



TSE MAG

Issue 21
Winter
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Toulouse
School of
Economics

Climate: The next threat

TSE faces the future

Policymakers have rarely been more in need of good advice. With infections resurging this winter, they tread a narrow and treacherous path between the precipice of the pandemic on one side, and an economic chasm on the other. As Victor Gay highlighted in the TSE Inaugural Lecture, the combination of these twin crises may leave scars that take many decades to heal.

In the long run, however, no challenge is greater or in more urgent need of evidence-based action than that of global warming. The Covid-19 crisis has exposed our collective failure to recognise that the health of our bodies, economy, and planet are deeply interconnected. Yet it has also been a reminder that when a collective will exists, everything is possible.

TSE's crisis response is testament to this spirit. Our researchers have adapted admirably, even under the latest lockdown: finding innovative ways to teach and inspire the economists of tomorrow, interacting with the public in lively debates, and maximizing the productivity benefits of collaborating remotely. We are proud of the success of regular webinars and our first online conferences. Difficult circumstances and growing enthusiasm for economic expertise have inspired us to embrace new media and new audiences.

I am deeply honored to be leading the climate team for President Macron's commission charged with finding solutions to the challenges of the Covid-19 era. My own work benefits enormously from the breadth and depth of environmental research in Toulouse, which is very much on display in this issue. Introduced by Jean Tirole's call for a new climate coalition, our special dossier includes a warning by Claude Crampes and Stefan Ambec that Europe's embrace of hydrogen is a risky bet. Following the Volkswagen testing scandal, Mathias Reynaert asks if vehicle emissions standards really work; and Céline Bonnet discusses the challenge of changing our high-carbon eating habits.

We also cherish the memory of the late Emmanuel Farhi, a stellar example to economists everywhere. And as part of our commitment to engage with global decision-makers, we feature interviews with Makhtar Diop on his work as the World Bank's Vice President for Infrastructure, and Google's chief economist Hal Varian.

Wishing you good health in these difficult times.



Christian Gollier,
TSE Director

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Appointments

Macron invites TSE experts to guide Covid-19 response

On May 29, the French President appointed TSE founder Jean Tirole and former IMF chief economist Olivier Blanchard to lead a special commission on ideas for the world after Covid-19. The team of 26 international economists will focus on three major challenges: climate, inequality and demography. TSE director Christian Gollier will lead efforts to respond to global warming. The commission will conclude its work with a report to be published in 2021.

“I am honored and delighted to be part of this commission,” said Jean. “Unemployment, over-indebtedness and purchasing power are crucial concerns, but we also need an overall vision for the future of our society. Thinking with leading economists on how to respond concretely, credibly and effectively to these long-term challenges will be very exciting.”



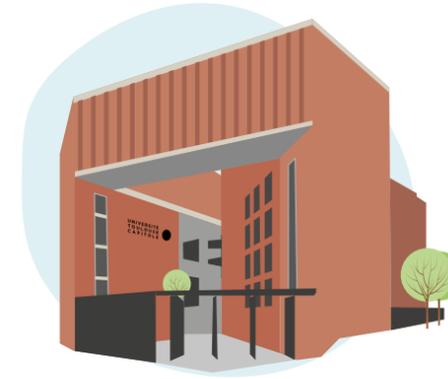
Report on EU-Mercosur trade deal delivered to French government

To evaluate the impact of the EU-Mercosur trade deal on sustainable development, the Prime Minister commissioned a panel of experts chaired by Stefan Ambec, Director of the TSE Energy and Climate Center. Their report finds that opening up markets will bring limited trade benefits but increase deforestation and carbon emissions. “The EU missed an opportunity to use its negotiating power to obtain solid guarantees that meet the environmental, health and social concerns of its citizens,” said Stefan. His panel has recommended substantial amendments and better impact assessments.

TSE founder urges Toulouse to embrace its youth

Jean Tirole recently led an independent commission charged with rethinking the economic future of the Toulouse area in the wake of the Covid-19 crisis. Delivering its recommendations in September, he was cautiously optimistic given the city’s strengths including the untapped potential of its young population, space industry and tourism sector.

News



European Heritage Days 2020

TSE opened its gates to the public for this year’s European Heritage Days. More than 300 visitors enjoyed a guided tour of our new building designed by Grafton Architects, winners of the 2020 Pritzker Prize.

Pierre Dubois joins the The Journal of the European Economic Association as co-editor

The TSE-UT1C professor will become co-editor starting January 2021 of the prestigious journal, covering IO, Health and Development economics.

TSE Public Webinar series

TSE held two public webinars, one in June and one in November on the Covid-19 crisis. In June, Zohra Bouamra-Mechemache (TSE-INRAE) discussed the impact of the pandemic on food and climate, Christian Gollier discussed tackling the climate crisis during the pandemic. In November Victor Gay (TSE-IAST-UT1C) detailed the long term economic impact of Covid-19 while Astrid Hopfensitz (TSE-IAST-UT1C) insisted on the psychological side of the crisis.

Prizes



TSE building receives the Equerre d’Argent 2020

This architectural annual prize, organized by French magazine AMC, rewards the best projects in France.

TSE ranked best in Europe for economics

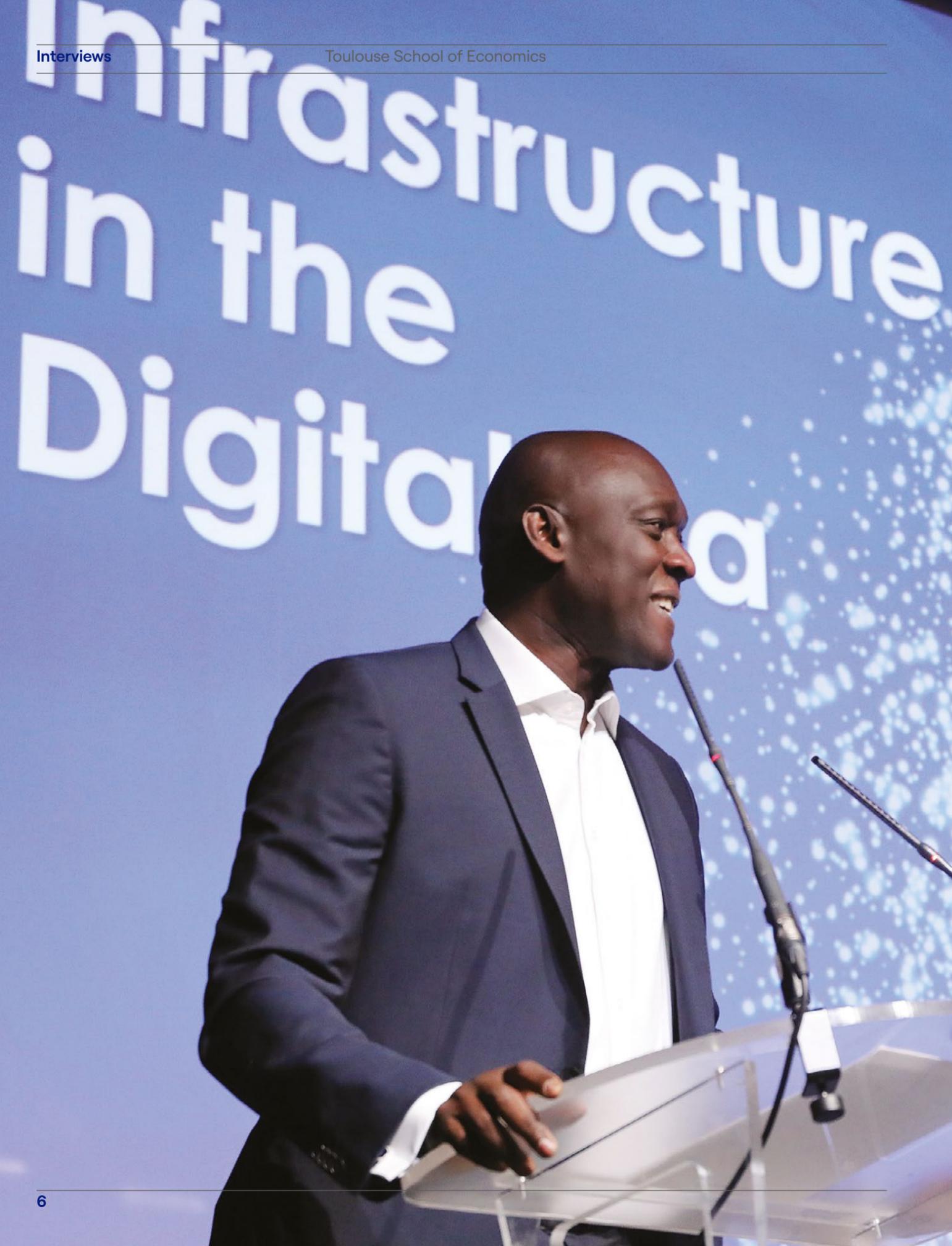
The Academic Ranking of World Universities, commonly known as the “Shanghai Ranking”, has named TSE as the top institution in economics in continental Europe and 22nd in the world.

Wilfried Sand-Zantman joins French gambling regulator

The TSE-UT1C-ESSEC professor has been appointed as one of the nine members of the Autorité Nationale des Jeux (ANJ), an independent authority in charge of regulating gambling in France. It aims to protect the vulnerable and prevent fraud.

Digital Center director receives Antitrust Award

TSE’s Jacques Cremer, along with Yves-Alexandre de Montjoye and Heike Schweitzer, received the prize in the Soft Law and General Antitrust categories for ‘Competition Policy for the Digital Era’, a report written for the European Commission.



“With the COVID-19 recovery, now is the time to accelerate progress towards more sustainability and inclusion”

Makhtar Diop,
World Bank Vice President
for Infrastructure

Jointly organized by TSE and Makhtar Diop, World Bank Vice President for Infrastructure, the first annual Infra4Dev conference took place last December in Toulouse. Here, the Senegalese economist explores the links between infrastructure, digitization and regulation, and reflects on the implications for Africa's future in a time of unprecedented crisis.

Can you summarize your current priorities within the World Bank's Infrastructure Department?

Our goal is to fill what are known as infrastructure gaps, and to do this we must try to increase the level of public investment in the infrastructure sector and, above all, improve the quality of public investment. It is also clear that public resources are not sufficient to make up the shortfall and private sector investment is needed. Finally, our goal is to assist countries in their post-COVID-19 recovery process. The big question is: how to get these actors to help rebuild better and maintain infrastructure? We have a department in charge of this financing, which aims to set up instruments such as purchasing power parities and guarantees in order to attract both national and foreign financing.

Do you have examples of such financing?

Suggested: We focus on developing countries, since this is our core mission. We have seen in the power sector a number of investments in public-private partnership (PPP) and power purchase agreement (PPA) where the private sector commits to sell electricity to distribution companies that are very often public and thus reduce the weight of their CapEx (capital expenditure). Many power plants today, apart perhaps from hydroelectricity, are private sector-led projects. We see in renewable energies such as solar and wind power, many investments made by the private sector. Whether in Ghana, Senegal or Zambia, we are now succeeding in having electricity production provided by the private sector. This is even more interesting

since these investments are in renewable energy sources whose costs have dropped significantly. Solar electricity can be obtained at 3 cents per kWh in Africa, and 8 cents per kWh if the cost of the batteries is considered. These rates are extremely interesting for countries that had very high costs when they imported their energy.

A second element is inter-city transport, especially with toll highways. We have the case of Dakar - Diamniadio in Senegal where the private sector has proposed investments that are passed on through a toll system. We provided guarantees and helped structure the project considering social and environmental issues. Currently, a similar project is underway in Kenya. There is also a lot of foreign investment in the mining sector, especially for materials that make it possible to produce smartphones and other digital products.

Finally, we are committed to the transformation of gas into electricity, as this is the least polluting production method in many countries to meet energy demand. We're trying to work with countries to move from diesel or coal to natural gas and to hydroelectricity.

“The role of the World Bank is to create a link between economic knowledge and know-how on the one hand and policy implementation on the other.”

You were the World Bank’s Vice President for Africa, what is your analysis of the current developments there?

We have a very diverse reality in Africa, with countries that have experienced different growth rates, even if there has been a general slowdown in growth over the last three years with a slowdown in global demand. It is important to know that a significant part of African growth comes from the evolution of the cost of raw materials, to be put in parallel with the growth in China which had a great impact on the demand for these raw materials.

There is also a reflection on the various regulations and governance related to this subject, as well as the repercussions that this will have on these developing countries. Of course, these countries have different lifestyles, but these changes will certainly offer them more significant opportunities for progress. We are seeing a diversification of sources of growth. It can be seen in the digital sector, which is becoming increasingly important and where access to the Internet and services provide other sources of growth. Kenya is one of the interesting cases, with the M-Pesa microfinance system, a real success story in the world of fintech.

These diversifications in some sectors are affecting the evolution and prospects for growth. This implies the need to accelerate and improve investment in education and the quality of education. Some African countries are making great efforts in terms of access to education, but more emphasis needs to be placed on quality. It is therefore a matter of working on the quality of these teachings and investing more and more in the field of science and technology systems. The latest estimate showed that only 22% of African students graduated in computer science, and this affects the overall productivity of economies and the capacity of countries to

process these raw materials. The new challenge facing African countries is to bring down the debt ratio, which has increased significantly in recent years to meet investment needs. These needs are mainly related to infrastructure and social sectors. The needs are not in line with the rate of growth of fiscal revenues. They are growing relatively slowly in relation to GDP. We are therefore faced with significant needs, which are accentuated by the demographic weight in some countries. In addition, considerable investments are being made in the public and private sectors. African countries have had to go into debt very quickly in recent years. It is therefore essential that they take measures to control these debts so that they are sustainable and balanced. These are the main challenges facing Africa in the coming years.

The COVID-19 outbreak, however, has had major impacts on countries with significant Independent Power Producers or toll road concession programs. We can already observe, globally, substantial disruptions over the course of the year. This would result in a more lasting downward trend in revenues of operating PPP projects. Countries vary in their exposure to PPPs: the countries most affected by these impacts are likely to be those with the largest exposure to PPPs combined with the weakest governance environments. A first order measure of PPP exposure is the cumulative unamortized investment in PPPs as a percentage of GDP. This metric can be as high as 10-15 percent of GDP for developing countries in Sub-Saharan Africa such as Ghana and Zambia. This is very much an upper bound, as it provides a crude approximation of the capital at risk if all PPPs were to invoke termination clauses, which is an extreme scenario. To support these countries during this time of crisis, we are focusing on short-term emergency response measures as well as medium-term recovery-oriented measures.

“Solar electricity can be obtained at 3 cents per kWh in Africa, and 8 cents per kWh if the cost of the batteries is considered. These rates are extremely interesting for countries that had very high costs when they imported their energy”

The conference with TSE mixed the views of economists with those of decision-makers. What are your impressions about it?

In my opinion, this type of crossover is essential because the role of the World Bank is to create a link between economic knowledge and know-how on the one hand and policy implementation on the other. For us, when we talk about regulations, one of the places in the world that has the greatest reputation is TSE. Great professors such as Jean-Jacques Laffont and Jean Tirole, who have left their mark on the economics of regulation at the international level, are part of the TSE DNA. It is therefore essential, in my opinion, that we can have this contact and benefit from the expertise that exists at TSE in order to be able to refine our recommendations to countries and create this interface between decision-makers and academics. The World Bank is precisely a privileged place for this.



This series of «Infra4Dev» conferences was initiated this year. I strongly believe in this type of initiative: when I was Vice President for Africa, I also set up a similar series. I had conducted five conferences with academic institutions such as the Paris School of Economics, the University of Berkeley, the University of Oxford and the University of California, where we addressed several relevant and important themes on African development.

“To support countries during the Covid-19 crisis, we are focusing on short-term emergency response measures as well as medium-term recovery-oriented measures”

We are therefore taking advantage of this conference, which brings together several TSE specialists, but also European specialists, to try to help them develop and further orient their work on developing countries. Finally, we have our report on global development, which this year will have data as its theme. There will be a strong component on the digital economy. We would therefore like to take advantage of these meetings to benefit from the possible contribution of TSE researchers to this global report.

We also plan to systematize TSE student exchanges with the World Bank. I am thinking of doctoral students who will be able to spend 3 to 6 months at the World Bank to write an article that will be useful to the Bank but also to their thesis. We also want to encourage TSE graduate students to apply to our Young Professionals Program because we will need a significant number of regulatory economists soon.

‘We take Google’s innovation for granted’

What are your current projects at Google?

I’ve been working on a variety of projects, many of which have to do with policy. I’ve been gathering facts on questions such as the impact of tax or antitrust issues, because a lot of the discussions take place almost at a philosophical level. I’m very much a fact-based person so I’m trying to pull together the relevant data.

Hal Varian
Chief economist at Google



Chief economist at Google since 2002, Hal Varian is also emeritus professor at the University of California, Berkeley, where he was founding dean of the School of Information. TSE Mag caught up with him to discuss the future of economics, innovation, and what it’s like to work at the internet giant.

How do you think AI will impact jobs?

There will be a certain impact of AI on jobs because there are now machines that can substitute for humans in a variety of ways. But a topic that has been left out of the discussion is the coming impact on the supply of labor due to ageing populations. Almost every developed country has a looming demographic crisis. In the US, the labor force is growing at half the rate of the population, and European countries like France, Spain, Germany or Italy have dramatically slowed the growth of their population. That means a reduction of the labor forces. It’s just as bad in Asia: the one-child policy in China had a huge impact on the labor force, and countries like Japan, South Korea are really in big trouble. So my view is there’s not going to be a shortage of demand but a shortage of labor supply, primarily due to the ageing of the population.

What could you tell us about the evolution of Google?

It was really a lot of fun being at Google in the early days because it was a talented group of people that were working very hard. There was a lot of visible progress and if you came

“There’s going to be a shortage in the labor forces, not a shortage of demand but a shortage of supply, primarily due to the ageing of the population”

up with an idea you could investigate it, write the code and release it in a very short amount of time. If you’re a little company and something doesn’t work, nobody notices; but if a big company makes a mistake, that is front-page news. So now you have to get a product review, a legal review, a privacy review, and on and on, to make sure all of these boxes are ticked and that slows things down. If you take 100,000 people and put them together – that’s the size of Google in terms of employees – there’s always going to be something going wrong so you have to spend a lot of time making things run smoothly. That’s why we all think fondly of the old days.

“There is a lot of potential value in collecting data even if it isn’t immediately analyzed because you want to look at the history and use it to get an insight into what is going to happen in the future”

How do you think the European regulation will shape innovation in AI and big data in the coming years?

Google is a leader in developing tools for dealing with large data and also for working on machine learning and artificial intelligence. There’s been some tremendous breakthroughs in the past 5-10 years. Things we take for granted like speech recognition or image recognition, those were big challenges recently and they’ve become part of our daily lives. We’re going to continue to see these kinds of developments over the next decades. It’s not going to be a gigantic change in the ways we do things but it will impact our lives.

Take, for example, autonomous vehicles. We would have self-driving cars already if it weren’t for humans, because the difficulty isn’t driving a car through a city, it’s predicting what these crazy human drivers and pedestrians and cyclists will be doing that raises a challenge.

How will big data and machine learning impact economic research?

It’s very inexpensive to capture data right now and different data sources give you different viewpoints on the

economy. Economists will be able to get a 360 view of what is happening at the city level, national level and global level.

Should we prioritize regulation of data or algorithms?

Like other tech companies, we recognize that regulation is inevitable because these big companies impact the economy. There is a lot of potential value in collecting data even if it isn’t immediately analyzed because you want to look at the history and use it to get an insight into what is going to happen in the future.

If you don’t collect the data, there’s no way to do that. It’s only by collecting economic data that you will be able to better manage the economy.

What is your impression of TSE?

TSE is a fantastic place. I’ve known many of the people here since they were graduate students and it’s really gratifying to me the success that they had here in developing this research center. It’s a highlight – not only of France or Europe, but of the world – in terms of research and insights.

Climate: The next threat

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'We need to build a climate coalition'



“Every international agreement must satisfy three criteria: economic efficiency, incentives to respect commitments, and fairness”

Jean Tirole,
Nobel Prize 2014

The Covid-19 vaccine has demonstrated our societies' capacity for radical, collective action to address global challenges. But the development of vaccines responded to a problem with immediate impact. The fight against global warming is no less urgent, but its delayed impact has led to a large market and political failure. We all have our part to play, says TSE founder Jean Tirole, in urging the international community to prevent global warming from inflicting lasting damage on future generations. Drawing on his book 'Economics for the Common Good', he maps a common-sense path to putting earlier negotiations back on track.

Despite the accumulation of scientific evidence that human actions play an important role in global warming, international action has been disappointing. The Paris agreement failed to create an international coalition for a carbon price in proportion to its social cost. It further failed to address the world shortage of green R&D (only 4% of our R&D focuses on global warming). In sum, it doesn't not take the free-rider problem seriously.

Every international agreement must satisfy three criteria: economic efficiency, incentives to respect commitments, and fairness. Efficiency is possible only if all countries apply the same carbon price. Adequate incentives require penalties for free riders. Fairness, a concept defined differently by each stakeholder, should be achieved through lump-sum transfers. The strategy of voluntary pledges to reduce emissions is another example of countries postponing a binding commitment on emissions to a later date.

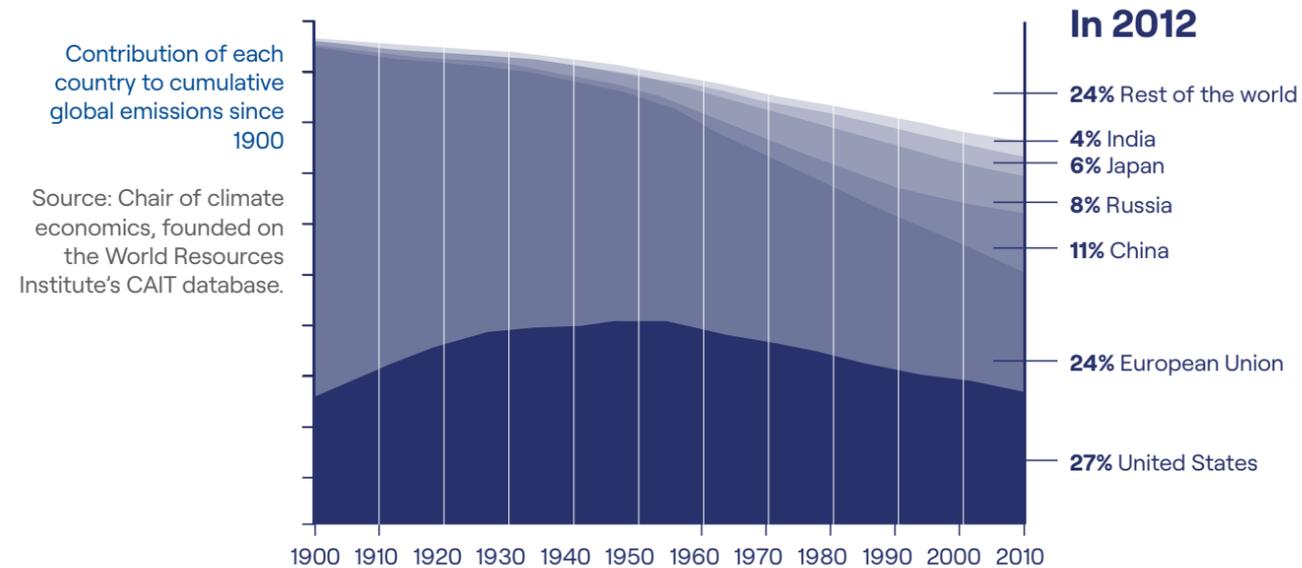
Glimmers of hope

However, we should not fail to mention reasons for optimism. First, public awareness of the problem has grown in recent years, even if the current pandemic may put environmental considerations on the back burner for a while. In addition, more than 40 countries, including some of the most important (the US, China, Europe) have created tradable emissions permit markets. Although they have generous ceilings and very low carbon prices as a result, they demonstrate a

commitment to use a rational policy to fight global warming. Local carbon markets may someday connect to form a more coherent and efficient global market, even if 'exchange rates' will be a thorny issue.

Finally, the sharp decline in the price of solar energy allows us to glimpse economic solutions to the problem of emissions in African and other developing and emerging countries. But all this will not be enough. So how can we build on these dynamics?

Although it is important to maintain a global dialogue, the UN process has shown predictable limits. Negotiations between 195 nations are incredibly complex. We need to create a "coalition for the climate" that brings together, from the outset, the major polluters, present and future. This could be the G20 or a more restricted group: in 2012, the five biggest polluters—Europe, the US, China, Russia, and India—represented 65 percent of worldwide emissions. The members of this coalition could agree to pay for each ton of carbon emitted.



At first, no attempt would be made to involve all 195 countries in the global negotiation, but they would be urged to join in. Coalition members would put pressure on the WTO, and countries that refused to enter the coalition would be taxed at borders. The WTO would be a stakeholder on the basis that non-participants are guilty of environmental dumping; to avoid undue protectionism by individual countries, it would contribute to the definition of punitive import duties.

What can we do?

Simply put, we need to get back on the path of common sense.

1. The first priority of future negotiations ought to be an agreement in principle to establish a universal carbon price compatible with the objective of no more than a 1,5°C increase in average global temperatures. Proposals seeking carbon prices differentiated on the basis of country not only open a Pandora's box, they are not good for

the environment, because the future growth of emissions will come from emerging and poorer countries. Underpricing carbon in these countries will not limit warming to a 2°C increase: high prices for carbon in developed countries will encourage the offshoring of production facilities that emit greenhouse gases to countries with low carbon prices, nullifying efforts made in wealthy countries.

2. Let us substantially increase green R&D efforts, by creating for example a European ARPA-E. And let us provide this entity with a proper governance so as to avoid a failed industrial policy.

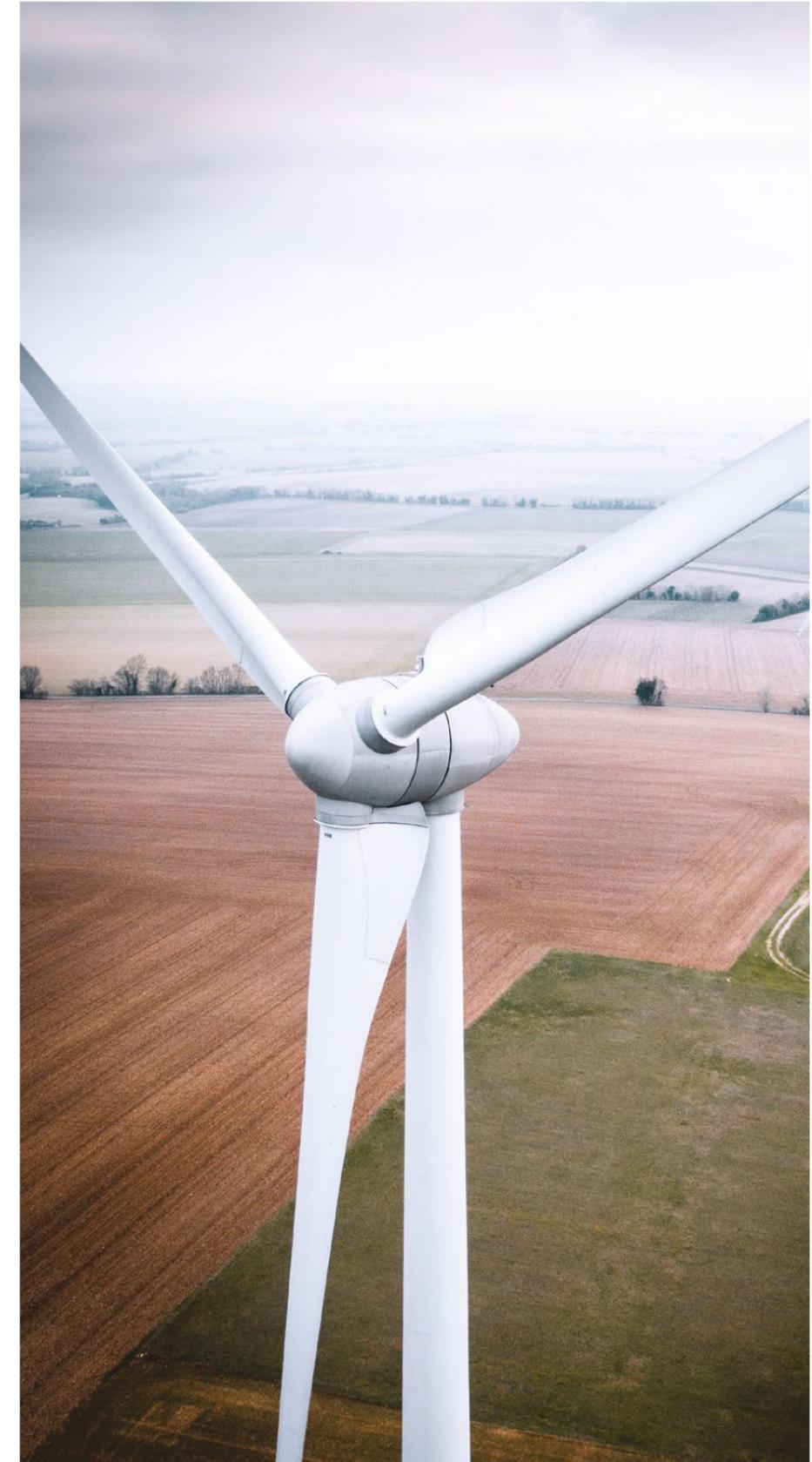
“Local carbon markets may someday connect to form a more coherent and efficient global market, even if ‘exchange rates’ will be a thorny issue”

“Let us substantially increase green R&D efforts, by creating for example a European ARPA-E.”

3. We also have to reach an agreement on an independent monitoring infrastructure to measure and supervise emissions in signatory countries, with an agreed governance mechanism.

4. Finally, let us confront head-on the question of equity. This is a major issue, but burying it in discussions devoted to other subjects does not make the task any easier. There must be a negotiating mechanism that, after the acceptance of a single price for carbon, focuses on this question. Today, it is pointless to try to obtain ambitious promises for green funds from developed countries without that leading to a mechanism capable of achieving climate objectives. Green financial assistance could take the form of financial transfers or, if there is a world market for emissions permits, of a generous allocation of permits to developing countries.

There is no other way forward.



The health of our planet

“The pandemic reminds us that we are all dependent on the earth’s ecosystem. Global warming will alter this ecosystem by fostering the occurrence of extreme events with similar economic and health impacts. It is up to us to act to limit future climate crises. The experience of lockdown has shown that there are solutions for reducing our carbon footprint. The pandemic is also testing our resilience to changes in our ecosystem. It demonstrates that we need to put in place public policies to protect the most vulnerable.”

Stefan Ambec, Director of TSE Energy and Climate Center



“Covid-19 emphasizes the need for well-designed accountabilities to balance protection and the economy. The lesson applies to climate policy, where existing instruments have high hidden costs, even though emissions pricing can be fair if the right recipe is used.”

Dominique Bureau, Representative for the Economic Council for Sustainable Development (CEDD)

Global warming threatens to have far more catastrophic effects than Covid-19. Have we learned any lessons from this pandemic to stave off environmental collapse? Will 2020 be the year the world began to fight back? We asked some leading thinkers for their perspectives.

“For Covid-19 as for global warming: my efforts protect you, and your efforts protect me. In this world of externalities, the equilibrium consists in waiting for others to make the effort, but nothing happens! Private interests are therefore not aligned with the common good, and laissez-faire leads to catastrophe. Restricting our freedoms has been the only solution to manage the current health crisis, but we can do better at solving the climate crisis without resorting to the extremes of ‘degrowth’. The key is a price for carbon.”

Christian Gollier, Director of TSE, author of ‘Le climat après la fin du mois’



“The decline in biodiversity may partly explain the resurgence of zoonotic diseases over the past 30 years, but global warming seems to have no direct link with the current pandemic. However, the pandemic could seriously complicate the fight against global warming. The economic crisis caused by the health situation requires us to deal with short-term emergencies that could be at odds with the need for long-term limitation of global warming. In this context, governments have no choice but to seek a way to combine ecological and productivity benefits. For the cohesion of our societies as well as the future of the planet, it is essential that they succeed in doing so.”

Thierry Pech, Managing Director of Terra Nova, Co-Chairman of the Governance Committee of the Citizens’ Convention on Climate

“The short-run effects of Covid-19 on global warming are really small potatoes; what matters is how this crisis will affect global warming policy. On the positive end, the Covid-19 crisis has made us more aware of our vulnerabilities (together with other climate disasters this year...). On the negative end, strained governments and households might find it less compelling to spend substantial resources on fighting global warming, taking more short-sighted decisions. The effects of limiting investment in cleaner technologies now could be long-lasting, so it is something to keep an eye on and prevent.”

Mar Reguant, energy economist (Northwestern University)



“Covid-19 is a historic opportunity to initiate the structural transformations of society and economy that are essential to reach the goal of zero net emissions. Even if, in the midst of the crisis, the greatest desire of many people is for everything to return to life as before.”

Katheline Schubert, environmental economist (Paris School of Economics)

The food and climate puzzle

Céline Bonnet

TSE economist and Director of Research at France's Agriculture and Environment Research Institute (INRAE)

Our high-carbon eating habits have damaged the environment and now threaten our future. Encouraging more sustainable practices, from the farm to the kitchen table, will require a regulatory recipe with multiple ingredients, says TSE economist Céline Bonnet. But consumers may find it hard to swallow.

Food consumption is responsible for between 15% and 28% of Europe's greenhouse gas emissions. Beef is the biggest culprit, with higher emissions than pork or chicken meat. Extensive production systems can also generate higher greenhouse gas emissions per unit of production, although grazing helps to sequester carbon. The consumption of animal products has implications for land and water use: producing animal feed uses 35% of land resources and 20% of drinking water resources. Livestock farming has other indirect effects on the environment, including soil degradation, air, water and soil pollution, loss of biodiversity, and deforestation.

The standard approach in economics recommends regulation at the level of the polluter, based on the "polluter pays" principle. However, research shows that it would be simpler, more efficient, and fairer for the food industry to regulate consumption rather than production.

"Research shows that it would be simpler, more efficient, and fairer for the food industry to regulate consumption rather than production"

This avoids any problem of measuring the different types of pollution at farm level (carbon impact, eutrophication, acidification, land use, water use, and loss of biodiversity). It also prevents unregulated imports from gaining an unfair advantage over domestic production.

There are three different types of regulatory instruments: fiscal policies, informational and educational tools, and behavioral instruments such as nudges. Fiscal policies are a particular focus of my research. I have shown that a high level of carbon tax (200€/tonne of CO₂ equivalent) on animal products would imply an increase in the price of animal products by 7% to 40%, depending on the type and the piece of meat. This price increase would allow a 6% reduction in greenhouse gas emissions from the purchase of animal products. Fiscal policies will therefore not be sufficient to achieve European targets of a 30% reduction in 2030 compared to 2005. They will have to be combined with other tools.

Information and education policies can reduce the asymmetry of information between producers and consumers on product quality, farming conditions and environmental impact. However, consumers must be prepared to pay for these attributes of the product. Economic research shows that quality is an important criterion for consumers, and some are willing to pay more for it, but environmental concerns are given much less consideration. Studies so far show that it is difficult to change eating habits, especially regarding meat which is perceived as a normal and necessary consumer good and part of the norm of traditional food.

"Fiscal policies must be combined with other tools to achieve European targets of a 30% reduction in emissions linked to animal products by 2030"

Behavioral instruments make it possible to change consumption habits and norms gradually. In France, the Green Monday initiative suggests we avoid meat or fish on the first day of the week, encouraging a simple and gradual transition to meals that have less impact on the environment. Experiments have also shown that if vegetarian options are placed first on restaurant menus, they are more likely to be chosen.

Reducing meat consumption is one of the major challenges for developed countries in the fight against global warming. Public authorities will have to improve regulation while supporting all actors in the sector to shift towards more environmentally friendly practices. Solving the problem will not be easy: many measures will have to be combined to produce significant effects.

"We need to consume less meat to help the climate"



Europe bets on hydrogen

Claude Crampes
(TSE-UTIC)

and Stefan Ambec
(TSE-INRAE)



European governments are risking billions of euros on a bet that hydrogen will gradually become a «clean, safe and affordable» energy carrier. But this may be wishful thinking, say TSE energy experts Claude Crampes and Stefan Ambec, unless there is a significant decline in production and distribution costs.

The energy scene's latest star is unquestionably hydrogen. In June, Germany promised to invest €9 billion in hydrogen technologies, overshadowing the 2018 French plan and its €100 million per year. In July, the European Commission announced its strategy to produce 1 million tons of "renewable hydrogen" by 2024 by increasing the existing 1GW fleet of electrolyzers, mainly powered by coal or natural gas, to at least 6GW using renewable energies. From 2024 to 2030, its target is 10 million tons with 40GW of capacity. The 2020 French recovery plan (Relance France) will invest €2 billion in the hydrogen sector over the next two years, and €7 billion by 2030. Demand will be supported by guaranteed repurchase prices similar to those enjoyed by wind and solar producers, a mechanism that has proven costly but effective for developing production facilities and reducing the cost of these energy sources.

These programs have several objectives: (i) Decarbonize production for industries such as oil refining and fertilizer production that cannot do without hydrogen; (ii) Extend uses to transport, construction, electricity production and manufacturing; (iii) Develop world leadership in the sector. But won't all these billions leak through the holes in a new Danaïdes' barrel?

“Green hydrogen optimists point to the cost of electrolyzers, which has fallen by 60% over the past decade. The European Commission predicts that economies of scale will cut the cost by a further 50% by 2030”

Counting the costs

More than 90% of industrial hydrogen is currently produced by chemical extraction of fossil hydrocarbons, thus emitting greenhouse gases. Hydrogen can also be obtained by electrolysis of water, but the cleanliness of this process depends on the energy used.

Hydrogen has a wide range of uses but distribution costs are high. It corrodes alloys, which can lead to catastrophic failures. It is very bulky in its gaseous state and has very little energy power, so it has to be compressed or liquefied (at -252°C), then distributed and retransformed into usable energy. The efficiency of converting electricity to hydrogen and back to electricity is very low: today, it takes almost 5kWh injected to recover 1kWh.

Renewable hydrogen (2.5–5.5€/kg) is currently not competitive with hydrogen produced using fossil fuels (about 1.5€/kg, excluding the cost of CO₂). Even adding carbon capture and sequestration, the latter comes to about 2€/kg. Green hydrogen optimists point to the cost of electrolyzers, which has fallen by 60% over the past decade. The European Commission predicts that economies of scale will cut the cost by a further 50% by 2030.

Hydrogen vs batteries

Storage: To make electricity/hydrogen double conversion profitable, high-price sales and low-price purchases are needed to cover installation and maintenance costs. On a daily cycle, it can be profitable to meet high peaks in the morning and evening. But longer-term storage in tanks is where hydrogen can outperform batteries as part of the solutions required for a 100% renewable electricity mix.

Transport: The windiest or sunniest places are not necessarily the most populated. Hydrogen and hydrogen-based fuels could make it possible to transport renewable energy over thousands of kilometers between production locations (with low prices) and consumption locations (with high prices). But again, the costs of installing and maintaining infrastructure, together with losses from transmission and double conversion, are higher than those of high-voltage line construction.

Fuel: Whether they use internal combustion or an electric motor connected to a fuel cell, hydrogen engines produce energy and water by combining hydrogen with oxygen from the air. The cleanliness of this conversion is ideal for urban transport. The big advantage of hydrogen over «all-battery» electric

vehicles is the speed of recharging. The disadvantage is the much greater volume and weight of the tank, compared to gasoline and diesel.

High stakes

Electrolyzers are one thing, their use of green electricity is another. The above plans seem to overlook the necessary investments in wind and solar power to separate hydrogen and oxygen, in storage and distribution, and in conversion equipment at consumption points. In France, the supply of nuclear energy to electrolyzers is a decarbonated solution, although certainly not 'green'. But in the long term, the multiplication of renewable production units will create tensions over the occupation of space, both on land and offshore. After supporting renewable energies and electric cars, Germany and France are betting on hydrogen to reconcile decarbonization and technical progress. This is a costly and risky gamble. One of the gains would be technological leadership on an essential energy resource, provided that guaranteed purchase prices do not encourage the development of a low-cost sector outside Europe. But the climate emergency also requires emerging countries to rapidly move away from fossil fuels, and therefore a wide dissemination of decarbonated technologies.

Do vehicle emission standards work?

Mathias Reynaert
TSE-UTIC Research Faculty

Today all major vehicle markets have adopted emission standards to improve local air quality and/or to regulate the production of greenhouse gases. In 2007, the EU announced one of the world's most demanding policies, obliging automakers to cut air pollutants by 18%. Evaluating the welfare impact of emission standards is not easy. It requires consideration of the political environment, the enforcement of the policy, and strategic decisions by firms. In a new paper 'Abatement Strategies and the Cost of Environmental Regulation', Mathias discusses the following responses that firms may adopt:

- **Pricing:** Firms can change pricing to shift the sales mix to vehicles with CO2 emissions below the target.
- **Downsizing:** Firms can sell smaller and less powerful vehicles that are more fuel efficient.
- **Innovation:** Firms can improve the fuel efficiency of their vehicle fleet by adopting technologies that improve the combustion process.
- **Gaming:** Firms may reduce emissions during the regulator's tests but not necessarily on the road. Enforcement of the emission standard plays a role in limiting gaming.

Using a detailed panel of vehicle attributes, prices, and sales for the

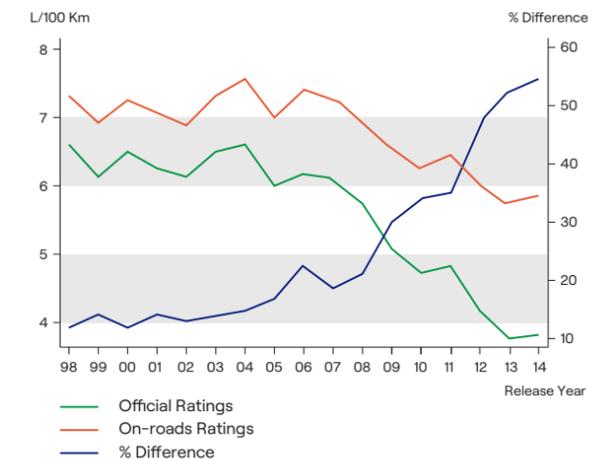
EU market, Mathias finds no evidence of price changes or downsizing in response to the emission standard. Every year, automakers seem to make vehicles more powerful, accelerate faster, and are larger, while emissions do not increase.

The same pattern of technological progress has been observed in the US market. If automakers use these advances to make more fuel-efficient vehicles, firms should be able to comply with emission standards. In the EU market, technological improvements appear to have happened twice as fast after the announcement of the emission standard. However, this is the result of looking at official emission numbers obtained from laboratory tests.

Performance gap

In a forthcoming paper, Mathias and his co-author compare the laboratory ratings, which form the basis of policy, with direct measures of on-road fuel consumption. They construct a data set that tracks fuel consumption and kilometers travelled for a panel of more than 250,000 drivers for 12 years in the Netherlands. Using these data, they estimate the percentage difference between the laboratory test and on-road performance for each vehicle vintage and model.

“Evaluating the welfare impact of emission standards is not easy. It requires consideration of the political environment, the enforcement of the policy, and strategic decisions by firms”



Official and on-road fuel consumption ratings and performance gap

Documents a sharp rise in this 'performance gap' coincident with policy change. Vehicles produced before 2007 show a small, relatively stable performance gap. Vehicles produced after that exhibit a large and rising performance gap, so that the 2014 model-year vehicles have performance gaps above 50% on average. The rise in the performance gap implies that around 65% of the gains in fuel economy since the introduction of the policy, as measured by laboratory tests, are false.

The effects of gaming

What are the welfare effects of emission standards when compliance strategies are technology adoption and gaming rather than price changes? And why did the market respond in this way to the EU standard?

Because of technology adoption, firms' costs increase. The increase in costs reduces profits and consumer surplus. Because of gaming, the reductions in actual CO2 emissions are just 5% instead of the 18% target. The combined value of emission savings and consumer and profit losses is negative. However, when Mathias considers two additional non-targeted welfare effects, he finds the emission standard to have a small positive impact as it also reduces other externalities, such as local pollution, congestion, and accident risk.

Political influence

What if the EU designed the regulation differently? Using his model to analyze alternative market outcomes, Mathias focuses on the standard's attribute base and lack of enforcement. Attribute basing makes the emission target dependent on vehicle weight. Firms selling lighter vehicles face

a more stringent target. He finds that attribute basing makes it much costlier to lower emission by changing prices. Firms have to distort prices more to reach the target because there are fewer vehicles to which firms can shift sales. If the regulation has a flat target without attribute basing, firms opt for changing prices together with some technology adoption. The flat target reaches actual CO2 emission reductions of 11%, much closer to the 18% target.

The introduction of attribute basing redistributes the incidence of the regulation between French, Italian, and German producers. Mathias' simulations show that the positions of the national governments are in line with the interests of their domestic firms. The French and Italian governments were in favor of regulation without attribute basing, while Germany lobbied for a steep attribute design.

Enforcement failure

Gaming is also a product of the political environment. A recent evaluation by the European Parliament blamed enforcement failures on car-producing member states. A better test procedure would mean that official and actual emissions are more similar.

With more enforcement, firms have to adopt costlier technology, and this increases consumer prices. But enforcement would have led to much higher CO2 and other externality savings, and the policy would have been welfare improving.

This research demonstrates that emission standards can be an unwieldy policy tool. The European political environment led to failures in both the design and enforcement of the emission standard that caused startling increases in strategic gaming.

“Vehicles produced after 2007 exhibit a large and rising performance gap, which implies that around 65% of the gains in fuel economy, as measured by laboratory tests, are false”

In memoriam Emmanuel Farhi

One of France's most beautiful minds has passed away, aged 41. TSE founder Jean Tirole pays tribute to the brilliance of a long-time friend and close collaborator who dedicated his career to improving public policy.

Tenured at Harvard only five years after his PhD at MIT, Emmanuel Farhi was the best macroeconomist, and undoubtedly one of the best economists, of his generation. As an economic theorist clearly on the Nobel track, he transformed the theory of taxation, macroeconomics, and international finance.

Emmanuel was born on September 8, 1978 in Paris. His father, André Farhi, was also an economist and his mother, Danièle Debordeaux, a social policy specialist. He was an outstanding student. Ranked first at the age of 16 in the French high school competition in physics, he could have become a physicist. The assistant of Cédric Villani, 2010 Fields medalist, he could have become a top mathematician himself. I could equally have envisioned him a startupper or a top civil servant; indeed, he long hesitated to continue his career within the corps des Mines, the elite French civil-service corps. But reading Paul Samuelson's text convinced him that economic ideas are an alternative route to making this world a better place, and so he opted to study for an economics PhD at MIT.

His scientific approach is characterized by four traits. First, Emmanuel was unabashed about being a theorist. While he welcomed the data revolution, he believed in the power of ideas. And the realm of ideas was his kingdom. He felt that,

while facts are important, they need a framework to become compelling. Theory further supplies the normative structure, that enables the move to policy recommendations, which were central to his career choice. In this respect, as in many others, Emmanuel was the worthy heir of the founders of the Econometric Society: When in 1930 the likes of Irving Fischer, Ragnar Frisch, Joseph Schumpeter, Divisia, Roy, Hotelling or Keynes founded the society, they aimed at unifying theoretical and empirical approaches and at "creating a society for the advancement of economic theory in its relation to statistics and mathematics". Second, although Emmanuel loved mathematics and was as proficient at it as any in the profession, he was not blinded by the tool. The elegance of his models was at the service of making ideas accessible, not of demonstrating technical prowess.

The third permanent trait was doubt, the DNA behind his research. He was distrustful of fads, certainties and preachers. He wanted to avoid the mistakes of the true believers. He was agnostic and let his science take him wherever it would lead, perhaps in unexpected directions. As a macroeconomist, his work can probably be best described as Keynesian, although he did not really care about labels. Again, not by falling into the trap of thought-hindering prior beliefs, but by

analyzing the conditions of Keynesian economics' validity and its limits. His pathbreaking work made explicit the microeconomic imperfections at the root of macroeconomic failure, so as to build a normative analysis and thus formulate economic policy recommendations.

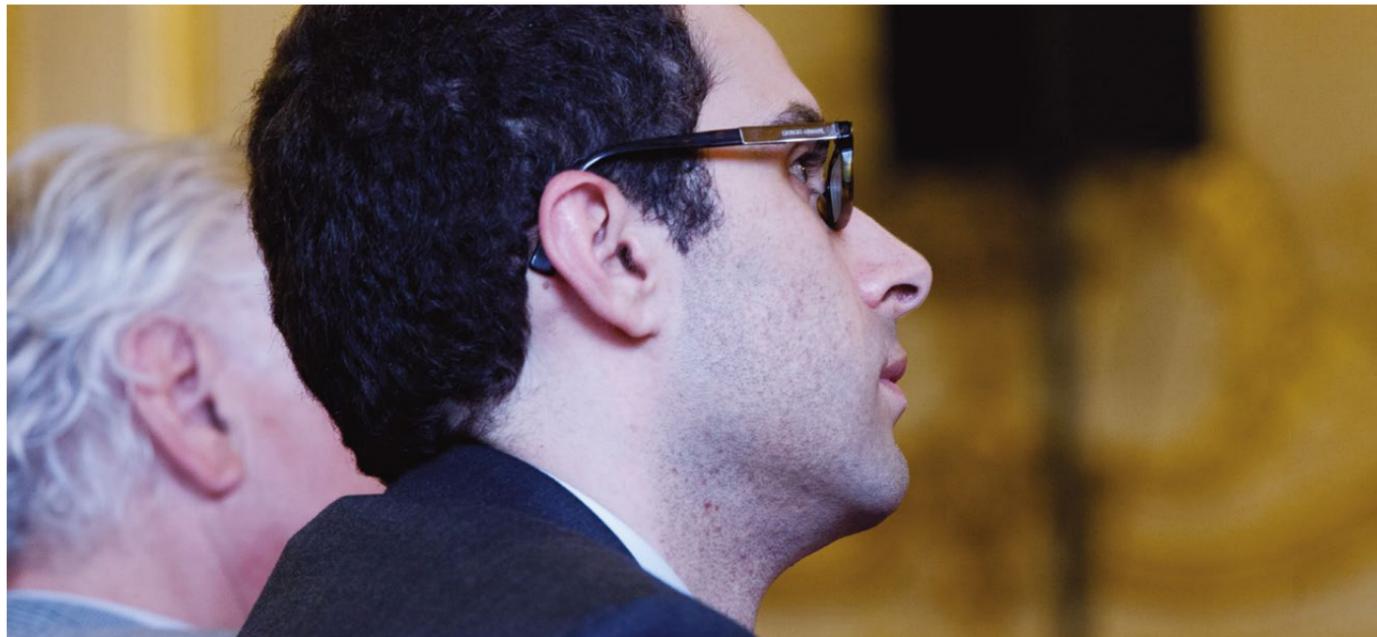
"His 2006 PhD conceptualized the consequences of a shortage of safe assets and the resulting inflow of liquidity to the United States. This imbalance was a harbinger of the 2008 crisis"

The fourth trait capturing Emmanuel's research is patience. In an interview given in April, and taking his recent work on value chains with David Baqaee as an illustration, he emphasized that good research requires a sustained effort (he invited the French journalist to a rendezvous in a few years); and that communicating this research calls for being transparent on empirical uncertainty and candid about the limits of our knowledge.

Jean Tirole,
TSE honorary chairman

When contemplating what he had already achieved by the age of 41, one cannot help experiencing a sense of huge scholarly loss, shuddering at the thought of the missing ground-breaking work that will never happen. I cannot do justice to the breadth of his contributions, and I will content myself with a few remarks.

In collaboration with Ricardo Caballero and Pierre-Olivier Gourinchas, his 2006 PhD conceptualized the consequences of global financial imbalances generated by a shortage of safe assets in high-savings countries and the resulting inflow of liquidity to the United States. This imbalance was a harbinger of the 2008 crisis, so much so that it contributed to the real estate boom and the increase in securitization in the United States. With Ivan Werning, Emmanuel also laid down in his thesis the foundations for a progressive taxation of wealth and capital in order to build a reasoned debate on a very sensitive subject. The first sentence of the article says it all: «One of the biggest risks in life is the family you are born into.» These authors have also improved our understanding of the dual role of taxation as a redistributive tool (from the richer to the poorer) and as social insurance (from the active to the unemployed, for example) made necessary by the heterogeneity of individual trajectories.



“Emmanuel was always a creative and rigorous collaborator in his quest for the common good, and his generosity, humor and communicative cheerfulness made him a dear friend”

After his PhD, Emmanuel went on to publish a series of articles that transformed Keynesian macroeconomics. He notably focused on slow price adjustment, the difficulty for the central bank to bring nominal interest rates below zero when cash guarantees a steady nominal value, the solvency constraints of banks and companies, the liquidity available in the economy, and (with Xavier Gabaix) economic agents' behavioral anomalies. His work, which will continue to be relevant in the post-Covid economy, had a sole purpose: contributing to the common good and improving our economic policies.

Emmanuel notably came up with the idea of using fiscal policy to lower real interest rates when the central bank can no longer adjust nominal rates downwards: an increase in VAT recreating some inflation, accompanied by a decreasing trajectory of labor taxes to neutralize the impact of this consumer price adjustment on firms' pricing response. Very technical for the layman, but innovative ideas to guide public policy, which only deep thinking can provide.

His insatiable curiosity then led him to the foundations of international finance. His work with Matteo Maggiori focused on a world in which risk-free assets, one of Emmanuel's favorite themes, are provided by one or more reserve countries. This work illustrates Emmanuel's ability to capture in a very simple model the essence of an important issue not previously understood. In the «Triffin Dilemma», a country – say, the United States, whose dollar has long served as a reserve currency – caters to an investment demand from investors across the rest of the world. Providing the liquidity demanded abroad when needed may lead to a risk of sovereign default and

undermine confidence in its currency; but if the dominant country does not provide that liquidity, its currency may be overtaken by another currency. Emmanuel and Matteo analyzed the possibility that a multipolar world be more unstable than a world with a single reserve currency, reconciling the Keynesian stance with that of financial stability.

With his former student, David Baqaee, Emmanuel had been working recently on exciting new methods. They aimed to analyze macroeconomics as a network of interacting industries and to see how economic shocks have cascading effects, with implications such as the tripling of the oil shock impact in the 1970s, or the current devastating economic effects of the coronavirus pandemic.

I have had the privilege of working with Emmanuel since his doctoral years. We began with the link between liquidity and financial stability: first analyzing the consequences of financial bubbles for economic booms and recessions; then working on the idea that the high level of short-term bank debt prior to 2008 was an equilibrium

herd behavior forcing central banks to implement monetary rescues. Both studies called for macro-prudential regulation, which has been implemented over the past decade. We then analyzed the vicious circles (or doom loops) created by the mutual financial interdependence between banks and their sovereigns, a major current concern in Europe. More recently, we have stressed the need for sound policies to deal with the growth of shadow banking. In recent months, we were working on «monetary industrial policy», focusing on the strategies of countries such as the United States and now China to attract savings and economic activity.

Emmanuel felt that he had chosen a wonderful occupation; he loved his work, his colleagues and his students. Yet, he thought we could do better collectively: take better care of students and junior faculty; be less competitive; listen more to others; show more respect and interest for those who work in different fields and with different approaches; restrain from using the media and the social networks to arouse interest in one's work prior to peer validation. It is true that our desire for recognition, which is human and a key motivator for accomplishment, sometimes grows into narcissism and distracts us from what we are meant to serve, science. We are all aware of our individual and collective shortcomings, but Emmanuel was more mindful than most of us about the need to strike the right balance between self-interest and other-regarding behavior. With his meritocratic upbringing, he valued hard work and expressed outrage at the little arrangements and self-promotion that plague any profession, including ours.

Those reflexions about our scientific duties, which he shared amicably with his friends over dinner, were not meant to take the high moral ground; that was definitely not his style. Most importantly, he implemented his standards as a colleague and a transmitter of knowledge. He

could talk enthusiastically about his own work without ever overselling it, and only after listening to his colleagues' own research. He was very kind to students and junior faculty. Nicolas Werquin, a young TSE researcher, accurately summed him up: “Emmanuel was a real role model for me. I of course admired his extraordinary intelligence and his depth of mind whenever we talked about research, but also the attention he paid to young researchers, his humility, generosity and kindness.”

Emmanuel never stayed in his ivory tower. Member of the French Government's Conseil d'Analyse Economique from 2010, he was involved in French intellectual life. A few hours before his death, he took part in a meeting of the French president's “commission of experts on the major economic challenges» which Olivier Blanchard and I have the honor of chairing. His intellectual qualities and his always well-argued dialogue made him a much sought-after advisor to public decision-makers, central banks, and other institutions in France and beyond. He actively advised the Banque de France, which awarded him a prize in 2013.

“Farhi” in Arabic means “joy”. And, beyond the gentle melancholia that one can discern in some of his pictures, joyful he was; he could talk passionately for hours about politics, arts, literature, movies or good food”

Emmanuel remained very close to France, where he returned as often as he could. He appreciated his home country's culture and art of living. A lover of French poetry and literature, he was very sociable and full of humor. A pure product of the French meritocratic republican

school, he was also committed to the scientific life of his country. He came to TSE several times a year, sharing his passion for economics with our young researchers and students. He sat for a long time on TSE's scientific council and was a member of its board of directors. He organized numerous conferences in France and in Europe, such as a very successful one in September 2019 at the Central Bank of Luxembourg with the world's leading experts on the international monetary system.

Since the fatal day of July 23, I have received many messages about Emmanuel from people from different horizons- economists, former classmates, childhood friends, other friends, students. These messages emphasized that with all his talent, Emmanuel could have been more than full of himself; and that instead he always remained modestly attentive to others.

«Farhi» in Arabic means «joy». And, beyond the gentle melancholia that one can discern in some of his pictures, joyful he was; he could talk passionately for hours about politics, arts, literature, movies or good food.

Emmanuel was a wonderful human being, and having friends like him is what gives us joy in our professional life beyond the sheer pleasure of research and teaching. For those of us who have had the privilege to have known him, it is hard to imagine a seminar or a conference without him, a dinner without his smile and laugh, and the loss of his support, insights, and friendship.

My thoughts go out to Emmanuel's mother, Danièle Debordeaux, his partner Micol, his family, as well as to all his students, collaborators and the whole scientific and professional community. We have lost an unparalleled thinker and a great human being. Let us do our best to keep his memory alive and to focus on remembering his talent, his intellectual legacy, his mentoring, and the good times spent with him.

What can history teach us about Covid-19?

Victor Gay
TSE Research Faculty

Epidemic risks were almost part of everyday life until very late in the 20th century. The Black Death probably killed around half of the European population. The Columbian Exchange wiped out nearly 90% of the Amerindian population. Even in 19th-century New York, there was some kind of epidemic crisis every decade or so. But in terms of its initial spread, rate of transmission, and severity, the 1918-1919 influenza is the natural historical counterpart to today's health crisis.

“The influenza pandemic was more deadly in locations with poor health, income, and air quality. This suggests that Covid-19 is unlikely to be a leveller: if anything, it will aggravate socioeconomic disparities”

Influenza in 1918-19

Focusing on US cities, Clay et al (2019) investigate why influenza hit some areas harder than others. Using infant mortality, illiteracy, and proximity to coal-fired power plants as proxies, they show that health and economic conditions, and environmental pollution,

The Covid-19 crisis is a unique combination of two daunting challenges, says economic historian Victor Gay. Lockdown restrictions, triggered by a health crisis, have themselves created an economic crisis. How will these crises interact? As the world faces this critical juncture, his TSE Inaugural Lecture argued that we have much to learn from catastrophic events in the past.

had an important impact on the distribution of excess mortality. Further research across the world has found that influenza was more deadly in locations with poor health, income, and air quality. This suggests that Covid-19 is unlikely to be a leveller: if anything, it will aggravate socioeconomic disparities.

Comparing the 1901-1929 growth trajectories of 43 countries, Barro et al (2020) find that a 1 percentage point increase in flu death rates was associated with a 3% fall in real GDP per capita. Overall, the pandemic represented a 6% decline in real GDP per capita. This is slightly less than what we expect from Covid-19. Other studies looking at medium-run effects in Italy and Denmark find that there was a recession but it was broadly over by the early 1920s.

Is there a health-economy tradeoff?

During the 1918-1919 influenza pandemic, non-pharmaceutical interventions (NPIs) in the US included school closures, quarantines, and bans on public assemblies. Correia et al (2020) find that such measures were quite efficient in flattening the mortality curve. High-NPI cities experienced a 45% decline in peak



mortality relative to the mean. Looking at manufacturing jobs and bank assets, Correia's study finds little evidence that NPIs hurt the economy. By reducing transmission and mortality, NPIs may even have boosted the economy by allowing more people to return to work. But the analysis is not clear cut. For example, limited NPIs might have been very efficient in protecting prime-age workers, for whom the influenza was much more deadly than Covid-19.

Long-term scars

In his "fetal origins" study, Almond (2006) finds that Americans born towards the end of the 1918-19 epidemic suffer from weaker socioeconomic outcomes many decades later. The 1960-1980 disability rates, high-school dropout rates, and income of those who were in utero during the influenza pandemic suggest it had lifelong scarring effects. These findings are supported by subsequent studies in Taiwan, Japan, Sweden, Switzerland, and Brazil. A possible explanation is that parents may have reallocated resources toward healthier siblings. Influenza may have had many other long-term effects. Studies in

Scandinavia appear to show a drop in fertility during the pandemic, followed by a baby boom.

The Great Depression

To understand today's economic challenges, the Great Depression may be a more useful point of comparison. Many studies show long-run scarring effects through in utero exposure to income shocks in 1929-1930.

Moulton (2017) compares the income in 1940 of those who entered the labor market before and after 1930. He finds 15% earnings penalties for the less-educated in the hardest-hit states. Recent research suggests this long-run scarring also created occupational and residential displacement for younger people, especially in rural areas.

More recently, research in the US suggests that people who entered the labor market after the global financial crisis (2009-2015 entrants) have 2-3% lower employment rates compared to pre-crisis entrants. Only 2009 entrants have lower earnings (2%), however, so employment scarring may be more persistent than wage scarring.

Lessons from the past

We must be modest about the limitations of historical comparisons; today's context is very different. For instance, in 1918-19 there was much less room for strategic choices about education. School closures and other NPIs were less stringent and disruptive; the standard of education and its returns were much lower.

The impact of Covid-19 on gender inequality is a big problem today, especially for working mothers, but in 1918 female labor force participation was much lower.

Nevertheless, the influenza pandemic and the Great Depression offer important lessons. If nothing is done, any health-economy tradeoff will be especially acute in the current context.

People with low socio-economic status – often women and minorities in high-contact jobs – compound many risks. Young jobseekers will be hit particularly hard by the economic downturn. These groups will together bear a disproportionate burden of the Covid-19 crisis, which may inflict scars that last for generations.