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Collective solutions, forged in crisis

The Covid-19 crisis presents grave risks for the fight against climate change. Overwhelmed by the health and economic crisis, governments and citizens may be left without the resources, motivation or bandwidth for making sacrifices to curb global warming. And yet the pandemic has also demonstrated the great feats of coordination that can be achieved when we decide to work together.

TSE director Christian Gollier is leading the climate team for an expert commission that President Macron has charged with finding solutions to the challenges of the Covid-19 era. Toulouse researchers have been energized by these challenges, engaging intensely in public debates. Our first online conferences this summer reached new audiences and academics are reaping the productivity benefits of working online. Through the TSE Energy and Climate Center and its partnerships, our economists draw on invaluable interactions with decision-makers and industry leaders, sharing and developing ideas, tools, and analysis.

In this newsletter, TSE Energy and Climate Center director Stefan Ambec discusses his report to the French Prime Minister on the EU-Mercosur trade deal and its threat to Brazilian rainforests. Research by Stefan Lamp reveals the considerable gains to be made by reallocating incentives for renewable energies such as solar power. And in the wake of the Volkswagen testing scandal, Mathias Reynaert has produced striking evidence that strategic ‘gaming’ of EU emissions standards is widespread. We are also proud to feature an interview with one of TSE’s recent PhD graduates, Filippo Maria D’Arcangelo, who joined the Economic Directorate at the OECD last September to focus on green growth.

We hope that the pandemic has increased awareness of the interdependence of our economies and ecosystems. TSE researchers are committed to exploring and understanding such relationships, to inform our collective decisions about the future of the planet. The stakes could not be higher.

Stay safe and keep well

Claude Crampes

TSE professor emeritus



News

EU-Mercosur: A green trade deal?

The European Union and Mercosur agreed in principle on a trade deal last year, after two decades of negotiations. To evaluate its impact on sustainable development, the French prime minister commissioned a panel of experts chaired by Stefan Ambec.

Here, the head of TSE's Energy and Climate Center outlines their findings that opening up markets will increase deforestation and carbon emissions, as well as their recommendations for addressing such threats to the environment.

Why do you describe the EU-Mercosur deal as a missed opportunity?

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. The Agreement is essentially a trade liberalization agreement that also incorporates facilitated access to government procurement and provisions on trade in services. Unfortunately, its provisions concerning respect for the precautionary principle, compliance with the Paris Climate Agreement, and recognition of European preferences with regard to environmental and health standards, labor standards and animal welfare preferences, offer relatively fragile guarantees.

From a European point of view, implementation of the Agreement is likely to lead to trade benefits that will have a low impact on the real income of European citizens. Some sectors (mainly industry and services) will benefit; others (mainly agriculture and agri-food) will suffer from competition with Mercosur countries. The expected commercial gains should also be put into perspective, given the significant presence of European direct investment in Mercosur industries (especially car manufacturing). Mercosur commitments to open up public procurement markets are likely to open up significant opportunities for European companies.

For agricultural products, liberalization will benefit certain EU sectors such as wines and spirits, cheese, and infant preparations. However, the Agreement will increase imports of beef, ethanol and honey from Mercosur countries, which could weaken European producers. Provisions on ethanol will also reduce outlets for European sugar. The bilateral safeguard clause to protect producers of sensitive agricultural products is welcome but its effectiveness is questionable.

The Agreement may increase sanitary risks and threaten standards. Here, too, it represents a missed opportunity to introduce requirements linked to production methods, in the interests of guaranteeing public health, respecting the concerns of European consumers (particularly in terms of the environment and animal welfare) and ensuring fair trade.

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TSE Energy & Climate Center Director Stefan Ambec (right) presents his report on the EU-Mercosur trade deal to French Prime Minister Jean Castex in September.

How will the deal impact the environment?

With regard to deforestation, the report focuses mainly on the pressure on forest and savannah areas in Mercosur countries, combined with an increase in their beef production as a result of the Agreement's partial opening of European markets. This increase accounts for only 2% to 4% of the annual volume of production in the region. However, deforestation is continuing or even accelerating, and beef is one of the main causes. Regulatory constraints in Brazil on agricultural expansion at the expense of exceptional ecosystems are strong but not sufficiently enforced. Likewise, the guarantees offered by existing sustainability initiatives and non-tariff clauses do not rule out the risk of additional beef exports to the EU being associated with deforestation.

Even if the increase in beef production could in theory be absorbed in the pasture lands by increases in livestock productivity, given the lack of regulation enforcement, the risk of deforestation cannot be excluded. We calculate that the additional pasture area needed to meet this increase in beef production would lead to a 5% acceleration of annual deforestation during the six-year period provided for in the Agreement for tariff reduction. This does not take into account the additional areas of crops needed to feed livestock and possibly to grow sugar cane.

This computed risk of deforestation has a high impact on the additional greenhouse gas (GHG) emissions attributable to the Agreement. The Sustainable Impact Assessment (SIA) mandated by the European Commission projected that it will produce between 4.7 and 6.8 million tonnes of CO₂ equivalent. Compared to the economic gains, the cost of this increase in GHG emissions is lower even with a social cost of carbon as high as €250 per tonne of CO₂ equivalent (the value recommended to the French government by the Quinet report for the 2030 emissions). Hence, the economic gain seems to more than offset the climate costs. Yet, this SIA, which is based on a computable general equilibrium model, does not take into account land use and thus deforestation. If we add the emissions generated by our estimate of the risk of deforestation, the result of the cost-benefit analysis is reversed: climate costs become higher than economic gains. This is true even with a social cost of carbon as low as €50 per tonne of CO₂ equivalent (the value in the Quinet report for 2020).

The Agreement also fails to include any effective measures for the implementation of the Paris climate commitments. It provides only for a specific dialogue mechanism. This is better than nothing, but it is yet another missed opportunity to encourage both sides of the Atlantic to face their responsibilities to future generations.

What are your key recommendations for a greener trade deal?

When it comes to evaluation, we need to rely on a land use model to take into account the impact of the Agreement on ecosystems and on emissions from deforestation. The emissions from international transportation attributable to the Agreement should also be assessed.

We also recommend that the definition of agricultural products include specifications such as origin or production method. One of the criteria could be not to contribute to deforestation, like for instance the moratorium on soya and the efforts to certify beef from "sustainable beef farming" set up by Brazilian supermarkets. Generally, it would be useful to improve the labelling of products in order to inform the consumer better, and to strengthen traceability.

The enshrinement of climate obligations in EU trade instruments should aim to raise them to the level of core commitments. One option is to link the tariffs applied to some products to compliance with countries' commitments in the Paris agreement. Concretely, it means suspending the liberalization of beef meat until the 1965 Forest Code is enforced by the Brazilian authorities. The evaluation of the fulfilment of these commitments could be based on progress assessment reports in the framework of the dialogue forums included in the Agreement. Trade-related environmental measures should be part of future trade deals negotiated by the European Commission. This idea is in line with the carbon border adjustment mechanism that forms part of the Commission's Green Deal.

FURTHER READING See the [full report](#) in French; or a [summary](#) in English.



French President invites TSE director Christian Gollier to guide climate response

The Covid-19 crisis shows us that when a collective will exists, everything is possible.

On May 29, French President Emmanuel Macron appointed TSE founder Jean Tirole and former IMF chief economist Olivier Blanchard to lead a special economic commission working on ideas for the world after Covid-19. The team of 26 international economists will focus on three major economic challenges: climate, inequality and demography.

TSE director Christian Gollier will lead efforts to respond to climate change. *"The Covid-19 crisis shows us that when a collective will exists, everything is possible,"* he said. *"On the basis of this experience, the Commission will work on the best way to coordinate individual and entrepreneurial wills in order to massively reduce our greenhouse gas emissions before it is too late."*

The role of the Commission is to propose an analytical framework based on economic science, from which it will make recommendations for more effective policy solutions. The Commission will conduct its work in complete independence, and will conclude its work with a report to be published in December 2020.



Céline Nauges is appointed Editor of the European Review of Agricultural Economics



Céline Nauges is research director at the French Institute for Research in Agriculture and Environment (INRAE) and member of the TSE Environmental Economics and Natural Resources thematic group. Adding to advisory roles at the OECD and the World Bank, she is now editor of the European Review of Agricultural Economics, which publishes theoretical and applied work on a wide range of topics including agricultural production, food, trade, rural development, and use of natural resources (including bio-energy).

More information available on the [website](#)



Portrait

Filippo Maria D’Arcangelo

As a student at TSE, Filippo studied how to use economic policies to manage common resources, with applications to the environment, agriculture and climate change. Since September, he has been advising the OECD on economic policy, with a special focus on green growth.

How did you become interested in studying carbon markets?

Many countries have addressed the threat of climate change by asking firms to pay for their atmospheric emissions, in order to curb their pollution. In my latest research, I study the (often unexpected) ways in which firms have responded to these interventions. I find that manufacturing firms have adapted and innovated their productive processes, as a consequence of the introduction of carbon markets, ultimately becoming more efficient. In the context of the European carbon market, I also study its effect on firms’ international investment decisions.

Climate change is one of the most pressing challenges facing humanity. As economists, we understand the importance of well-designed policies in reconciling economic development with long-term sustainability. My research aims at providing evidence-based policy recommendations to ensure that climate change is addressed, while economic activity is preserved.

What do you hope to achieve in your new role?

In September, I joined the Economic Directorate at the OECD. I am involved in the analysis and study of economic policies for the OECD member states and beyond, with a special focus on green growth. This opportunity will bring me to the forefront of policy research, putting me in a position to influence national and international policymakers.

Global problems, such as climate change, need to be addressed at a coordinated, supranational level. The OECD is in the perfect position to do this, because of its international outreach and authoritative role. It will be my continuous effort to strengthen the empirical and analytical research the OECD pursues in support of its policy recommendations.



How has your time at TSE prepared you for your new role?

TSE can count on exceptional resources that are invaluable for a policy-interested economist such as myself. First, its PhD program is rooted in excellency and the whole school strives to provide its students with a wide array of technical tools. Second, TSE has gathered and maintained a very wide and diverse community around its researchers. Other research institutions, the private sector, and international organizations contribute frequently to this community. As a PhD, I was grateful to be continuously exposed to ideas from diverse perspectives by means of conferences, seminars and workshops. TSE has internationally renowned researchers, with a specialization in environmental and climate change economics. I could count on the expertise and feedback of the very active environmental group when working on my thesis.

What is the role of economists in these challenging times?

It is the duty of economists to maintain their efforts in providing answers which are rooted in scientific reasoning. In time of pressing crisis, there is a strong temptation to give in to oversimplified reasoning and erroneous solutions. Economists have perfected instruments to estimate the causal impacts of public policies and have an informed view on which of them work and how. It is thus our duty to guide the public discourse, providing solutions that are effective, efficient and equitable.

The response to global crises, such as the climate crisis or the current Covid-19 pandemic, have often been unilateral. In the absence of coordination, national interests prevail in a scenario similar to the “Prisoner’s Dilemma”, where the common good is abandoned for individual interests. Economists working in international institutions such as the OECD can play a crucial role in fostering the cooperation needed to overcome global crises.

How is Covid-19 impacting the fight against climate change?

While the number of victims tragically increases, we also experienced an improvement in environmental data. This results from the fall in economic activity as many countries strengthened lockdowns, but also from changes in the way we work, consume and produce. It is not clear yet whether any of these effects will be persistent but the question arises as to whether a similar radical transformation could be enforced to tackle climate change. On the one hand, this crisis shows us that innovation, technology and ingenuity can contribute a great deal to help us to adapt and overcome difficulties, while employers and employees adopt new solutions for their daily work. Since these changes have occurred after the lockdowns, it also shows that it is hopeless to expect any dramatic change to happen on its own: coordination should be enforced with the right policies. On the other hand, the statistics show the immense economic cost of restricting economic activity and we are heading towards a new economic crisis. We also observe how, when we are forced to adopt drastic policies such as the lockdown, the burden is not equally shared.

With this tradeoff in mind, there are two false ideas common to the Covid-19 pandemic and climate change. First, denial can be incredibly dangerous: in the first weeks of the pandemic, its seriousness was underplayed and this has cost time and thousands of lives. If the public is deaf to the scientific community, a few discordant voices can pollute the debate and favor inertia to protect personal interests at the cost of the common good. Second, the message that a reduction of economic development is inevitable, or even desirable, is equally damaging. We are just at the beginning of this crisis, yet people are losing their jobs, their firms and their means for survival. This is evidently not desirable, but it is also not inevitable. Our ability to adapt and innovate will eventually help us through this downturn, while the state should intervene to compensate those who are most affected.

Do you have any career advice for future TSE students?

An important component of my PhD life is that I always kept engaged with diverse environments and people. As academics, we want to establish a flourishing network with peers all over the world, to disseminate and share ideas. It is also important to participate in outreach with public institutions and the private sector, so that our research is transferred into action. The latter is sometimes harder to do, as it requires time and skills that we tend not to train as much. Yet it was, for me, a very rewarding experience and an element of my success in finding a job.

The opinion expressed and arguments employed herein do not necessarily reflect the official views of the OECD or the governments of its member countries.



Research highlights

Finding the right FiT for renewable energy

Stefan Lamp

Subsidies for renewable energy are often wielded as a blunt instrument, consuming huge sums of taxpayers' money with mixed results. How can such policies be better targeted geographically? A new paper by TSE's Stefan Lamp evaluates the use of feed-in-tariffs to promote solar power in Germany. He finds that a more flexible approach - adapting incentives according to the costs and benefits of different locations and taking into account transmission - would yield considerable gains.

Success in the fight against climate change will largely rely on the adoption of renewable energy sources (RES). Yet, to many policymakers, the decision to introduce RES in electricity markets hinges on the size of the potential economic impacts. RES are still more costly than conventional technologies in some regions, they are not perfectly correlated with demand, their intermittency is problematic, the storage costs are prohibitively high, and their power output cannot be adjusted by grid operators.

Expensive subsidies

Regulated by the government, feed-in-tariffs (FiTs) are widely used to incentivize the deployment of RES. They guarantee a preferential rate paid to RES producers of electricity and specify long-term contracts of about 15 to 20 years. They have been implemented in a number of jurisdictions including Australia, California, Germany, Ontario, and Spain. These subsidies do not necessarily account for the costs and benefits of RES technologies. Usually the incentives differ by technology - for example, solar versus wind - but do not account for the relative productivity of the technology or the marginal benefits, which largely depend on the specific location of the plant.

While FiTs have been an effective tool in increasing the penetration of RES, they are also expensive. In 2015 alone, Germany's total subsidy accounted for roughly €22 billion, leading to intense political debate about how to distribute the total cost between different consumer groups (see for instance Gerster and Lamp, 2020). The location of RES also has implications for the dispersion of benefits from electricity storage and from new products such as electric vehicles.

While feed-in tariffs have been an effective tool in increasing the penetration of renewable energy sources, they are also expensive. In 2015 alone, Germany's total subsidy accounted for roughly €22 billion.

Reallocation rewards

Most FiT programs have very little or no variation in the amount of the incentive on output by geographical location or by time of day. Does this correspond to a lack of variation in the marginal benefits of RES? In a new working paper, '(Mis)allocation of Renewable Energy Sources', Stefan and his co-author seek to answer this question empirically.

Focusing their analysis on solar power in Germany, the first country to implement large-scale FiTs for RES, they combine high-frequency data on load and supply for each of the four transmission system operators (TSOs), together with fuel input prices, input-output tables on primary energy inputs and electricity output, as well as data on ancillary services.

The researchers measure the benefits from an additional unit of RES electricity output due to the displacement of production from conventional sources. These benefits include the private costs of production and grid reliability as well as the social costs of the emissions displaced. The results show that although the heterogeneity in average marginal overall benefits across regions ranges only from 40.8 to 44.4 €/MWh, their components contain a large range of variation. The mean avoided production costs across TSOs range from 19.3 to 29.4 €/MWh. The largest amounts of avoided emissions do not coincide with the largest savings in operating costs due to the differences in the technology portfolio mix of each TSO. The researchers use a conservative value for the social cost of carbon (SCC) of 31.71 €/tCO₂ – the marginal benefits and the reallocation gains they generate are much larger when using higher SCC values. The avoided ancillary costs constitute up to 3% of the overall marginal benefits, on average, but with large standard deviations.

Stefan and his co-author then construct counterfactual scenarios in which RES capacity is reallocated, starting in regions with the highest marginal benefits. They do this for different values of solar capacity penetration while keeping total solar capacity in the market constant. The results show a 6.4% increase in value (ancillary services, avoided production costs, and avoided emissions combined) relative to the current allocation, assuming a relatively low maximum solar penetration rate of 20%. These gains reach 10.9% if the penetration rate allowed is 40% instead of 20%.

Transmission capacity

Given the importance of electricity trade in the reallocation of RES output, the researchers calculate the gains from an increase in transmission capacity between subregions. They split the largest TSO into two parts with different average solar productivity, making the South region a net exporter of solar to the North region. They estimate that the average transmission capacity consistent with the observed gap in marginal costs across the two subregions is about 3 gigawatts (GW), which is in line with current projects under construction. They then perform a counterfactual allocation of total installed solar capacity in Germany, taking into account the transmission constraint that allows the South to export solar electricity to the North. They show that the gains from reallocation range from approximately 18% to 40% depending on the rate of solar penetration and transmission capacity.

Applying these figures to a benefit-cost analysis for the current project under construction, the researchers conclude that the net benefits of the project can be positive, even without accounting for other forms of RES or other interconnections when sufficient capacity is allocated in the region with the highest total benefits.

Future research

Stefan and his co-author's high-frequency data sources are publicly available, which makes their approach widely applicable to other jurisdictions. Their use of actual solar output data instead of output from a simulation model, their inclusion of health benefits through the social cost of carbon of emissions avoided, and the savings from production and ancillary services costs, have received little to no attention in the literature. It is worth noting that their analysis does not attempt to design the optimal FIT structure, but rather to quantify the benefits left on the table given its current structure. However, the researchers show empirically that a quota mandate in the form of a fraction of the total capacity that should be RES in the region, can also induce gains in RES cost efficiency.

The authors acknowledge that a more comprehensive study would also include wind installations. In the best-case scenario, there is no misallocation of wind plants in Germany and the total gains from misallocation would only be caused by misalignments in incentives for solar plants. Therefore, the researchers see their results as a lower

“Most feed-in tariffs have very little or no variation in the amount of the incentive on output by geographical location or by time of day. Does this correspond to a lack of variation in the marginal benefits of renewable energy sources?”

bound on the gains from potential misallocation. Another avenue for future research is to include transmission constraints across the different regions to be able to value surpluses if they exist. Once again, the researchers' results can be seen as a lower bound for the true gains since their study implicitly values excess solar production, if any, at a marginal benefit of zero. In either of those two cases, their framework can be easily extended if more data were available.

SUMMING UP

This research develops a comprehensive framework to measure misallocation of RES, inspired by the rigidity of existing FIT incentives. The framework consists of three steps: measuring the marginal benefits from an additional unit of output from RES, using those valuations to measure the potential gains of an efficient allocation of solar PV installations, and accounting for further gains if transmission capacity is expanded.

The researchers find evidence of heterogeneous marginal benefits from increasing renewable capacities, even using a low social cost of carbon. Allocating solar panels according to their productivity and marginal benefits would yield significant gains. For medium-high levels of solar penetration, these gains could be increased by building a new north-south transmission line.

FURTHER READING

Stefan's working papers, including *'(Mis)allocation of Renewable Energy Sources'* (2020) and *'Sunspots that matter: the effect of weather on solar technology adoption'* (2018), are available to read on the TSE website.



Do vehicle emission standards work?

Mathias Reynaert

What impact do vehicle emission standards have on consumers, businesses, and the environment? In the wake of the 2015 Volkswagen testing scandal, research by TSE's Mathias Reynaert suggests that this policy tool can be risky and unpredictable. Investigating strategic responses in the European car market, he finds a growing divergence between on-road fuel consumption and laboratory results that suggests widespread 'gaming' of tests by manufacturers.

Today all major vehicle markets - from China to Mexico - 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%, to a yearly average of 130g CO₂/km from 2015. By comparison, the US standard required only 152g CO₂/km in 2016.

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' (The Review of Economic Studies, 2021), Mathias discusses the welfare outcomes of the following strategies that firms may adopt in response to emissions standards:

- **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 that are 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⁽¹⁾. 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 EU emission standard. However, this is the result of looking at official emission numbers obtained from laboratory tests.

Performance gap

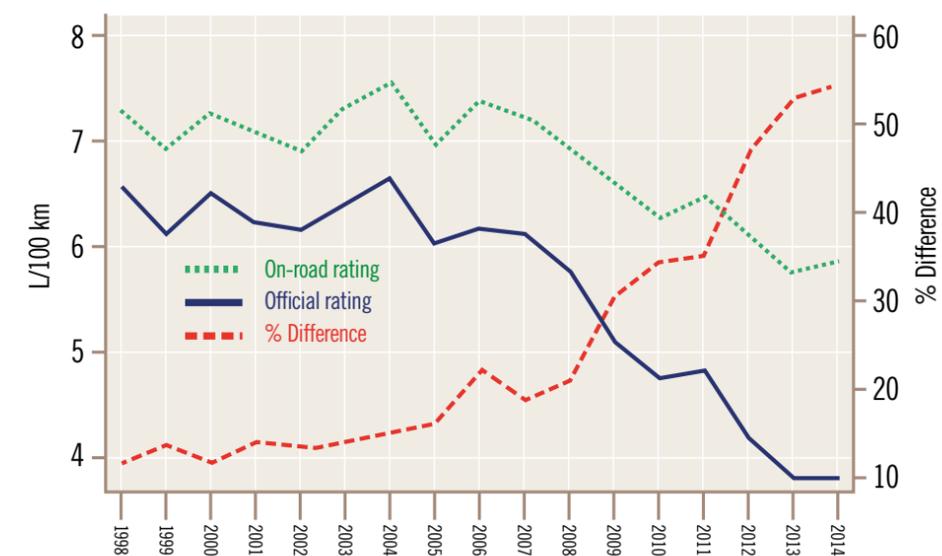
In a forthcoming paper in American Economic Journal, 'Who Benefits When Firms Game Corrective Policies?', Mathias and his co-author

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.

(1) See Knittel, C R (2011), 'Automobiles on Steroids: Product Attribute Trade-Offs and Technological Progress in the Automobile Sector', American Economic Review 101(7): 3368-99.

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. Figure 1 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.

FIGURE 1: MIND THE GAP



The rise in the performance gap (the % difference between official and on-road fuel consumption ratings) since the 2007 announcement of the EU emission standard implies that around 65% of recent fuel economy improvements, as measured by laboratory tests, are false. Source: Reynaert and Sallee (forthcoming)

The effects of gaming

Faced with his empirical evidence that automakers chose to respond to the EU emission standard by increasing technology adoption and by gaming the tests, Mathias considered two questions. First, what are the welfare effects of emission standards when compliance strategies are technology adoption and gaming rather than price changes? Second, why did the market respond in this way to the EU standard? To provide answers, his REStud paper develops and estimates a structural model of vehicle demand and supply to study the impact of the regulation on consumers, firms, and the environment.

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 sum of the value of emission savings and consumer and profit losses is negative so that the regulation reduces welfare. However, when Mathias considers two additional non-targeted welfare effects, he finds the emission standard to have a small positive impact. The emission standard also reduces other externalities, such as local pollution, congestion, and accident risk. This includes a correction for consumer undervaluation of fuel economy.

Political influence

Mathias' model allows analysis of potential market outcomes if the EU designed the regulation differently. He focuses on two aspects: the attribute base of the standard and the lack of enforcement.

Attribute basing makes the emission target dependent on vehicle weight. Firms selling more lightweight vehicles face a more stringent attribute-based 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.

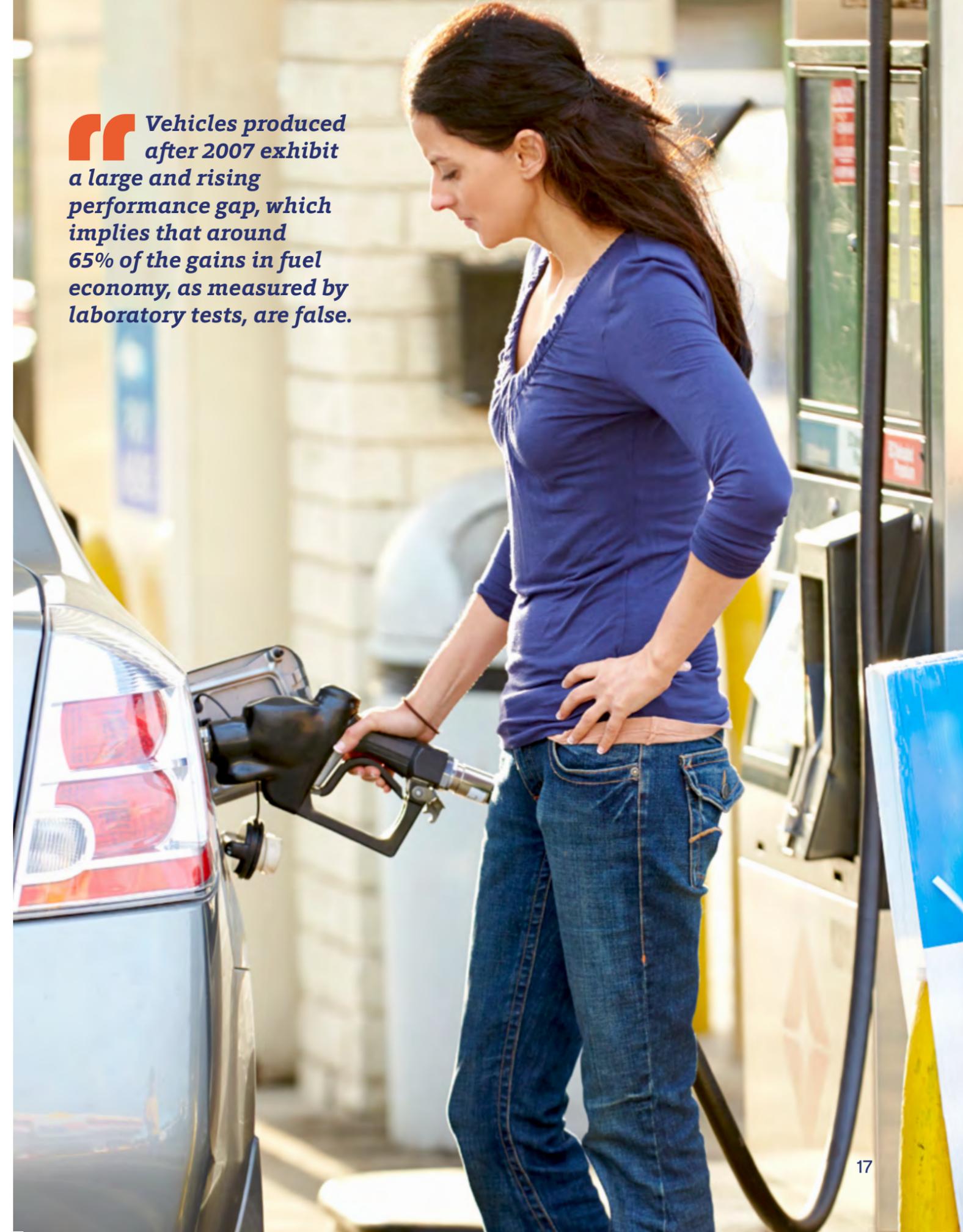
Gaming is also a product of the political environment. A recent evaluation by the European Parliament has placed responsibility for enforcement failures with the car-producing member states. Mathias' model allows him to compute the effects of better enforcement. A better test procedure would mean that official and actual emissions are more similar. With more enforcement, the reductions in consumer surplus and profits are higher. Firms have to adopt costlier technology, and this increases prices further. But enforcement would have led to much higher CO₂ and other externality savings, and the policy would have been welfare improving.

SUMMING UP

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. As a result, CO₂ emissions were cut by just 5% instead of the 18% target. The EU policy also stimulated technology adoption which may have reduced profits and consumer surplus. To evaluate the impact of emissions standards, Mathias shows that it is crucial to understand both their political and practical implementation in combination with strategic responses.

FURTHER READING

Mathias' research, including *'Who Benefits When Firms Game Corrective Policy?'* (2020) and *'Abatement Strategies and the Cost of Environmental Regulation'* (2021), are available to read on the TSE website.



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.



Outreach

Recent events

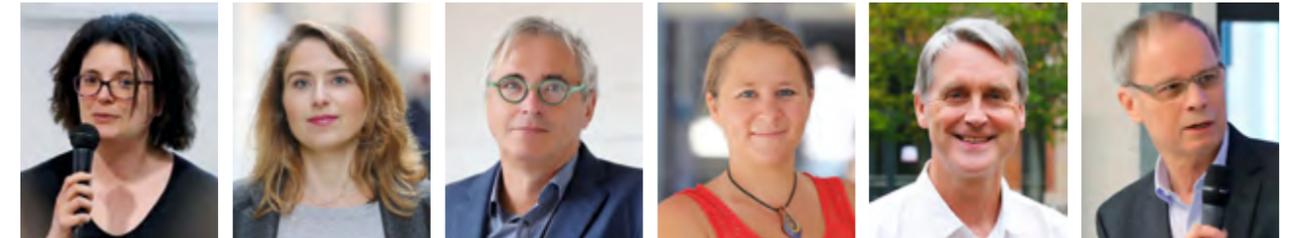
The world after Covid-19 Webinars, June 9 & June 22

▶ Watch the videos online in French:
(*Webinar for our partners*) (*Webinar: Covid & Climate change*)

In June, as France was easing lockdown measures, TSE organized two webinars to debate the consequences of Covid-19.

The first of these online events was open to the general public, another historic step in TSE's efforts to reach beyond the traditional research community. Various experts including Zohra Bouamara-Mechemache, Catherine Casamatta, Christian Gollier, Sophie Moinas, Paul Seabright and Jean Tirole (pictured below, from left) took the floor to explain some of the unprecedented societal, environmental and economic impacts of the current crisis, as well as suggesting policy solutions.

An exclusive webinar was also organized for TSE's partners along similar themes.



How can we finance the energy transition? Toulouse, September 10

TSE director Christian Gollier joined an energy and climate roundtable with Thierry Cotelle, President of the Agence régionale Energie Climat (Arec), Jean-Luc Da Lozzo, CEO of organic waste recycling company Cler Verts, and Julien Chardon, founder of green energy startup Ilek.

Organized by journalists at La Dépêche Éco and the auditing and consulting firm Mazars, the event was attended by 50 regional decision-makers. Key questions arose about the financial difficulties and lack of resources for businesses to embrace the energy transition. However, surveys show that there is a growing awareness in companies and communities about the importance of tackling climate change.

Further reading, in French: "[Comment financer la transition énergétique ?](#)"



Debate

TSE Debate is a portal that gathers the opinions and analysis of TSE researchers on topics of public interest such as electric cars, the European carbon market, and renewable energy. Members of the center regularly publish blog posts and newspaper op-eds that can be consulted in TSE Debate's "Energy" section. Here we feature some of the recent posts.



Betting on hydrogen

Claude Crampes and Stefan Ambec
September 14, 2020

Hydrogen will gradually find its place in the energy mix. This is the wager that our governments in Europe are making with billions of euros of investment. For the moment, it rather sounds like wishful thinking: one day hydrogen will be a "clean, safe and affordable" energy carrier.



Energy efficiency in buildings: from theory to practice

Claude Crampes and Stefan Ambec
July 7, 2020

The Citizens' Climate Convention set up by President Macron has placed energy-efficient buildings at the heart of the debate on the post-Covid recovery plan. In our enthusiasm for thermal insulation, long perceived as a profitable opportunity in addition to being climate-compatible, we are turning our backs on results obtained in the field.

Tesla on the lookout for profitable electrons

Claude Crampes and Stefan Ambec
June 2, 2020

On April 28, 2020, Tesla applied to become an electricity supplier in the UK. This initiative does not make Tesla a major player in the electricity market, but, given the dynamism of its CEO, it's a first step towards a development strategy based on its mastery of battery technology.





Oil during and after lockdown

Claude Crampes and Stefan Ambec
May 13, 2020

Since the beginning of the pandemic, oil prices have collapsed. On Monday, April 20, the deliverable barrel for May traded at a historic low of minus \$3763. On that day, black gold was worth no more than the junk we want removed from our homes. Harold Hotelling, who theorized the evolution of the price of oil in 1931, must have been turning over in his grave. If this dizzying fall is not compatible with Hotelling's model, a recent extension of this theory could reconcile it with the facts. And tell us something about post-lockdown oil prices.

Water division

Claude Crampes and Michel Moreaux - April 28, 2020

Conflicts over the use of water have been a recurring issue in the history of mankind. Today's conflict between Ethiopia, Egypt and Sudan over the filling of the "Great Dam of the Ethiopian Renaissance" on the Nile is an opportunity to recall the economic particularities of water resources.



Covid-19: infected electricity markets

Claude Crampes and Stefan Ambec
April 15, 2020

The fall in economic activity caused by the spring 2020 shutdown has led to a drop in industrial production and thus in energy consumption by firms. This sudden drop in demand due to the pandemic is a natural experiment that tests the resilience of electricity market mechanisms. The French system for supplying independent electricity retailers with nuclear electricity, the so-called ARENH, may not survive it.



TSE hopes to welcome you in 2021 at a future event. In the meantime, we look forward to seeing you at our online conferences. More information coming soon.

The TSE Energy & Climate Center – alongside the existing TSE Digital and Sustainable Finance research centers – showcases our academic activities, supporting Toulouse experts in their efforts to build new analytical tools to meet contemporary challenges. Bringing together the skills and experience of leading industrial and academic partners, the TSE Energy & Climate Center focuses on the economics of energy industries, natural resources and the environment.

Our scientific outreach publications and events are regular opportunities to share ideas and knowledge with practitioners, policymakers and the public. The TSE Energy & Climate Center is particularly focused on providing expertise on the institutional framework within the European Union and beyond, as well as empirical observations and basic theoretical modelling.

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