social score depends on transparency/citizens' awareness about the way it is computed, together with opaqueness about its components.

One of the most problematic aspects of mass surveillance is guilt by association, so I also consider a social rating system in which mingling with dissenters is tantamount to dissenting oneself. By encouraging ostracism of dissenting friends and family, states can thus apply another form of social pressure on disobedient citizens. Blending an individual's social relationships into a social score can also weaken resistance to autocratic regimes by destroying the social fabric, forcing citizens to cut beneficial ties with others.

Is democracy in danger?

Social scores have the potential to undermine democracies, as a majority can exploit the same strategy to force a minority to comply. While autocratic countries may be wary of public platforms, my research suggests democratic ones may need to be concerned about private ones. Tech firms can manipulate voters' opinions about hostile politicians, just as a state-controlled platform can leverage social scores to suppress dissent. Similarly, religious organizations can exercise social control by managing the flow of information about individuals' behavior. These scenarios may or may not be (social) science fiction, but we have to come to grips with them all the same.

Social ratings have tremendous potential to enhance trust in society. They have already helped to encourage better behavior on e-commerce and ride-hailing platforms, or more careful driving. However, a key challenge for our digital society will be to design principle-based policy frameworks that discipline governments and private platforms in their integration and disclosure of our data.

Read the paper on our website

Scientific team

Today more than 60 TSE researchers have an interest in digital economics.

- Henrik Andersson, *UT1 Capitole, TSE*
- Emmanuelle Auriol, *UT1 Capitole, TSE*
- Milo Bianchi, *UT1 Capitole, TSM, TSE*
- Christophe Bisière, *UT1 Capitole, TSM, TSE*
- Jérôme Bolte, *UT1 Capitole, TSE*
- Jean-François Bonnefon, *CNRS, TSE*
- Matthieu Bouvard, *UT1 Capitole, TSM, TSE*
- Stéphane Caprice, *INRAE, TSE*
- Catherine Casamatta, *UT1 Capitole, TSM, TSE*
- Catherine Cazals, *UT1 Capitole, TSE*
- Daniel L. Chen, *CNRS, TSE*
- Frédéric Cherbonnier, *IEP, TSE*
- Helmut Cremer, *UT1 Capitole, TSE*
- Jacques Crémer, *TSE*
- Abdelaati Daouia, *UT1 Capitole, TSE*
- Alexandre de Cornière, *UT1 Capitole, TSE*
- Roberta Dessi, *UT1 Capitole, TSE*

- Isis Durrmeyer, *UT1 Capitole, TSE*
- Daniel L. Ershov, *UT1 Capitole, TSE*
- Frédérique Fève, *TSE*
- Sébastien Gadat, *UT1 Capitole, TSE*
- Farid Gasmi, *UT1 Capitole, TSE*
- Eric Gautier, *UT1 Capitole, TSE*
- Fabien Gensbittel, *UT1 Capitole, TSE*
- Bertrand Gobillard, *UT1 Capitole, TSE*
- Renato Gomes, *CNRS, TSE*
- Alexander Guembel, *UT1 Capitole, TSM, TSE*
- Ulrich Hege, *UT1 Capitole, TSE*
- Marc Ivaldi, *EHESS, TSE*
- Doh Shin Jeon, *UT1 Capitole, TSE*
- Bruno Jullien, *CNRS, TSE*
- Yassine Lefouili, *UT1 Capitole, TSE*
- Jean-Marie Lozachmeur, *CNRS, TSE*
- Nour Meddahi, *UT1 Capitole, TSE*
- Hervé Ossard, *TSE*

- François Poinas, *UT1 Capitole, TSE*
- Sébastien Pouget, *UT1 Capitole, TSM, TSE*
- Jérôme Renault, *UT1 Capitole, TSE*
- Patrick Rey, *UT1 Capitole, TSE*
- Mathias Reynaert, *UT1 Capitole, TSE*
- Arnaud Reynaud, *INRAE, TSE*
- Andrew Rhodes, *UT1 Capitole, TSE*
- Silvia Rossetto, *UT1 Capitole, TSM, TSE*
- Anne Ruiz-Gazen, *UT1 Capitole, TSE*
- Mohamed Saleh, *UT1 Capitole, TSE*
- Wilfried Sand-Zantman, *ESSEC Business School, TSE*
- Paul Seabright, *UT1 Capitole, TSE*
- Christine Thomas-Agnan, *UT1 Capitole, TSE*
- Jean Tirole, *TSE*
- Karine Van Der Straeten, *CNRS, TSE*
- Stéphane Villeneuve, *UT1 Capitole, TSE*
- Takuro Yamashita, *UT1 Capitole, TSE*

Moreover, TSE and IAST researchers collaborate with numerous researchers in universities around the world on digital economics questions.

- Marcel Boyer, *CIRANO - Montréal*
- Emilio Calvano, *University of Bologna*
- Vessela Daskalova, *Cambridge-INET Postdoctoral Fellow*

- Anna D'Annunzio, *TBS*
- Johannes Hörner, *Yale University*
- Estelle Malavolti, *ENAC*

- Antonio Penta, *Universitat Pompeu Fabra*
- Jean-Charles Rochet, *University of Geneva, SFI*

Visitors

- Gary Biglaiser *(UNC Chapel Hill)*
  June 21 - 29, 2021
- Hubert Tardieu *(Gaia–X)*
  September 15, 2021
- Ro'ee Levy *(Tel–Aviv University)*
  September 29, 2021
- Marc Perves *(Apple)*
  October 13 - 14, 2021

- Aurélie Pols *(ECPC Maastricht University)*
  October 27 - 28, 2021
- Isabelle Piot–Lepetit *(INRAE)*
  November 24 - 25, 2021
- Thibault Larger *(Amazon)*
  December 14, 2021

Grants

In 2021, five members of TSE Digital Center received funding from the European Research Council (ERC) for on-going research projects.

ERC "Starting grants"

Isis Durrmeyer

"Understanding price dispersion: new structural models of price discrimination and applications"

Daniel Garett

"Dynamic Mechanisms"

Renato Gomes

"Competition and Regulation of Platform Markets"

ERC "Advanced grants"

Bruno Jullien

"Information services: competition and externalities"

Jean Tirole

"Markets and their limits"

Scholarships

Luise Eisfeld

In 2021, the TSE Digital Center awarded a scholarship to **Luise Eisfeld**. Her main areas of expertise are Empirical Industrial Organization and the Economics of Digitization. In her thesis, under the supervision of TSE researchers Bruno Jullien, Daniel Ershov and Alexandre de Cornière, she explores how digitization affects market structure and competition between firms.

Luise is interested in understanding how companies interact in different industry settings, how one should deal with market failures, and at which point the government should step in and regulate economic actors. In the past, Luise investigated the influence of online product rankings on sellers' pricing behavior on e-commerce platforms. She is now working on a new research paper focused on "Acquisitions and Entry in Software Markets". As of Spring 2022, she will be a visiting student at the Technology and Policy Research Initiative (TPRI) at Boston University.

Jacopo Bregolin

Willy Lefez

All the best to **Jacopo Bregolin** and **Willy Lefez**, who left TSE with a PhD in Economics after receiving a Digital Center Scholarship to complete their studies.

Jacopo joined the University of Liverpool (UK) and Willy the European School of Management and Technology Berlin (Germany).

Scientific Events

Conferences

Digital workshops

Seminars on the
economics of platforms

Competition policy seminars

Conferences

Digital Economics Conference
January 7 & 8, online

TSE's Digital Economics Conference is one of our longest-running events. Through the years we have welcomed academics and practitioners from across the world to discuss advances in the digital economy and the effects it may have on today's societies. The 14th edition, held online in January 2021, broached a variety of topics such as data sharing, media and social media, competition on and between platforms, pitfalls of reputation mechanisms, consumer search and platform recommendations, and self-dealing and self-preferencing.

We were thrilled to feature keynote lectures from **John Vickers** (University of Oxford) and **Ekaterina Zhuravskaya** (Paris School of Economics). The conference ended with a fascinating roundtable on *"What Engineers Wish Economists Knew about Digital Technology"*. Thank you to all our speakers and participants, who made this annual event so exceptional despite unusual circumstances.

Relive some of the highlights online! A selection of recordings is available on our YouTube Channel.

4th Doctoral workshop on the economics of digitization
May 18 & 19, online

Hosted by TSE, this two-day international workshop brought together doctoral students involved in research in the field of the Economics of Digitalization.

Keynote speaker **Luis Cabral** from New York University talked about *"Media and Entertainment in the Digital Era: Theory and Empirical Evidence from Books, Music, and Movies"*.

Congratulations to **Zheng Gong** (University of Toronto) who won the best paper award, sponsored by the ifo Institute, for *"Growing Influence"*.

Conference on Econometrics of Games, Matching and Networks
June 16–18, online

At this conference organized jointly by CEMMAP and TSE, top leaders of the field discussed the recent advances in the econometrics of Games, Matching and Networks.

Find the program and more information on the conference webpage.

FIT IN Initiative Inaugural Conference
December 2 & 3, online

The FIT IN Initiative Inaugural conference, organized at the same time as the 2nd Conference of TSE's Sustainable Finance Center, was held online on December 2 and 3, 2021. Participants enjoyed keynote speeches with Jean Tirole (2014 Nobel Laureate in Economics, TSE) and Jean-Charles Rochet (Professor of Finance, University of Geneva, SFI), as well as brilliant academic presentations on mobile money in developing countries, competition between digital financial service providers, and welfare effects of data sharing. We look forward to the next edition in 2023!

Find more information in the Highlights section of this report and on the conference webpage.
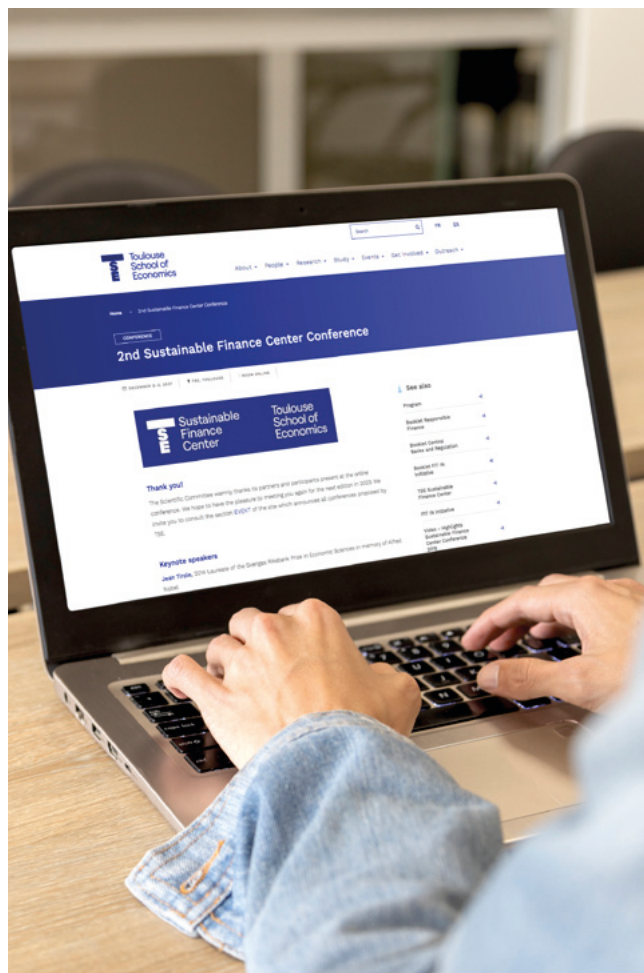
Digital workshops

Organized by Daniel Ershov and Doh-Shin Jeon

The digital workshop takes place every other Wednesday at lunchtime. It is an interdisciplinary forum for interactions with policy makers, practitioners/experts in the private sector and researchers in various disciplines in order to meet the challenges from the digital economy and society. The workshop covers a broad range of topics such as artificial intelligence, cybersecurity, privacy and data, digital platforms (including regulation and competition issues), social media (including political aspects), fintech, and more. It attracts a broad group of faculty and PhD students. Speakers, in addition to giving the talk, have opportunities to have one-on-one meetings with TSE faculty and students who are working on digital markets, big data and AI.

Daniel Ershov

Doh-Shin Jeon
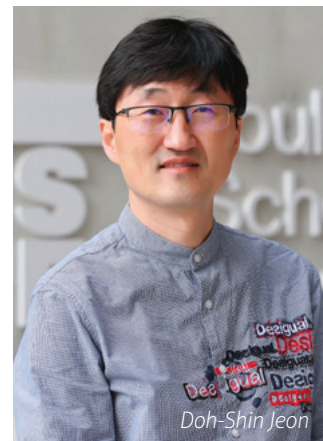
- November 24 - **Isabelle Piot-Lepetit,** *"The Challenges Arising from Big and Smart Data in Agriculture"*

- November 10 - **Brent Mittelstadt,** (Oxford Internet Institute, University of Oxford), *"Bias Preservation in Machine Learning"*

- October 27 - **Aurélie Pols,** (Board Member European Center for Privacy and Cybersecurity (ECPC), Maastricht University, Netherlands and DPO, independent and external of mParticle), *"Consequences of Apple's ATT - AppTrackingTransparency - on Digital Data Flows"*

- September 29 - **Ro'ee Levy,** (Berglas School of Economics, Tel Aviv University), *"Social Media and Mental Health"*

- September 15 - **Hubert Tardieu,** (Ex-Chairman of the Board GAIA-X), *"The Business Data Challenge Contribution of GAIA-X"*

- June 23 - **Horacio Larreguy,** (TSE, John F. Kennedy School of Government, Harvard University), *"Online Political Information: Facebook ADS, Electorate Saturation, and Electoral Accountability In Mexico"*

- June 9 - **André Veiga,** (Imperial College London), *"Attention, recall and purchase: Experimental evidence on online news and advertising"*

- May 26 - **Aurélien Mähl,** (DuckDuckGo), *"Competition in the search engine market"*

- May 12 - **Huan Tang,** (London School of Economics), *"The Value of Privacy: Evidence from Online Borrowers"*

- April 14 - **Greg Taylor,** (University of Oxford), *"Information Security and Competition"*

- March 31 - **César Hidalgo,** (Center for Collective Learning, Artificial and Natural Intelligence Institute (ANITI), University of Toulouse), *"How Humans Judge Machines"*

- March 17 - **Céline Castets-Renard,** (University of Ottawa, Faculty of Law, Chair Accountable AI in a Global Context and Chair Law, Accountability and Social Trust in AI, ANITI (France-ANR)), *"Beyond the Ethics: Towards A Legal Regulation of AI"*

- March 3 - **Milena J. Petrova,** (Wallapop), *"Working as an Economist in Tech"*

Seminars on the economics of platforms

Organized by Jacques Crémer, Andrei Hagiu and Julian Wright

Jacques Crémer

Andrei Hagiu

Julian Wright

The "Economics of Platforms" seminar series, which is hosted by TSE, was born from an idea of Professors Andrei Hagiu, of Boston University, and Professor Julian Wright, of the National University of Singapore. It offers economists interested in platforms a regular time to keep abreast of new developments.

The great variety of topics and the quality of the speakers is apparent from the list below. Less apparent is the success of the format in which a relatively short presentation is followed by a five to ten minute discussion, often of the highest quality, and a series of questions and answers. A friendly international community of scholars has developed around the seminars, and TSE can be proud of its contribution to this endeavor.

- November 30 - **Erik Madsen,** (New York University), *"Insider Imitation"* with Nikhil Vellodi
- November 16 - **Kohei Kawaguchi,** (Hong Kong University of Science and Technology), *"Merger Analysis in the App Economy: An Empirical Model of Ad-Sponsored Media"* with Toshifumi Kuroda and Susumu Sato
- November 2 - **Timothy Simcoe,** (Boston University), *"Complementary Multi-Sided Platforms"* with Doh-Shin Jeon, Yassine Lefouili and Yaxin Li
- October 19 - **Ginger Zhe Jin,** (University of Maryland), *"Platform as a Rule Maker: Evidence from Airbnb's Cancellation Policies"* with Jian Jia and Liad Wagman
- October 5 - **Thomas Philippon,** (New-York University), *"Data Sharing and Market Power with Two-Sided Platforms"*, with Rishabh Kirpalani
- September 21 - **Jacopo Bregolin,** (TSE), *"Authority and Delegation in Online Communities"*
- September 7 - **Alexander White,** (Tsinghua University), *"Optional Intermediaries and Pricing restraints"*, with Chang Liu and Fengshi Niu
- July 27 - **Hanna Halaburda,** (NYU-Stern), *"Will Blockchain Disrupt Platform Businesses?"*
- July 13 - **Leonardo Madio,** (University of Padova), *"The Economics of Platform Liability"*, with Yassine Lefouili
- June 29 - **Tat-How Teh,** (National University of Singapore), *"Multihoming and Oligopolistic Platform Competition"*, with Chunchun Liu, Julian Wright and Junjie Zhou
- June 15 - **Susan Athey,** (Stanford University), *"Platform Annexation"*, with Fiona Scott Morton
- June 1 - **Arun Sundararajan,** (New York University), *"The Limits of Centralized Pricing in Online Marketplaces and the Value of User Control"*, with Apostolos Filippas Fordham and Srikanth Jagabathula

- May 18 - **Kai Hao Yang,** (Yale University), *"Equivalence in Business Models for Informational Intermediaries"*
- April 20 - **John J. Horton,** (MIT Sloan & NBER), *"Pricing in Designed Markets: The Case of Ride-Sharing"*, with Jonathan V. Hall and Daniel T. Knoepfle
- April 6 - **Shota Ichihashi,** (Bank of Canada), *"Addictive Platforms"*
- March 23 - **Hsin-Tien Tiffany Tsai,** (National University of Singapore), *"Steering via Algorithmic Recommendations"*
- March 9 - **Alessandro Bonatti,** (MIT Sloan School of Management), *"The Economics of Social Data"*
- February 23 - **Ulrich Laitenberger,** (Telecom-ParisTech), *"Vertical Integration of Platforms and Product Prominence"*
- February 9 - **Ruslan Momot,** (HEC Paris), *"Digital Privacy"* (with Itay P. Fainmesser and Andrea Galeotti)

Many of these seminars can be viewed on our YouTube channel in our digital economics playlist.

Competition policy seminars

Organized by Estelle Malavolti and Patrick Rey

Estelle Malavolti

Patrick Rey

The competition policy seminar focuses on topics related to the Law and Economics of Competition Policy and Regulation. It serves as a platform of intellectual exchange between competition policy practitioners, researchers and students. The goal is to confront important competition policy challenges with the current state of economics literature, so as to identify relevant research topics.

A number of topics are related to the digital economy, which creates new challenges for regulators and competition agencies while opening up new research avenues, making the exchange between practitioners and academics particularly useful.

- March 5 - **Ioannis Lianos,** (University College London) and **Michael Jacobides,** (London Business School), *"Ecosystems and Competition Law in Theory and Practice"*
- March 26 - **Ana Sofia Rodrigues,** (Autoridade da Concorrência (AdC) - Portuguese Competition Authority), *"An enforcer's view on competition and algorithms in the digital economy"*
- October 1 - **Helen Jenkins,** (OXERA), *"How to Regulate Data Access to get the Benefits of Data Sharing?"*
- November 12 - **Fabien Curto Millet,** (Google), *"Competition and Regulation in the Digital Economy: a Roadmap"*
- December 3 - **Pascale Déchamps,** (Autorité de la Concurrence), *"Privacy and Competition: Experience in Treading a Fine Line"*

Outreach

Common Good Summit

Debate: Meet the experts

Book release

Press articles and media

Common Good Summit: How to regulate platforms?

The Common Good Summit was organized by TSE, *Les Echos* and *Challenges* business magazine on May 27 and 28, 2021.

A roundtable was dedicated to the regulation of platforms with **Thierry Breton** *(European commissioner for Internal market)*, **Jacques Crémer** *(TSE Professor),* **Bengt Holmström** *(2016 Nobel laureate, MIT)* and **Luc Julia** *(Renault Chief Scientific Officer).*

A full account of the Common Good Summit can be found in the ***TSE Mag, issue 22.***

COMMON GOOD SUMMIT
May 27-28, 2021
100% DIGITAL

Where are Europe's tech giants?

Can Europe build its own Silicon Valley? Keeping pace with the rise of the Big Data barons, and platform markets that are spreading and mutating with incredible speed, is a Sisyphean task for policymakers and economists. In a robust exchange of views at the common good Summit, 2016 Nobel laureate Bengt Holmström clashed with the European Commissioner for the Internal Market over his role in fostering digital innovation.

"My job is not to regulate, but to organize," insisted Commissioner Breton. "This is not directed against anyone, but we need rules in our digital space as we have for land, sea and air. And this is what Brussels has done with the Digital Services Act and the Digital Market Act. The last time Europe organized its digital space was in the early 2000s, with the e-Commerce Directive. We are now probably organizing the rules for the next 20 years, ensuring fair competition to protect innovation. We missed the first wave of the information revolution – for personal data – but we are now be better positioned than everyone for the new, much bigger wave concerning industrial data. In the next 5-10 years, you will see powerful new European players in this space."

> **Regulation is not easy in the digital world. It doesn't work to stop Facebook from doing what it shouldn't, but it does give people the keys to what is acceptable**
>
> **Luc Julia,** *Scientific Director, Renault*

Data is gaining preeminence as a wealth driver, agreed Holmström. "Digitization is not really the new kid on the block. The value of data, platforms, and scalability are the big new things. It's not just about having the data, it's about using it efficiently." However, the MIT professor highlighted Europe's failure to compete with China and the US. "One of the disturbing facts is that among the top 10 biggest or most valuable companies in the world there are no EU companies. Seven of those 10 are platform businesses. Of the top 100 most valuable startups in the world, there are only two EU entries. It's not that there are no startups in Europe, but it seems they sell out somewhere else."

Striking a more optimistic note, the Commissioner stressed the vibrancy and emerging strengths of EU innovation. "The vaccine strategy is a story of European startups: Four of the five vaccines have been developed in Europe with European money. ASML are the world leader in making microchips and are indispensable for the digital space. So I see another story on the ground. But it's true that we have to catch up, to accelerate. My mission is to provide what is needed for this energy and young talent to do in the digital space what they did in the pharmaceutical space. We will generate data like never before in Europe. Our automotive industry is still driving innovation. Connected cars with supercomputers provide a lot of data, and automakers will be happy to share some of this to create innovation. So we are working to have the right data pool, on a voluntary basis."

So why has Europe fallen behind? Holmström believes policymakers need a lighter touch. "Why do you think the ecosystems in the US and Asia have grown so big?" he asked. "Is it because the government has organized and orchestrated? There is a problem with size and privacy but to argue that the government has to tell these kids how to play in the sandbox seems an error in mindset. The evidence is obvious: Companies can do it very well themselves."

"We are not organizing the ecosystem; the stakeholders are," retorted Breton. "It is absolutely not a top-down approach, we are business-oriented people. I've run companies all my life – I'm the first CEO to be a Commissioner. Before I joined, my department was organized like a Communist country. I said to the industry: How do you want to organize yourselves? We organized ourselves as their counterpart. And it seems to work."

"You are not following business, you are putting constraints on business," the Nobel laureate hit back. "Both the US and China have left these companies to innovate, they have not started with regulation because it's so uncertain. Data is totally different to a traditional good. Once we've seen how this new world plays itself out, we will be in a better position to regulate. We should give more slack to companies in the beginning and invest in training of entrepreneurs."

> **We need regulations to ease the tension between our love of technology and its big-picture failures**
>
> **Jacques Cremer,** *TSE*

As Europe struggles to catch up, has the pandemic changed the rules of the game? "There is a pre-Covid and a post-Covid situation," said Breton. "The US government has never before put so much money in private companies, because of the crisis. China too. The level playing field is something to watch very carefully here. For the next fight in industrial data, let's ask all the players from the industry: What are the constraints? What do you need? And then work together. We are using our capacity not just to do this openly, but also to invest and do a little of what the US is doing for our own companies."

TSE-IAST Debate: meet the experts

How will artificial intelligence change society? – *December 9, online*

To help the general public grasp such a vast topic, TSE and IAST invited three AI experts to a public debate to illuminate the possibilities that this technology can offer.

Jean-François Bonnefon discussed how AI would raise new ethical questions and issues. **César Hidalgo** shared insights on how humans perceive machines and how machine learning could improve democracy, economics and our understanding of complexity. **Dana Pizarro** shared her views on how AI works for pricing, how consumers can adapt and what the rise of AI will mean for economics.

▶ Video available on our YouTube channel

Book release

TSE researcher Jean-François Bonnefon heads the AI and Society program of the TSE Digital Center. A man of many hats, he is also Chair of Moral AI at the Artificial and Natural Intelligence Toulouse Institute (ANITI) and the President of the European Commission expert group on the ethics of driverless mobility.

Released in 2019 and translated into English in 2021, his book *"The Car That Knew Too Much"* is the inside story of the groundbreaking experiment that captured what people think about the life-and-death dilemmas posed by driverless cars.

"Should I sacrifice myself by driving off a cliff if that could save the life of a little girl on the road?" Human drivers don't find themselves facing such moral dilemmas. Human brains aren't fast enough to make that kind of calculation; the car is over the cliff in a nanosecond. A self-driving car, on the other hand, can compute fast enough to make such a decision—to do whatever humans have programmed it to do. But what should that be? This book investigates how people want driverless cars to decide matters of life and death.

In *The Car That Knew Too Much*, psychologist Jean-François Bonnefon reports on a groundbreaking experiment that captured what people think cars should do in situations where not everyone can be saved. Sacrifice the passengers for pedestrians? Save children rather than adults? Kill one person so many can live? Bonnefon and his collaborators Iyad Rahwan and Azim Shariff designed the largest experiment in moral psychology ever: the Moral Machine, an interactive website that has allowed people — eventually, millions of people — from 233 countries and territories — to make choices within detailed accident scenarios. Bonnefon discusses the responses (reporting, among other things, that babies, children, and pregnant women were most likely to be saved), the media frenzy over news of the experiment, and scholarly responses to it.

Boosters for driverless cars argue that they will be in fewer accidents than human-driven cars. It's up to humans to decide how many fatal accidents we will allow these cars to have.

The Car That Knew Too Much, by Jean-François Bonnefon, *MIT Press.*
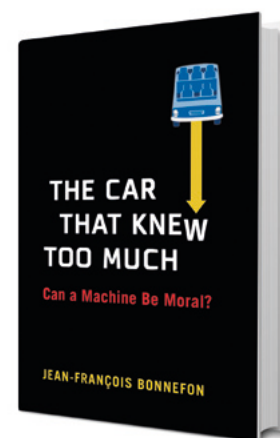
Press articles and media

- **Marc Ivaldi,** "Fusion TF1-M6 : entre passions et raisons", *Les Echos, December 15*
- **Jacques Crémer,** "Tout commence par le cloud", *Le Point, November 4*
- **Alexandre de Cornière,** "Google's $5 Billion Android Battle Could End Its Dominance", *Barron's, October 5*
- **Alexandre de Cornière,** "Google and EU head to court to decide the fate of €4.3 billion fine", *Euronews, September 27*
- **Jean-François Bonnefon,** "Qu'ont les économistes à dire sur la morale ?", *The Conversation, August 26*
- **Jean-François Bonnefon,** "How 's growing influence can make humans less moral", *Los Angeles Times, August 2*
- **Jacques Crémer,** "India's digital economy must foster choice, competition, innovation: Experts", *The Print, July 31*
- **Doh-Shin Jeon,** "Do big platforms hold up innovation?", *Digital Future Society, June 9*
- **Catherine Casamatta, Pierre Dubois, Christian Gollier, Mathias Reynaert** and **Jean Tirole,** "Common Good Summit", *Challenges, June 3*
- **Bruno Jullien,** "Économie numérique et IA, un pari gagnant ?", *Exploreur, May 12*
- **Catherine Casamatta,** "Les cryptomonnaies désormais considérées comme une valeur refuge par certaines entreprises", *Le Monde, April 29*
- **Daniel L. Chen,** "Racisme, sexisme: les IA peuvent-elles supprimer les discriminations dans les affaires judiciaires ?", *Numerama, April 19*
- **Jean-François Bonnefon,** "Est-il moral de tuer une personne pour en sauver d'autres ?", *Science et Vie, April 18, 2021*
- **Catherine Casamatta,** "Quand le Bitcoin sort de la clandestinité", *Le Point, February 4, 2021*
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Working papers

Policy papers

Contributions to other policy-oriented publications

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- Laurent Miclo and **Stéphane Villeneuve,** "On the forward algorithm for stopping problems on continuous-time Markov chains", *Journal of Applied Probability, vol. 58, n. 4, December 2021, pp. 1043–1063*

- Fanny Lafouresse, Romain Jugele, Sabina Müller, Marine Doineau, Valérie Duplan-Eche, Eric Espinosa, Marie-Pierre Puissegur, **Sébastien Gadat** and Salvatore Valitutti, "Stochastic asymmetric repartition of lytic machinery in dividing CD8+ T cells generates heterogeneous killing behavior", *eLife, October 2021*

- **Claude Crampes** and **Yassine Lefouili,** "Green Energy Pricing for Digital Europe", *Enjeux numériques - Annales des Mines, n. 15, September 2021, pp. 37–41*

- Justin Johnson and **Andrew Rhodes,** "Multiproduct mergers and quality competition", *The RAND Journal of Economics, vol. 52, n. 3, September 2021, pp. 633–661*

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- **Doh-Shin Jeon, Bruno Jullien** and Mikhail Klimenko, "Language, Internet and Platform Competition", *Journal of International Economics, vol. 131, n. 103439, July 2021*

- Bernard Bercu, **Sébastien Gadat** and Manon Costa, "Stochastic approximation algorithms for superquantiles estimation", *Electronic Journal of Probability, vol. 26, n. 84, June 2021, pp. 1–29*

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- **Mathias Reynaert,** "Abatement Strategies and the Cost of Environmental Regulation: Emission Standards on the European Car Market", *The Review of Economic Studies, vol. 88, n. 1, January 2021, pp. 454–488*

- Joanna Morais and **Christine Thomas-Agnan,** "Impact of Covariates in Compositional Models and Simplicial Derivatives", *Austrian Journal of Statistics, vol. 50, n. 2, January 2021, pp. 1–15*

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- **Marc Ivaldi,** Ambre Nicolle, Frank Verboven and Jiekai Zhang, "Displacement and Complementary in the recorded music industry: evidence from France", *TSE Working Paper, n. 21-1199, March 2021*

- Aurore Archimbaud, Fériel Boulfani, Xavier Gendre, Klaus Nordhausen, **Anne Ruiz-Gazen** and Joni Virta, "ICS for multivariate functional anomaly detection with applications to predictive maintenance and quality control", *TSE Working Paper, n. 21-1182, January 2021*

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- **Milo Bianchi, Matthieu Bouvard, Renato Gomes, Andrew Rhodes** and **Vatsala Shreeti,** *Mobile Payments and Interoperability: Insights from the Academic Literature,* December 2021

- Stephanie Assad, **Emilio Calvano,** Giacomo Calzolari, Robert Clark, Vincenzo Denicolò, **Daniel Ershov,** Justin Johnson, Sergio Pastorello, **Andrew Rhodes,** Lei Xu and Matthijs Wildenbeest, *Autonomous Algorithmic Collusion: Economic Research and Policy Implications,* March 2021

- **Yassine Lefouili** and **Leonardo Madio,** *The Economics of Platform Liability,* July 2021

Focus – The economics of platform liability

Tech giants are under pressure to stamp out online abuses, including e-commerce fraud and the spread of hate, violence, and misinformation. But can regulators hold digital platforms responsible for the misbehavior of their users? In a recent TSE Digital Center policy paper on *'The Economics of Platform Liability',* **Yassine Lefouili** and **Leonardo Madio** provide a novel analysis of the crucial trade-offs and incentives to be considered by firms and policymakers.

Yassine Lefouili

Why do current liability rules need updating?

LM: Existing liability regimes, designed in 1996 in the US and 2000 in the EU, were established to foster the growth of "information society services", protecting them from endless litigation and stimulating investment. However, over the past 20 years, the platform economy has become extremely diverse and its largest firms have grown very powerful. Online platforms generally adopt a multi-sided approach, mediating interactions among several groups of agents who can be exposed or expose others to risks. Due to the global reach of many platforms, it can be difficult, if not impossible, for victims to claim compensation. Similarly, harmful content can spread rapidly thanks to groups, algorithms, and recommendation systems.

Policymakers have only recently begun to address platform liability problems. In December 2020, the European Commission unveiled its proposal for the Digital Services Act, which continues to ensure conditional liability exemption to online intermediaries but introduces additional obligations for "very large" platforms. In the UK, the proposed Online Safety Bill imposes a duty of care on digital services providers. In February 2021, stricter rules were proposed in the California Assembly for intermediaries selling defective products.

Leonardo Madio

What is the key focus of your study?

YL: Our study investigates the incentives for platforms to engage in self-regulation and the effects of changing liability rules on platforms' most critical economic decisions, such as those related to pricing strategies, terms and conditions, business models, and investments. We restrict attention to the following types of misconduct on platforms: counterfeit sales, copyright infringement, and hate speech, and we focus on e-commerce platforms, social networks, and hosting platforms. Our objective is to improve our understanding of the direct and indirect benefits and costs associated with a stricter liability regime.

Should tech giants get the same treatment as start-ups?

LM: Relatively lenient liability rules may have helped existing platforms to gain financial resources, leaving them better equipped for stricter liability than new entrants. Large incumbents can also exploit their extensive user data to better "train the algorithms" and reduce their liability costs. A one-size-fits-all liability regime for platforms thus seems likely to amplify existing asymmetries.

A liability regime can take these aspects into account by introducing additional clauses for "big" platforms. For example, large e-commerce platforms could be held liable when a vendor selling counterfeits disappears from the radar of primary enforcement. Platforms could be exempted from this burden if they share data and technologies with rivals to identify illegal content. Such a policy would also limit the potential adverse effects of stricter liability and reduce barriers to entry and expansion. A well-functioning market for monitoring tools would help to assure users that the likelihood of suffering harm is not higher on smaller platforms.

What other advice do you have for policymakers?

YL: Our paper establishes that increasing liability affects not only illegal conduct on platforms and the resulting litigation but also some of the platform's key economic decisions. It also shows that any liability reform requires careful consideration of the effects on third parties' incentives.

An optimal liability system should incentivize platforms to limit or avoid harm as well as to invest in prediction accuracy when using automatic tools. To be effective and avoid platform cherry-picking on what to remove and what to maintain, a liability regime should also help third parties to report alleged violations. Also, allowing researchers access to raw and aggregate data on content moderation and removal activity, may help policymakers ensure the right balance with respect to core democratic freedoms.

Overall, our economic analysis offers support for i) reform of current liability regimes, ii) cost-benefit analysis of potential upgrades, and iii) differential treatment of the largest platforms. We also recommend a multi-dimensional approach that designs liability rules in conjunction with other regulatory policies, including competition policy, consumer protection, and privacy.

Paper available to read on the TSE website
Find more information and the final reports on the European Commission website.

Contributions to other policy-oriented publications

Since 2018, TSE researcher Doh-Shin Jeon has worked as a member of the Expert Group of the EU Observatory on the Online Platform Economy. The Expert Group's final report, composed of a set of five papers, was made public in early 2021 following stakeholder feedback and reactions on the progress reports, which were published for consultation in July 2020.

Can you briefly describe the role of the Observatory and your experience as a member of this group?

The European Commission (EC) set up the Observatory on the Online Platform Economy on 26 April 2018, tasking it with monitoring and analyzing developments in the online platform economy. The Observatory is comprised of a group of Commission officials, a dedicated expert group of independent experts and a support study. In September 2018, the EC appointed, for a two-year term, 15 independent experts as members of the expert group.

Doh-Shin Jeon

My personal experience of the first mandate is very positive for two reasons. First, it allowed me to discover the main policy issues which preoccupy policy makers. As the digital economy is fast-moving, the academic economic literature often lags behind important policy issues. Second, working with other experts who have diverse backgrounds broadened my perspective. Even if we all work on the online platform economy, our approaches and preoccupations are not the same. I invited two of them to be speakers at the TSE Digital workshop.
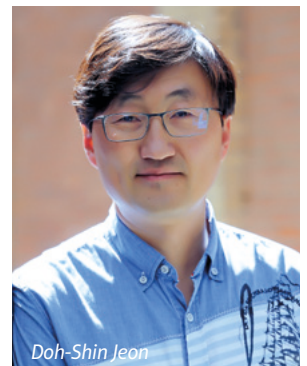
What are the main topics addressed in the report that the expert group recently released?

The group wrote five reports during the first mandate; I contributed to four of them. As I review the last report in the next question, I below briefly discuss the other ones.

Report on measurement and indicators: A challenge to policy makers and researchers is that there is a lack of data on many aspects of online platforms. The objective of this report is to identify indicators that could be used to monitor the online platform economy and to recommend corrective actions in areas where no indicators are available to ensure such data becomes available. For instance, the report makes a recommendation to introduce obligations on "major" platforms to report all acquisitions to the EC, which is adopted in the recent proposal of the Digital Markets Act by the Commission.

Report on differentiated treatment: This report analyses practices of differentiated treatment, whereby a platform applies dissimilar conditions to business users in equivalent situations and explores the extent to which such practices constitute a potential source of "unfairness" in the relationship between platforms and businesses. The report aims to provide guidance on how to assess the impact of differentiated treatment from a technical, economic and legal perspective.

Report on data: The report aims to present how data is generated, collected and used in the online platform economy, and what the main policy issues are in these regards.

Report on platform power: This report maps different sources and types of power in the platform economy by bringing together insights from law, economics, political science and business strategy. The objective is to uncover elements of platform power that deserve more attention. For instance, the report emphasizes platforms' ability to influence consumer behavior and the role of platforms as gatekeepers of public interests such as democracy and healthcare.

Could you highlight the key points of your case study on "Market power and transparency in open display advertising"?

Digital advertising is at the core of the digital economy since many websites and applications rely on revenue from digital advertising. My case study aims to shed light on various ways Google built up its market power and took advantage of it in the ad intermediation industry for open display advertising. My study was very timely as, on December 16, 2020, ten states in the U.S. filed a lawsuit against Google's monopolization of online display advertising.

There are two main formats of digital advertising: search advertising and display advertising. Display advertising can further be divided into open display advertising and display advertising from "owned-and-operated" platforms. In the open display advertising market, the vast majority of publishers (e.g. newspapers) sell their advertising inventory to a wide range of advertisers through a complex chain of third-party advertising intermediaries. On the supply side, there are publisher ad servers and supply-side platforms (SSPs), including ad exchanges. On the demand side, there are demand-side platforms (DSPs) and advertiser ad servers. Google is the leader at each layer of intermediation and its publisher ad server has more than 90% market share both in the U.K. and in the U.S.

My study explains how the ad intermediation market functions and describes how Google established its position in the vertical chain of ad intermediation and took advantage of it. I conclude the study by presenting some reflections on ways to build a level playing field and to promote consumer surplus and incentives for publishers to invest in content.

Following a competitive selection process for the 2nd term of the expert group, the Commission has appointed 15 high-profile experts and Doh-Shin's mandate as member of the expert group has been renewed.

As part of the Digital Regulation Project hosted by the Yale Tobin Center for Economic Policy, TSE researcher Jacques Crémer contributed to the following papers:

- *"Consumer protection for online markets and large digital platforms"*, Policy Discussion Paper N°1, *May 20, 2021*

- *"Fairness and contestability in the digital markets act"*, Policy Discussion Paper N°3, *July 6, 2021*

- *"Equitable Interoperability: the "Super Tool" of Digital Platform Governance"*, Policy Discussion Paper N°4, July 13, 2021

- *"International Coherence in Digital Platform Regulation: An Economic Perspective on the US and EU Proposals"*, Policy Discussion Paper N°5, August 9,2021

Jacques Cremer

Partnerships

New and renewed partnerships

TNIT

Join forces

New and renewed partnerships

Karine Van Der Straeten

New partnership with Amazon

Last summer, TSE was delighted to begin a new partnership with Amazon which joined the Digital Center's research project sponsors. The team of researchers involved in the partnership, led by Karine Van Der Straeten, is composed of Doh-Shin Jeon, Yassine Lefouili, Patrick Rey, Mohamed Saley, with Paul Seabright as senior scientific advisor.

TSE hopes that this first year of partnership will be the beginning of a long-term relationship.

A renewed partnership with Orange

Our partnership with Orange, which has offered significant support to TSE since 2008, has been renewed for a two-year period. The objective of this partnership is to develop ambitious research and scientific activities for telecommunications.

With the support of Orange, TSE researchers develop their research work on issues such as the economics of data, the environmental impact of telecoms and network sharing. Regular meetings and interactions take place between TSE researchers and the Orange Group team working on regulation.

Current partners

We are highly grateful to all our partners and donors for their support.

Main donors	Donors	Research project sponsors
AIRBUS	CAUSALITY LINK	Amazon
orange™	FIT IN Initiative supported by Bill & Melinda Gates Foundation	BBVA
ANT FINANCIAL	Microsoft	Meta
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Join forces

Connecting our research to real-world stakes

Philanthropic support and research partnerships have played a significant role in the creation of TSE Digital Center and in its development ever since. And today more than ever, the long-term support of our public and private partners remains essential to promote research in the field of digital economics.

TSE Digital Center is designed to encompass the participation of a wide range of partners, whether corporations, institutions, individuals or charitable organizations from France and around the world. That is because there is a constant need for increased analysis and collaboration on topics related to digital economics. Working alongside practitioners, TSE researchers aim to develop targeted research projects directly connected to society concerns and economic actors, as well as outreach initiatives allowing a stronger anchoring of TSE scientific expertise in the public debate.

"By joining the community of partners, you will help us achieve our ambitious scientific goals and encourage the emergence of a leading research center in Europe in the field of Digital Economics.

You can support research undertaken with a specific scientific project and/or contribute to a fund dedicated to the long-running operations of the Center. Such funding could help us secure existing posts and endow new ones. We are also looking for funding to create new research projects and visiting programs, and to offer additional research grants and scholarships. In addition, we value the provision of databases our researchers can work on. And last but not least, we enthusiastically welcome financial support for projects with a multidisciplinary approach.

Donations made to TSE through the Jean-Jacques Laffont – TSE Foundation, through TSE-Partnership Foundation (TSE-P) or through American Friends of TSE, provide tax benefits to the donor.

Some research programs may be at the crossroads of several themes (e.g. digital finance). Take a look at the list of our other thematic centers:

- **TSE Competition Policy & Regulation Center**
- **TSE Energy & Climate Center**
- **TSE Health Center**
- **TSE Infrastructure & Network Center**
- **TSE Sustainable Finance Center**

Eve Séjalon

If you would like to join us, please contact **Eve Séjalon**, Head of Research Partnerships and Centers at *partnership@tse-fr.eu*

TNIT Toulouse Network for Information technology

15 successful years of partnership between Microsoft and TSE

Created in 2005 and financed by Microsoft, the **Toulouse Network for Information Technology** (TNIT) aimed to foster high quality economic research on the software industry, the development and role of the Internet, intellectual property, cloud computing, antitrust and competition policy.

The aim of the network was to encourage some of the best academic economists in the world to engage on the issues generated by the rapid development of information technology. Members pursued active research in areas of interest of the network. They also participated in a yearly meeting where they discussed each other's research and interacted with high-level practitioners about the evolution of the industry. The role of TSE was to provide scientific support, and to guarantee that the research could be conducted in full independence.

This partnership has come to an end but the scientific contributions of TNIT members remain available on the TSE website. TSE is extremely thankful to Microsoft for its support and to the members of TNIT for their involvement in this network. The amazing quality of the researchers involved was key to the success of the network. Four of them have won the John Bates Clark Medal of the American Economic Association, probably the most prestigious award in economics short of the Nobel Prize. And Luis Garicano has become an important member of the European Parliament.

TNIT Members: Daron Acemoglu *(MIT),* **Susan Athey** *(Stanford University),* **Nicholas Bloom** *(Stanford University),* **Glenn Ellison** *(MIT),* **Luis Garicano** *(London School of Economics),* **Matthew Gentzkow** *(Stanford University),* **Chad Jones** *(Stanford Graduate School of Business),* **Josh Lerner** *(Harvard Business School),* **Jonathan Levin** *(Stanford University),* **Kiminori Matsuyama** *(Northwestern University),* **Ariel Pakes** *(Harvard University),* **Robert Porter** *(Northwestern University),* **Suzanne Scotchmer (†)** *(Berkeley),* **Ilya Segal** *(Stanford University),* **Mike Whinston** *(MIT),* **Heidi Williams** *(Stanford University).*

Scientific coordinators: Jacques Crémer *(TSE)* and Jacques Lawarrée *(Microsoft)*

For more information, see the 25th and final issue of TNIT News retracing the network's achievements.
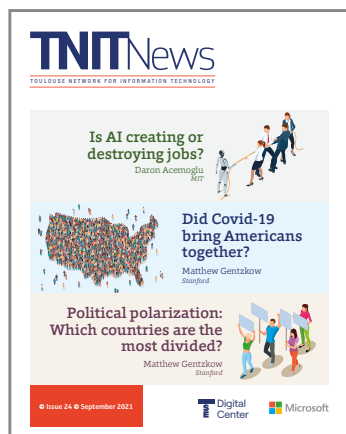
A series of newsletters specific to the TNIT project is available on the TSE website.

TNIT meeting in 2014. From top left: *Jacques Crémer, Yassine Lefouili, Jacques Lawarrée, Chris Nelson, Daron Acemoglu, Sue Glueck.* From bottom left: *Kiminori Matsuyama, Glenn Ellison, Susan Athey, Josh Lerner, Michael Whinston, John Levin, Glen Weyl, Nick Bloom.*

TNIT meeting in 2014

Connecting research and education

Master's courses

Business talks

Executive Education

Although they take place outside the framework of TSE Digital Center, we find it interesting to highlight educational activities in the field of digital economics carried out by other entities within the TSE house.

Indeed, TSE faculty involved in the research activities of TSE Digital Center are also often committed to transferring cutting-edge knowledge to the students in an initial or continuing education program.

Master's courses

Several courses are offered to students as part of the TSE Master's program within the University of Toulouse.

M1 – Statistics and econometrics – Data Science for Social Sciences
OPTIMIZATION FOR BIG DATA

The "Optimization for big data" lecture is an introductory course that describes some modern algorithms useful in statistics and optimization. These algorithms will pay specific attention to the high dimensional framework involved by big data and the associated computation time.

In the today's big data era, old-fashioned statistical or econometrics methods become useless for possibly different reasons: high dimensional settings, on-line learning or difficult non-Euclidean structure. This induces serious troubles with simple regression methods (including linear models and logistic regressions) and to bypass these difficulties, efforts are needed both on the algorithmic side and the statistical side. The goal of this course is to present some recent advances on optimization that helps for solving numerical problems derived from statistical modeling (including L1 penalized mean square or logistic loss, on-line learning).

M2 – Economics of Markets and Organizations
DIGITAL ECONOMICS

This course presents theoretical models and empirical evidence exploring how digitization affect markets and economic activity: what is changing but also what remains unchanged. Lectures also touch on issues of competition policy as they relate to recent anti-trust activity in digital markets. At the end of the lectures, students understand the economic models underpinning competition, market power and regulation in digital markets. Students also learn about the main streams and important papers in the large literature examining online markets and digital technology. Specific topics include search, big data and advertising, artificial intelligence, reputation mechanisms and copyright. Methodologically, students are exposed to causal inference (i.e., difference-in-differences) and model-based (i.e., discrete choice logit) empirical methods of data analysis. Students learn to apply both sets of tools to real world data.

DATANOMICS

Introduction to the legal regime of data protection with a special focus on the General Data Protection Regulation (GDPR). This course aims at giving a good understanding of data protection's objectives by analysing the international and European legal framework and to provide the tools to better understand the GDPR.

M2 – Econometrics and Empirical Economics
MACHINE LEARNING FOR ECONOMICS

The main goal of the course is to familiarize students with machine learning methods for quantitative and qualitative prediction (regression and classification). Both supervised and non-supervised methods are studied.

The course covers Lasso and Ridge Regression, Trees, Random forests and Boosting, Neural Networks, Support-Vector Machines, Principal Component Analysis and Clustering.

M2 – Economics and Competition Law
MARKET REGULATION IN THE DIGITAL WORLD

This course at the master's degree level was created in 2016. The course discusses recent regulatory issues and competition policy topics related to the digital economy. Lectures cover the following topics: net neutrality, uses of personal data online, bundling in platform markets: economic analysis of the Microsoft and Google cases, news aggregators and their effect on traditional media and the sharing economy.

ECONOMICS OF INNOVATION AND INTELLECTUAL PROPERTY

We introduce the students to a selection of important current issues in the economics of intellectual property (IP). After the introduction to the messy current situation of the IP world and firms' IP strategies, we review important contributions of economics to topics such as licensing, litigation and injunction, settlement, weak patents, patent pool, patent trolls (or NPEs), cross-licensing, standard setting organizations etc. Big data and AI have created a new platform economy and have been transforming traditional sectors. We will try to understand innovation in platform ecosystems and platformization of new and old sectors.

M2 – Data Science for Social Sciences
MATHEMATICS OF MACHINE AND DEEP LEARNING ALGORITHMS

Deep learning has been strikingly successful in recent years as an efficient method to solve supervised machine learning problems. In this course, we will emphasize several mathematical issues involved in deep learning for artificial intelligence problems. We will address, among others, the following topics:

- Introduction to supervised learning (classification and regression): risk bounds, logistic regression, plug-in classifiers, Feed Forward neural networks and back-propagation optimization
- Deterministic optimization algorithms and gradient descent
- Stochastic optimization algorithms and gradient descent
- Global optimization and non-convex problems, stability of local minimizers
- Generative Antagonists Networks

More details on our master's courses can be found on our website.

Business Talks

Lorna Briot

If you would like to join us and take part in a future Business Talk please contact
Lorna Briot, Head of Careers
at *careers@tse-fr.eu*

Throughout the academic year, TSE's Career Service organizes a series of Business Talks open to TSE students. These events welcome a range of speakers from CEOs, executives and alumni. These talks aim to develop their economic culture through fascinating case studies and to encourage them to reflect on a career plan. Many thanks to our speakers mentioned below for sharing their experiences across a wide range of digital matters in 2021.

- December 2 - **Pascale Déchamps,** from the French Competition Authority, spoke about how *"To serve consumers by promoting competition: working at the French Competition Authority"*.

- October 14 - **Shruti Sinha,** Economist at Amazon and Associate Member at TSE, gave a talk about *"Economists in Tech: At the Intersection of Science and Business"*.

- February 25 - **Léa Deleris,** Head of RISK Artificial Intelligence Research at BNP Paribas, presented a conference on Data Science in a Financial Institution: *"What does it mean in practice and what are the key challenges ? A day-to-day life and ecosystem of a data science team within a large financial institutions"*.

Executive Education

An excellent opportunity to exchange thoughts, ideas, and spar with truly outstanding economic thinkers.

Since its creation, TSE has focused on educating future economists and supporting researchers to solve key economic and social issues through collaborative research as well as tailor-made training sessions for leaders and practitioners to go through transformational change.

In 2021, our sessions were conducted online wherein we welcomed participants (both from the private and public sector) from across the globe.

- *March 10:* What's new in Merger control: Theory and Policy
- *June 17:* Algorithms and Competition
- *October 20:* Recent developments in the economics of competition

Participants were able to gain an in-depth understanding of key economic issues such as:

- Evolution of merger control in digital markets
- Relationship between mergers and trade with special attention to acquisitions of strategic companies by foreign players
- Impact of artificial intelligence on the dynamics of competition
- Use of algorithms as screening devices by competition agencies.

10 organizations joined us

40 high-profile international speakers

15 countries represented

+350 participants trained online

Priyanka Talim

Our programs are designed to deliver excellence through a practical and innovative experience. If you would like to conduct a brainstorming session to identify your organization's needs and develop a customized course, please contact **Priyanka Talim**, Head of Innovation at *exed@tse-fr.eu*

TSE Executive Education

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