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Spring
2018

EAERE Magazine

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EAERE Magazine serves as an outlet for new research, projects, and other professional news, featuring articles that can contribute to recent policy discussions and developments in the field of environmental and natural resource economics. It is published quarterly in the Winter, Spring, Summer, and Fall. Contributions from the wider EAERE community, especially senior level researchers and practitioners, and EAERE Country Representatives, are included in the magazine.

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Carlo Carraro is Professor of Environmental Economics at the University of Venice and President of the European Association of Environmental and Resource Economists (EAERE). He is Vice-Chair of the Working Group III and Member of the Bureau of the Intergovernmental Panel on Climate Change (IPCC). He is also Co-Chair of the Green Growth Knowledge Platform and Fellow of the Association of Environmental and Resource Economists (AERE). He is President of the HforHuman Foundation and Scientific Director of the Fondazione Nord Est.

Dear EAERE Community,

The year is off to a busy start. With the new Council set in place, we have commenced 2018 with a focus on broadening the scope and breadth of our reach, as evidenced through several initiatives, including enhanced communication and dissemination efforts, and in particular the creation of this new EAERE Magazine.

The Magazine is intended to serve as an outlet for new research, projects, and other professional news, featuring articles that can contribute to recent policy discussions and developments in the field of environmental and natural resource economics. It will be published quarterly in the Winter, Spring, Summer, and Fall. Astrid Dannenberg, University of Kassel, Germany is presently serving as the EAERE Magazine Editor. Contributions from the wider EAERE community, especially senior level researchers and practitioners, and Country Representatives, will be featured in the magazine.

As this year's Board of Country Representatives has a renewed vision to strengthen our Association's links with local communities of environmental and resource economists, articles written by Country Representatives are an integral part of the magazine. Through these Country Representatives, who this year display an even stronger representation of national and regional levels groups, the Association is reinforcing the link between EAERE and international, national, and regional associations operating in our field or in similar fields. The goal is to promote their activities and national policies, and to enhance relationships with other national and/or regional environmental economics associations, in order to act as an amplifier of their activities and national policies. In this way, we aim to circulate information on policy actions taken by individual countries or groups of countries, and to strengthen the role of our Association as a platform for discussion and exchange of ideas for all those operating in our field.

The contents of the Magazine will also be disseminated via social media to reach a broader audience, including members of the Association and non-members. We are active on social networks (Twitter, Facebook, LinkedIn, and Instagram) where scholars and environmentally concerned persons can follow us for updates on the Association's initiatives and services, as well as information on relevant events, policy news, technological innovations, schools and conferences, job openings, etc.

The Magazine and use of social media are part of a larger communication strategy that has been set in action to give more visibility to our discipline and the debate on environmental issues and policies, and to offer a better service to our members. To achieve these ends we are working towards a more frequent and content dense dissemination of information and materials targeted to an expanded audience including members and non-members, such as practitioners, civil servants, international organizations, and the policy community worldwide.

We have additionally created a new monthly newsletter, EAERE Highlights, to provide updates and announcements on news, events and conferences, open job positions, and educational programs to the EAERE community. Information submitted by members to the website is further disseminated through the monthly newsletter. This regular briefing will keep members well-informed on environmental and natural resource economic happenings in Europe.

I hope that you enjoy the new EAERE Magazine, as well as EAERE Highlights and our social media presence.

I look forward to seeing you at the World Congress in Gothenburg this June. As always, our members' support, participation, and feedback are of utmost importance to us. Please do share your views on our Association and send your comments and suggestions to me at carlo.carraro@eaere.org.

Happy reading.

Sincerely,

Carlo Carraro



Astrid Dannenberg is Professor of Environmental and Behavioral Economics at the University of Kassel and Council Member of the European Association of Environmental and Resource Economists. She was previously a Researcher at the Centre for European Economic Research in Mannheim, the University of Gothenburg, and Columbia University in New York.

Dear EAERE Friends and Colleagues,

I'm very excited to introduce the new EAERE Magazine. Before I'll tell you about our first issue, I want to warmly thank Mireille Chiroleu-Assouline who served as the Editor of the Newsletter during the last two years. I also want to thank Katie Johnson, our new communication strategist, who has done a great job since she started, and Monica Eberle who has helped us, as always, whenever needed. And, of course, I want to thank all the people who have contributed to the first issue.

We have four articles reporting on new advances in environmental economics. Two of them are about the consequences of climate change and the other two are about climate change mitigation efforts at the national and individual level. Anouch Missirian and Wolfram Schlenker (both Columbia University, New York) write about the effects of temperature and precipitation fluctuations on migration to the European Union. James Rising (Grantham Research Institute on Climate Change and the Environment, London School of Economics) provides a piece on new research on the social cost of carbon and the importance of higher resolution climate projections. On the mitigation side, Mads Greaker (last year's winner of the Erik Kempe Award, Oslo Metropolitan University) writes about the support of electric vehicles in Norway and the EU and how they could help to reach the targets made under the Paris Agreement. Martin Kesternich (Centre for European Economic Research, Mannheim) looks at mitigation efforts at the individual level and presents research on people's willingness to pay for carbon offsetting. Following these pieces on recent research, Sandra Paulsen (Institute for Applied Economic Research, Brasília) contributes an article on environmental economics in Brazil and the development and progress of the Instituto Escolhas.

Finally, at the end of the issue is a completely new feature that we have introduced to support intergenerational exchange within our association and could be described as "juniors-ask-big-shot." A number of PhD students and Postdocs in Germany and the UK have put together a list of questions that they would like to ask a senior researcher who has had a long and successful career in environmental economics (thanks to all who have contributed to this). I'm very happy that Sir Partha Dasgupta has agreed to be the first interviewee in this new series and answer the youngsters' questions. I was very curious about both the questions and the answers – and I hope so are you. Enjoy reading!

Astrid Dannenberg

University of Kassel, Germany

Weather fluctuations and migration to the EU

Anouch Missirian¹ and Wolfram Schlenker^{1,2}

¹Columbia University ²National Bureau of Economic Research



Anouch Missirian is a PhD student in the Sustainable Development program at Columbia University. Prior to pursuing a doctoral degree, she was a student in biology and ecology at the Ecole normale supérieure in Paris, and got a masters' degree in Environmental Economics at AgroParisTech.



Wolfram Schlenker is a Professor at the School of International and Public Affairs (SIPA) and the Earth Institute at Columbia University and a Research Associate at the National Bureau of Economic Research (NBER). He previously was an Associate Professor of Agricultural and Resource Economics at the University of California at Berkeley and an Assistant Professor of Economics at the University of California at San Diego.

Climate change is suspected to lead to population displacement. There is a movement at the United Nations to looking into international protection for environmental migrants. The well-documented effects of projected temperature changes on various sectors of the economy and the implied changes to livelihoods make it seem likely that there will be migration responses. To date, only local displacements by sea-level rise and within-country displacements have been extensively modelled. Much less is known on responses involving international migration. We conducted a recent study that analysed the effects of temperature and precipitation fluctuations on the number of asylum applications filed into the European Union over 2000-2014. We found that deviations from a moderate temperature optimum in the origin country led to increases in asylum applications, with hotter-than-normal temperatures having a larger effect than lower-than-normal temperatures. Extrapolating to future climatic conditions, we found that the number of asylum-seekers to the EU would likely increase in case nothing is done to mitigate climate change or to locally adapt to the new conditions.

There is an extensive literature linking changes in climatic conditions to various sectors of the economy

(agriculture, worker productivity, GDP, energy demand) as well as socio-economic outcomes (mortality). At the same time, climate-induced changes in these sectors (e.g., agriculture) have been shown to influence prices (e.g., recent food price spikes), and as a result, conflict. Putting all these pieces together, a straightforward hypothesis would be that international migration streams are related to weather changes in the origin country via various channels, e.g., through the impact on agricultural output, food prices, and conflict. Given that internal and international population displacements are a contentious and challenging question for domestic and international politics and policy-making, correctly anticipating and modelling changes in future migration flow is key.

We conducted an analysis “**Asylum applications respond to temperature fluctuations**” that was recently published in *Science* (issue n°6370). The study focused on distress-driven migration, specifically asylum applications, which are a small share of overall migration patterns. For example, total asylum applications into OECD countries are roughly one tenth of overall migration inflows. Given the well-established link between local weather conditions and conflict,

it appears likely that distress-driven migration would respond to local weather conditions. To uncover the link between migration across borders and weather fluctuations, we combined 15 years of asylum applications to EU countries (2000-2014) with fine-scale weather data in the origin countries. When the weather data is averaged over population centres, no significant relationship is found. However, when weather is averaged over the growing season in the places where crops, especially maize, are grown, a significant relationship is detected.

We find that asylum applications respond in a non-linear fashion to temperature: they increase as temperatures get more extreme, both hot and cold. Moderate temperatures in a given source country that are ideal for agriculture, i.e., around 20°C, result in the fewest asylum applications to the European Union from that country. Positive deviations, i.e., warmer temperatures, had a slightly larger effect than negative deviations, akin to earlier findings on the response of crop yields to temperature.

The study evaluates how asylum applications from a country deviate from the country-specific average number of applicants as temperatures in the same country deviate from their respective average. The analysis hence compares a country to itself across years, while allowing the detected temperature-sensitivity to vary by the average climate in a country. Given that institutional differences (democracies versus dictatorships) undoubtedly have an effect on the desire to flee a country, we account for those baseline differences and focus on comparing a country to itself over time. Each year, some countries randomly experience hotter-than-usual temperatures, or positive temperature shocks, while others receive negative temperature shocks. These temperature shocks are not correlated with baseline differences, e.g., a dictatorship is just as likely to receive warmer than normal temperature as a democratic country.

From a statistical perspective, our analysis is comparable to a medical drug trial, where a random subset of the patient population is given a new drug. While there are several factors that influence human health beyond the drug, randomly giving a new drug to a patient in a medical trial will enable the researchers to identify the correct average treatment effect of the drug. By the same token, while we are aware that many factors influence the decision of people to apply for asylum, our setup using random year-to-year weather shocks allows us to identify the correct average effect of these weather variables.

Our paper conducts several sensitivity checks and generally finds comparable results. For example, we allow the response to differ by how corruptness index of the source country, the distance of the source country to the EU, or the share of the population that is employed in agriculture, but find no difference. Moreover, recognizing that the decision to apply for asylum in a destination country might take time, both the decision to leave as well as the time to get there, we estimate both models using asylum applications in the same year as the temperature shock as well as asylum applications summed over the concurrent year as well as the next two years to allow for delayed impacts, again with similar results. More strikingly, when we look at changes in acceptance rates over the next two years following weather-induced changes in asylum applications, we see acceptance rates that are on average three times as high as baseline averages. In other words, receiving countries deem applications that are attributable to weather shocks worthy of protection at significantly higher rates than on average, yet these protections are tied to fleeing persecution.

What could be the causal chain linking temperature anomalies to increased asylum applications? While the study doesn't provide a definitive answer, the findings point at a few non-mutually

exclusive hypotheses involving the rural sector. As mentioned above, agricultural yields are sensitive to temperature, and so are GDP growth rates; thus deviations from temperature optima may threaten livelihoods and lead to population displacement. In addition, aggressive behaviour and conflict have been shown to be increasing in temperature. These livelihood and conflict channels, either in isolation or in interaction, are consistent with increased distress-driven migration, hence increased asylum applications, in response to hotter-than-normal temperatures.

Hotter-than-normal temperatures are projected to increase in frequency and magnitude in the coming decades due to climate change, and to do so heterogeneously across space. Our study simulates future changes in distress-driven migration by applying the detected asylum-temperature relationship to future temperature trajectories as projected by the 21 models in NASA's Earth Exchange Global Daily Downscaled Projections (NEX-GDDP). We use projections for both moderate (RCP 4.5) and severe (RCP 8.5) warming. Colder-than-20°C countries will see a decrease in the number of predicted applications by the end of the century, while moderate and hotter-than-20°C countries will see an increase. Overall, all else being equal, both moderate and severe climate change were projected to lead to more asylum applications, by 28 % and 188 % compared to the current average of 351,000 applications per year, respectively, although the confidence intervals are wide and have a long upper-tail, suggesting the possibility of even significantly larger responses. To put these numbers into perspective, the recent spike in asylum applications in 2015 saw the average number rise from 351,000 to 1.5 million.

Our forecasts should be taken with a grain of salt: magnitudes and signs matter more than the exact number,

given the long projection horizon and the number of influential factors left aside (i.e. considered as constant). These numbers should be taken as baseline projections absent game-changing policies. At the same time, we test whether the observed relationship varies by various socio-economic factors, but find no evidence thereof, so the assumption that it will remain stable under a warmer climate appears a good starting point.

Many climate impact assessments have shown the effect of changing weather conditions on the economy, yet the novelty of our paper is to show that there might be repercussions beyond the country through international migration streams. Even if a country is not directly impacted by climate change, it might be indirectly impacted through migration streams. Our analysis, and in particular its simulation exercise, highlights the policy challenges of future asylum flows to the EU: mitigation, adaptation, prevention and planning could alleviate the distress associated with them by reducing their magnitude or better preparing for them.

In light of those results, and considering the importance of *internal* displacement in response to environmental conditions and as a stepping-stone for international migration, better understanding its response to weather fluctuations seems worth the effort in systematic data collection and analysis.

The future of the cost of climate change

James Rising

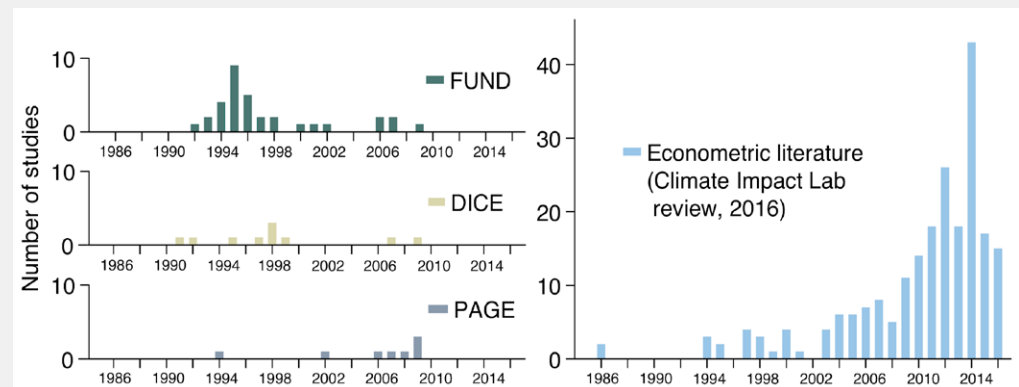
*Grantham Research Institute on Climate Change and the Environment
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James Rising is an interdisciplinary modeler at the Grantham Research Institute on Climate Change and the Environment at the London School of Economics. His research is on the feedbacks between environmental and human systems, focusing on the impacts of climate change and the water-energy-food nexus. Prior to joining GRI, James held postdoctoral positions at the Energy & Resources Group at UC Berkeley and the Energy Policy Institute at the University of Chicago. He received his Ph.D. from Columbia University's program in Sustainable Development.

Research on the impacts of high temperatures has evolved quickly over the past decade. Recent econometrics research has exposed causal relationships between high temperatures and mortality, labor productivity, agricultural yields, energy demand, economic growth, and many other areas, and these analyses are getting more sophisticated every year. Higher resolution climate projections have helped translate these relationships for future populations, producing empirical estimates of the costs of climate change. While most current methods miss the potential of adaptation, rapid research is testing new

techniques that try to handle adaptation. Estimates of the global cost of climate change used in policy have evolved much more slowly. Climate, the economy, and policy are brought together in Integrated Assessment Models, or IAMs. Three of these, FUND, DICE, and PAGE, are used by the U.S. Environmental Protection Agency to evaluate the costs and benefits of regulation in light of climate change impacts. A recent literature review by the Climate Impact Lab found that most of the parameters used to inform FUND and DICE are over 20 years old. The fact that the EPA is continues



(Left:) Publication dates of studies used to inform the FUND, DICE, and PAGE Integrated Assessment Models. (Right:) Recently available econometric literature available, by date of publication.

to use only these models, despite the emergence of several new models, is another indication of regulatory inertia. The future of the process of costing climate change depends on bringing research and policy closer together.

Our recent paper published in *Science* sets out a new vision for bringing this research in empirical environmental

economics to bear on social policy¹. First, it lays out criteria for the kinds of studies that are appropriate for large-scale impact forecasting. These include the intuitive argument that the studies should be representative of the entire area being projected; based on data valid for real-life circumstances (rather than lab settings); and estimate causal, rather than correlative, relationships.

Second, it argues that the full extent of uncertainty-- in both climate changes and economic parameters and responses-- be represented. And third, that we build systems that can continue to be updated as new science comes out. A key tool in this process is meta-analysis: the process of synthesizing multiple studies. Our paper relies on the Distributed Meta-Analysis System² to combine estimates, and maintain a library of results for the future.

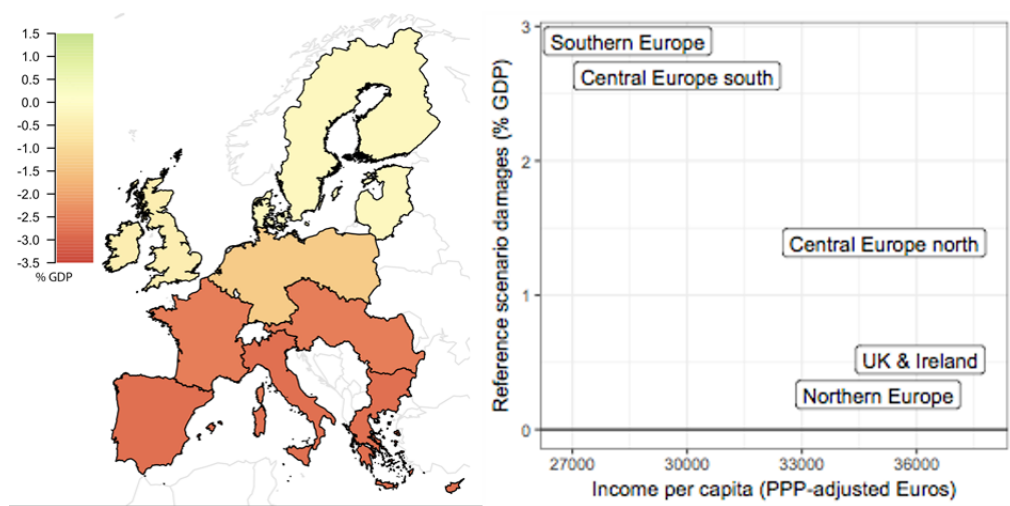
Resolution matters for identifying the costs of climate change too. Older IAMs computed uniform damages across large segments of the world, but climate affects us where we are, and different groups have very different outcomes to look forward to. The PESETA II project to estimate climate impacts in Europe found a distinct north-south gradient, placing harsher damages on some of the poorer European countries³. A similar pattern exists in the United States, and we found that this results in welfare losses over twice the monetary losses, producing the equivalent of over 10% losses in GDP by the end of the century.

The future of climate impact damages should focus on these improvements: a greater commitment to empirical grounding and the uncertainty that

comes with it, more comprehensive and nuanced estimates, and higher resolution impacts and their consequences for different groups. But the future of the costs of climate change is more than better research of its physical and financial impacts.

The U.S. EPA under Scott Pruitt has recently made a troubling change in how it accounts for the costs of climate change. Since 2010, the U.S. government has accounted for the impacts of climate change through a global “social cost of carbon” (SCC), which is the total loss to all countries from an extra ton of CO₂. This corresponds to the optimal carbon tax to address the externality of CO₂-driven climate change, estimated at \$42 for CO₂ released in 2020 under a 3% discount rate⁴. In October, the EPA quietly swapped this global SCC for a domestic SCC, accounting only for the costs to the U.S. economy⁵. Under this accounting, a ton of CO₂ costs only \$6.

Even for a domestic SCC, this number may be far off. Our domestic accounting of the costs of climate change in the U.S. translates to a \$23 per ton cost, and it only accounts for six kinds of impacts that have been empirically estimated (in order of potential impact: mortality, labor productivity, energy expenditures, yields of four crops, coastal property



(Left:) Total welfare impact under a business-as-usual scenario for 2080s, as a percent of GDP, from data from PESETA II. (Right:) The greatest damages fall to the poorest members of the EU. The damages are from the map left and incomes from the World Bank for 2016.

damage, and crime). If the empirical U.S. results are an indication, the global costs may be 4 times current estimates. Since our estimates are for a rich, temperate country, impacts for poorer, hotter areas are sure to be greater and their welfare consequences greater still.

The discussion in Europe hinges less on the value of the SCC, muddying the use of this work in the European context. While the SCC can inform carbon taxes, the comprehensive price for an optimal cap-and-trade system needs a different estimate. This is the “shadow price of carbon” (SPC), which is the price the marginal emitter would pay to emit an additional ton of CO₂. The shadow price is determined by the costs of abatement, rather than damages. If the SCC says how costly climate change is, the SPC says how costly mitigating it (e.g., to 2° C) will be. Under an optimal climate policy, the two numbers become the same.

Empirical estimates of the SPC are hard to produce, because of the lack of information on the true costs businesses face. However, the challenge is not so different from inferring the costs and potential of adaptation for an SCC: it requires comprehensive models, high resolution, recognition of uncertainties, and systems that are designed to update as new science emerges.

Finally, the SCC and SPC are far from exclusive or contradictory. The full economic costs of climate change encompass the costs of impacts, the costs of mitigation, and the costs of adaptation (another key area of research in our field). These are the three key relationships that modellers of IAMs need to generate better numbers and inform policy. In this way, the empirical work I have focused on here is also not in conflict with the development and improvement of IAMs. Bringing our field together can close the information gap and reveal our prospects for the future.

Endnotes

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EU and the electric vehicle - mutual love?

Mads Greaker

Oslo Metropolitan University



Mads Greaker has a PhD in Economics from the University of Oslo. Since his PhD, he has worked for the Research Department at Statistics Norway. He recently switched to the new university in Oslo; Oslo Metropolitan University (Oslo Met) where he is teaching industrial organization and resource economics. His research has for the later years focused on all aspects of green technological development; incentives for environmental R&D, clean versus dirty R&D, clean technology adoption and green industrial policies.

By electric vehicles (EVs) policy makers refer to both plug-in-hybrids (PHEVs) and battery electric vehicles (BEVs). While PHEVs have an internal combustion engine, and can only run for short distances on electricity alone, BEVs are just propelled by their battery. The EV is emerging as the number one mitigation technology for reducing greenhouse gases (GHG) from road transport. For instance, the IEA (2017) predicts that the EV stock will range between 9 million and 20 million by 2020 and between 40 million and 70 million by 2025 as compared to 2 million at the time of writing. Although the numbers are impressive, according to the IEA, only the high ends of these intervals are consistent with a 2°C target trajectory. Success of the EV is dependent on

further development of the battery technology increasing the energy density in batteries and lowering their production costs. According to the IEA (2017), such improvements in battery technology will likely happen as long as policies continue to target the deployment of EVs. As of today, more and more EU and EFTA countries launch a proactive EV policy. Norway has for many years been the most prominent example. In Norway, BEVs are exempted from both value added tax and vehicle registration tax, which for some of the more expensive brands can make up more than 50 percent of their sales price. PHEVs also enjoy a favorable tax treatment. Other countries, which have had a proactive EV policy for some years are

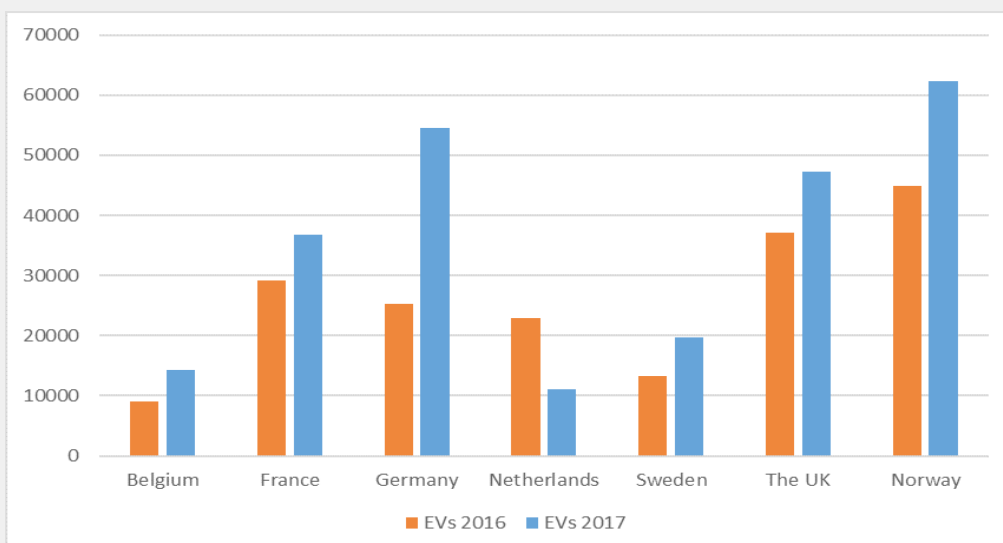


Figure 1 "EV sales 2017 in selected EU (EEA) countries" (Source: European Automobiles Manufacturers Association)

the Netherlands, France, and the UK, but other countries such as Belgium, Germany, and Sweden are now following suit as can be seen in Figure 1.

EVs and CO₂ abatement

Emissions from transport in the EU will overtake power as the largest CO₂ emitting sector by 2030 (EU, 2017). Looking at cars in isolation, it is clear that switching from an ICEV to an EV will reduce both emissions of CO₂ and local pollutants such as particles and NOx. However, as Holland et al (2016) point out, the environmental effects of EVs depend on how the EVs are charged. In the US charging of electric cars gives rise to increased production of electricity from mainly coal and gas power. According to Holland et al (2016), at some locations this fully reverses the positive environmental benefits of electric cars. To some extent this is explained by the assumptions in their main scenario that the US emission caps on NOx, SO₂, and CO₂ for the power sector are non-binding. In the EU, looking towards 2030, this seems like an unreasonable assumption, in particular with respect to CO₂. For the EU it therefore seems safe to assume that substituting ICEV with EVs reduces emissions without any leakage from the power market.

Even if substituting to EVs does not increase emissions from the power sector, EVs may not compare well to GHG abatement options with respect to costs. There exist several studies of the cost of reducing CO₂ emissions by switching from ICEVs to EVs. For Norwegian EV policy, Holtmark and Skonhoft (2014) find that the loss in tax revenue per ton CO₂ saved is more than 1000 times the CO₂ price in EU Emission Trading System (ETS) at that time. Other studies look into marginal abatement costs and find less frightening figures, see for instance the Norwegian Environmental Directorate (2016). Still, all studies seem to show that EV abatement costs

exceed the current permit prices in the EU ETS by a large amount. So why do Norwegian politicians stubbornly carry on with their EV policy even if they could reduce CO₂ emissions to a fraction of the costs by buying international emission permits? And why do other European countries now seem to follow Norway's example?

ETS and non-ETS emissions

The ambitious plans for phase-in of electric cars in Norway and other European countries could to some extent be explained by how the EU plans to fulfil its emission reduction target under the Paris Agreement. Pursuant to this agreement, the EU has set one target for the emission sources covered by the EU Emission Trading System (ETS), and another target for the sources outside of the ETS, the so called non-ETS sectors. For the non-ETS sectors the EU has committed to reduce emissions by 30 percent compared to 2005 levels. Moreover, the rich, western European countries have agreed to do a lion's share of the emission reductions: Germany must reduce non-ETS emissions by 38 percent, France and the UK by 37 percent etc. The EU is planning a scheme for trading in non-ETS emissions among EU/EFTA countries, however, to date no institutions have been established to organize and monitor this trading. Moreover, there is great uncertainty as to what the prices will be for a non-ETS emission permit. Analyses by Aune and Fæhn (2016) suggest that these may be around € 200/ton CO₂. Switching to electric cars for western European countries may then turn out to be more economically sound than if you compare with ETS prices.

Network effects

The existence of network effects may make it desirable to subsidize EVs temporarily even if the EV abatement

costs seem to exceed the relevant CO₂ permit price. According to Farrell and Klemperer (2007), the consumption of a good has positive network effects if one agent's purchase of the good i) increases the utility to all others who possess the good and ii) increases the incentive of other agents to purchase the good. Recent research suggests that electric cars satisfy both i) and ii). The network externality is indirect, as it mainly results from a wider range of complementary goods and services. For example, Zhang et al. (2016) find, based on data from Norway, that access to charging stations has a strong positive effect on willingness to pay for an electric car. Moreover, Li et al (2017) use data from the US and estimate a model which combines EV sales with charging station stocks. They find that a 10% increase in the stock of charging stations will increase EV demand by 8%. Furthermore, there likely are additional kinds of complementary services which would make the EV more appealing such as a viable market for used EVs, a system for recycling of batteries, service cars that can provide fast re-charging if stuck somewhere on the road etc. Finally, other contributions point to social norms and collective efficacy as types of network effects (see for instance Barth, Jugert and Fritsche, 2016).

Greaker and Midttømme (2016) analyze the optimal tax on a dirty network good that is being challenged by a clean network good. Their analysis is carried out in a dynamic model in which a transition from an incumbent network to the entrant network takes time. The reason is that the network

goods are durable goods, and as long as they have been produced, they will stay in the market until they wear out. Greaker and Midttømme (2016) find that taxing the dirty network good far above the Pigouvian rate may be desirable in order to facilitate a rapid transition to the clean network good.

Greaker and Midttømme (2016) illustrate their findings with point of departure in the development of the stock of BEVs in the greater Oslo area. The network benefit to each car consumer depends positively on the stock of EVs (stock of ICEVs). The parameters in the network benefit function are then chosen such that the model replicates the development of EV sales in the Oslo area given the current Norwegian subsidy policy.

In Figure 2 the share of EVs in the car stock is given by the x-axis, while the y-axis measures a one-time registration tax on a new ICEV in tens of thousands USDs per car. First, note that the optimal ICEV tax depends on the market share of EVs, and that it starts high, increases further and then falls as the EV picks up.

To get to the current ICEV tax, Greaker and Midttømme (2016) calculated the net present value of the EV use subsidies and the fossil fuel taxes, and added these to the tax rebate for EVs. Note that in their model with given car demand a subsidy to an EV has the same effect as a tax on an ICEV. We see that the current Norwegian ICEV tax, which can be interpreted as the current EV subsidy, falls short of the optimal tax.

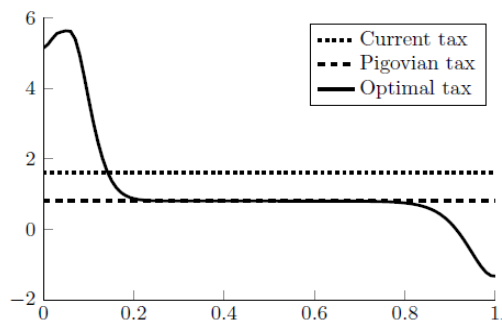


Figure 2 "The optimal tax on ICEVs"

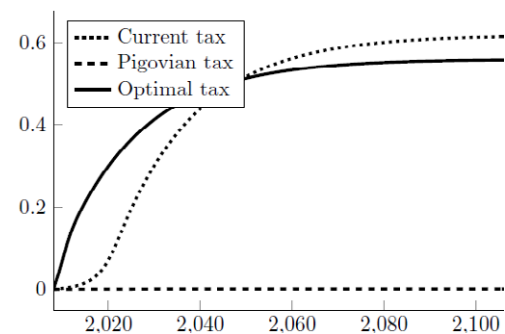


Figure 3 "Market development"

Finally, observe that the Pigovian tax in the example is about half the size of the current tax, and even further below the optimal tax. The Pigovian tax is based on Norway's national carbon emission reduction target for 2020. That is, it is equal to the net present value of all the expected emissions from a fossil car valued at the costs of reducing other carbon emissions in Norway.

In the numerical illustration the current tax leads to a too slow market development, while the Pigovian tax would have led to no EVs at all (excess inertia), as can be seen from Figure 3.

In Figure 3, the share of EVs in the car stock is measured on the y-axis, while the x-axis shows the years starting in 2008. The three graphs show the market development with the three different tax rules. Note that even with the high current tax, it takes some time to convert the market. The reason is that in the model some consumers strongly prefer fossil cars (for instance due to range and/or loading capacity), and as long as other consumers have fossil cars these consumers will buy a fossil car even if the tax is high. With the optimal tax, the market converts to EVs faster, and the welfare loss of staying with an insufficient network of EVs is decreased.

Clearly, as Greaker and Midttømme (2016) points out, the numerical model is a very simplified representation of the car market. All the same, the results suggests that network effects can be important drivers of policy.

Conclusion

Both the emission reduction targets for the non-ETS and the market inertia created by network effects might provide answers to the question of why the EU now seems to have fallen in love with the EV. Another potential reason is the desire to promote technological development in EVs. The car industry is important for

the EU, and by providing the industry with a lucrative home market for the EV, the industry has a better chance of succeeding with the ICEV to EV technology transition.

One may wonder, however, whether emission cuts in the transport sector could be achieved more reasonably if some of the subsidies that currently go straight to purchasers of electric cars had been used for further improvement of the charging and other infrastructure. By giving subsidies to purchasers of electric cars, we compensate them immediately for an inadequate charging network. By promising to develop the charging network faster than market developments imply, the compensation requirement could be reduced, and thereby also the need to subsidize electric cars. Interesting recent research points in the direction of subsidizing the refueling networks, see for instance Pavan (2017).

Electric cars are not the only zero-emission alternative to petrol and diesel cars. Many people had, and may still have, a strong belief in hydrogen-fuel transport. One reason is that this technology may be better for heavier vehicles, and people requiring a long driving range. Nonetheless, hydrogen cars will require a network of electrolysis stations, entailing a high investment cost. Investing in hydrogen cars alongside electric cars may therefore mean a poorer network for electric cars, and in a maximally undesirable scenario, both types of car may achieve too little market adoption because of poorly developed filling and charging networks.

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Bottom-up climate mitigation efforts

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Given the limitations to solve the global climate dilemma in international negotiations, bottom-up efforts can become an important tool to help to avoid climate change at dangerous levels. At the same time, these bottom-up mitigation efforts can be considered as a populations’ willingness to voluntarily provide and support costly climate change mitigation policies and services. Several empirical studies have therefore focused on the acceptance of climate mitigation efforts by revealing the underlying individual willingness-to-pay (WTP) for abating CO₂.

Löschel et al. (2013) and Diederich and Goeschl (2014) use framed-field experiments to investigate acceptable cost levels and the willingness to avoid negative consequences of climate change among the German population. In these studies, participants had the opportunity to purchase their desired amount of carbon allowances which were then withdrawn from the European Union Emissions Trading Scheme. Both studies report a (close-to) zero median WTP and a mean WTP of 12 EUR per tCO₂ (Löschel et al. 2013) or 6 EUR per tCO₂ (Diederich and Goeschl 2014), respectively. According to these findings, a political majority for substantial (i.e. costly) climate policy appears difficult to achieve. Recent framed-field experimental studies more explicitly focus on the role of the spatial dimension for assessing the demand for global and local public goods provision (e.g., Diederich and Goeschl forthcoming, Gallier et al.

2017, Löschel et al. 2018). Löschel et al. (2018) study the demand for global and local environmental protection in China. Related to the previous studies, participants from Beijing had the opportunity to purchase carbon allowances from two Chinese CO₂ emissions trading schemes (ETS) in Beijing or Shenzhen (2000 km south of Beijing) where the first scheme in addition to global climate protection also generates local co-benefits to citizens from Beijing. They report that at low prices the demand for Beijing ETS permits is significantly higher than for Shenzhen ETS permits which stresses the role for co-benefits on voluntary contributions to climate change mitigation. For their sample, the mean (median) WTP per tCO₂ is about 1.47 (0.64) EUR for Beijing ETS permits and 1.43 (0.22) EUR for Shenzhen ETS permits.

In addition to these empirical methods, a growing body of field experiments being implemented as randomized controlled trials (RCTs) have been used to explore the stability and consistency of preferences for certain environmental programs or resource conservation campaigns. As one example for investigating pro-environmental behavior, research has focused on the demand for “green goods” which explicitly link public goods contributions to individual harm-related behavior. As a prominent “green good”, carbon offsetting programs provide the opportunity to reduce pollution externalities and therefore

diminish one's own contributions to a public bad. In contrast to pure donation decisions, carbon offsets and private consumption are inherently linked and may therefore be subject to potential feedback effects from one to another.

In a recently conducted project, we have studied the demand for carbon offsetting in a field experiment within the German long-distance bus market (Kesternich et al. 2016a). The offsetting program was introduced as an official part of the conventional online booking system of the bus operator. After having chosen their ticket for the bus travel, participants were asked whether they would like to offset their related carbon emissions for a given price. Based on individual carbon emissions of 47g CO₂ per passenger kilometer and a price of 17.90 EUR per tCO₂ charged by the collaborating offsetting provider, offsets were sold at 0.08 EURO per 100 person kilometer. Across all bookings, the travel length on average amounted to 268 km, resulting in corresponding CO₂ emissions of 12.6 kg and an offsetting price of about 0.21 EUR or slightly more than 1% of the total ticket price in the baseline scenario. Under these conditions, 27.0% of all customers participated in the carbon offsetting program during their first ticket purchase.

In addition to this baseline scenario, we introduced different treatment groups with financial stimuli such as price discounts of 25%, 50% or 75% to study price sensitivities. Moreover, we considered different matching schemes that multiplied the participants' contributions at a specific rate (e.g., 1kg of CO₂ reduction added for every kg offset by the customer) at no further expense for the customer. As typical for RCTs, participants were randomly assigned into the baseline and into the different treatment groups. Under the assumption that due to the randomization no systematic differences persist between the two groups, differences in response behavior could

be tracked back to the specific attributes of the program in the different groups.

Our analysis reveals that both the price discounts and the matching schemes were able to further stimulate participation but with a modest sensitivity to prices. However, looking at average payments across all customers net of the respective subsidy we only find little differences compared to the baseline scenario. Our most appealing finding is the dominance of the 1:1 matching scheme which also hold in the long-run, i.e. by observing returning customers. While the treatment effects of the price discounts disappeared rather quickly for returning customers after their first booking, only the 1:1 matching schemes further enhanced net contributions when customers were treated repeatedly. Even after removing the financial subsidies we find higher participation rates and net contribution levels for customers previously facing a 1:1 match. One speculative explanation for this surprising finding is that fairness concerns matter for customers: a 50-50 split might be considered as a "fair" burden sharing of carbon emissions between the bus company and the customer.

Does that mean that financial incentives are key to launch pro-environmental behavior? Non-monetary interventions grounded at the intersection of psychology and behavioral economics have broadened the economic toolkit to stimulate environmental protection and resource conservation. These small scale behavioral "nudges" typically include commitment devices, information provision, social norms like peer-comparison, goal setting, or default options. A growing number of empirical applications in a variety of environmental economic settings (e.g. water use, electricity consumption, recycling) underline their (cost) effectiveness.

In a related experiment we have looked at the effect of a subtle non-price based change in the choice architecture

by altering the default option of the offsetting program (Kesternich et al. 2016b). In the baseline scenario, bus travelers had the opportunity to offset their carbon emissions but could also simply ignore the offer without indicating an explicit decision and continue the booking process without participating in the program. This design corresponds to a classical “opt-in” setting with non-participation as the default option. In our “active choice” treatment, customers were required to explicitly indicate their offsetting decision in order to finalize the purchase of their ticket. Our results suggest that the “active choice” request was able to increase the share of participants in the carbon offsetting program by 50% compared to the baseline scenario. Most notably, we find similar treatment effects when analyzing returning customers, providing evidence that active choice requirements maintained increased contributions in the context of iterated decision making. After we finished our experiments with the bus company in fall 2013 the carbon offsetting program remained online and is currently still part of the online booking system of the bus operator.

How do these findings relate to other studies on participation in carbon offsetting programs? Löfgren et al. (2012) study carbon offsetting behavior of air travelers to the Annual Conference of the European Association of Environmental and Resource Economics (EAERE) in Sweden in 2008. The underlying offsetting cost was 20 EUR per tCO₂, resulting in individual amounts of 10 EUR (for 0.5 tCO₂) for flights from within Europe and 40 EUR (for 2.0 tCO₂) for transatlantic flights. Participation rates among environmental economists was generally higher compared to our bus customers. In the opt-in scenario, 39.3% of the participants took part in the campaign. Similarly to our findings, the share increases in the active choice condition (46.8%) but the difference

between the two settings is not significant in this study. Löfgren et al. (2012) explain the missing significance with the characteristics of their subject pool of mainly environmental economists such that default effects may attenuate with market experience. In a similar study, Araña and León (2012) observe participation in a carbon offsetting program among air travelers to scientific conventions and conferences in Gran Canaria from 2009 to 2011. They consider both different default sets (opt-in vs. opt-out) and offsetting prices (10, 20, 40, and 60 EUR). Their results suggest acceptance rates to decrease in prices irrespectively of the frame of the default option. For small prices, participation is higher in the opt-out design. On average, participation rates are in the range of those observed by Löfgren et al. (2012) and amounted to 45% in the opt-in design and to 57% in the opt-out sample. The mean WTP per tCO₂ corresponds to 39.82 EUR in the opt-out frame and to 25.91 EUR in the opt-in sample.

A major insight of these examples on voluntary contributions to climate protection is that citizens' willingness to engage in voluntary climate protection appears to be both context-sensitive and population-specific even if we focus on a narrowly tailored activity such as carbon offsetting. Research shows that individuals do not only differ in their motives for carbon offsetting but these different types of motivations also shape responses to offset prices and offset rates in quite different ways. While voluntary contributions to climate protection will quite certainly not be sufficient to close the emissions gap at the global level, they may contribute to stimulate spill-over or interaction effects in different areas of sustainable consumption and deepen the general awareness for climate protection. As an inspiring example, Carlsson et al. (2016) explores the impact of a social information campaign targeting water conservation in households on

the use of residential electricity in the respective households. While the social information campaign reduces water use both for households with inefficient and efficient water consumption in the pre-intervention phase, positive spillover effects on energy consumption can only be observed for the latter group. The potentials and limits of informal institutions and particularly social norms as a mean to contribute to large-scale behavioral change are not yet fully understood. Field experiments provide a meaningful tool to further deepen our understanding on the role of social norms for environmental protection, including their potentials in groups of individuals, companies and among other non-state actors.

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Brazil and choices in Economics and the Environment: Instituto Escolhas taking the lead

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Sandra has a PhD in Economics from the Swedish University of Agricultural Sciences is a former student at the Environmental Economics Unit of the University of Gothenburg. Once a research assistant at The Beijer Institute of Ecological Economics (1999-2006), Sandra has worked for the National Commission on Environment and as a consultant for UN-ECLAC and UNEP in Chile during the 90's, and as an environmental economist for the Swedish EPA (2007-2011). Back in Brazil since 2011, she rejoined IPEA, where she started as a researcher in 1987. Since 2015, she has acted as scientific counselor to Instituto Escolhas.

One of the world's major countries in biodiversity and forest coverage, Brazil has undergone huge changes in the last few decades, increasing per capita income, life expectation and years in school for most of its population. However, during the last few years, Brazil has been facing multiple political and socioeconomic problems, related to corruption, bad macroeconomic decision making and political turmoil, with the impeachment of a president, increase in unemployment rates, and economic stagnation. Economic recovery is, hopefully, on its way after this year's coming presidential election.¹

Capacity building and the sustainability debate

Nevertheless, we all know that economic growth cannot sustain itself if it does not consider nature². That is the reason why Instituto Escolhas is great news in Brazil: "It aims to qualify the debate on sustainability by translating into numbers the economic, social, and environmental impacts of public and private decisions. Its objective is to produce studies, analysis, and reports to support new approaches and arguments capable of overcoming the ideological polarization in planning conflicting choices, enabling solutions to make sustainable development feasible."³

A nonprofit civil organization founded in August 2015, Instituto Escolhas has carried out and published the results of studies about:

- Urban mobility & low carbon;
- The impact of zero deforestation in Brazil;
- The impact of zero emissions from the electricity sector;
- The impacts of changes in the Brazilian electricity matrix;
- Investment needs to recover 12 million hectares of forests and comply with the Brazilian NDC; and
- The economic and social impacts of a carbon tax in Brazil.

Besides these reports, the Institute provides on its website an online bibliographic research platform focused on Economics and the Environment, aiming to foster research in the area in Brazil.

In spite of the importance of Environmental Economics issues in the Brazilian economy (see, for example, the recent news about the Doce River in Minas Gerais, or the Norwegian mining company polluting the Amazon River basin), there are in the country only a few study centers and researchers focused on this area.

Only a few Departments of Economics offer graduate courses in Environmental and Natural Resource Economics at our universities. Moreover, there is a Brazilian Association of Ecological Economics⁴, connected to the International Society of Ecological Economics (ISEE), but Brazil does not have a national association of environmental and resource economists. During the last two years, no more than seven Brazilian economists, both practitioners and from the academic world, have been members at EAERE.

The Instituto Escolhas launched, therefore, last year, the Economics and Environment Chair, in partnership with Insper⁵ and sponsored by one of the Brazilian big banks, to encourage the teaching and research of contemporary and global socio-environmental issues from an Economics perspective. With the idea of stimulating cooperation between Brazilian and foreign institutions, the Economics and Environment Chair wants to contribute towards expanding the number of researchers that are addressing the complexity of environmental issues in a scientific way, establishing bridges of dialogue between multiple views and stakeholders, so important for overcoming the dilemmas inherent to the country's development process.

Under the umbrella of the Chair, Instituto Escolhas, together with Insper, has already offered courses on Taxation and the Environment (Prof. Bernard Appy, LCA Consultants); Environmental Economics: Analytical Foundations and Experimental Evidence (Prof. Timo Goeschl, University of Heidelberg, also a member of EAERE); and Urban Mobility and its Socio-environmental Impacts (Prof. Fernando Haddad e Prof. Priscila Claro, Insper), for example. Most of the lectures in these courses are available online⁶ and the Institute has plans to organize other courses with both Brazilian and international guests.

Considering the deeply needed increase in capacity building in the area of Environmental Economics in Brazil, the Instituto Escolhas has established a scholarship program. Even though there were resources available for three scholarships in the first call (December 2016), two for Master and one for PhD, there were only applications from master candidates that year and the Institute selected four master students to receive the scholarship. The projects approved were in the following areas:

- Climate Change in Brazil: Systemic Effects on the Brazilian Economy from Changes in Agricultural Productivity;
- Cost-Benefit Analysis of Virtual Water Exports in the Brazilian Agricultural Sector;
- Vehicles Moved to Natural Gas in Brazil: Consequences for the Fuel Market;
- Costs of urban immobility in São Paulo.

As recently as last February, a student awarded the Escolhas scholarship and researching on the theme of virtual water was the first to defend her Master's Degree in Economics, at the Luiz de Queiroz College of Agriculture (Esalq) of the University of São Paulo (USP).

Last December, at the 39th Brazilian Meeting of Econometrics, hosted by the Brazilian Society of Econometrics (SBE) in Natal, Northeast Region, the Instituto Escolhas announced the second edition of the Scholarship Program for Masters and PhDs.

This time, besides the increase in the number of good applications, the Institute selected seven projects to receive financing in 2018/2019, four for PhD candidates and three for candidates for the Master degree. It is also interesting to emphasize the fact that the selection committee was able to choose candidates from different regions of the country, contributing to

the decentralization of study centers where students will receive financing for their research activities.

Gigantic gaps and challenges

By reading these pieces of news, you might think that Brazil is doing great in the domain of Environmental Economics. Unfortunately, that is not the case.

As a recent OECD Environmental Performance Review of Brazil points out, there are huge pressures on the environment and natural resources and “managing the natural asset base sustainably and equitably and decoupling economic growth from environmental pressures is paramount if Brazil is to achieve resilient and inclusive economic development”.⁷

In addition, even if Brazil has a modern and comprehensive environmental legislation framework at all levels of government, there are implementation gaps and the challenges are as gigantic as the complexity presented by the size of the country.

Among the environmental policy instruments in use in Brazil, environmental licensing and permitting regulations are one of the most important. Yet, they are often perceived as undesirable obstacle to investments. In the two houses of the Congress, there are current legal initiatives to minimize the requirements for carrying out infrastructure and other projects with potential environmental impacts in areas of the Amazon or the Cerrado biomes, with the risk of endangering ecosystems and compromising the provision of important ecosystem services.

A recent seminar with a follow-up book publication by IPEA - a public think-tank doing research and studies to help improve public policy making in Brazil-, has called the attention to the need of improving and strengthening the environmental licensing process.⁸

In the area of environmental accounting for attaining sustainable development goals (SDGs), the National Congress has recently approved a law, giving the National Institute of Geography and Statistics (IBGE) the task of calculating the Green Domestic Product, following the guidelines of the System of Environmental Economic Accounts, according to the UN’s international standard.

Both to make progress in Environmental Accounting and to improve implementation and enforcement of the environmental legal framework, there is a need for a growing group of young economists, ecologists, statisticians, and other scientists to make a difference in the way we measure environmental change and produce knowledge to inform decision-making and public policy to promote the SDGs.

There is, therefore, a need for long-term capacity building to deal with the current and future challenges posed by climate change. Consequently, initiatives as the ones put in place by Instituto Escolhas and Insper are good news and deserve our attention.

I hope that the coming World Congress of Environmental and Resource Economists in Gothenburg will offer opportunities to discuss alternatives for cooperation to help us make rapid and steady progress both in the science and in the practice of Environmental Economics.

Endnotes

1. For a quick view about Brazil current situation, check this: https://www.carbonbrief.org/the-carbon-brief-profile-brazil#_=

2. See, for example, the interesting short article by George Martine at IUSSP’s online news magazine <http://www.niussp.org/article/global-population-development->

[aspirations-and-fallacies/](#)

3. <http://escolhas.org/en/quem-somos/>

4. Eco-Eco, <http://www.ecoeco.org.br/>

5. insper is a non-profit higher education and research institution based in the city of São Paulo, and currently one of the most flourishing schools of Economics and Management in Brazil, together with FGV-Fundação Getúlio Vargas (both in Rio and in São Paulo) and the already traditional university departments in São Paulo, Rio de Janeiro, Minas Gerais e Brasília.

<https://www.insper.edu.br/en>

6. Some of the classes are available on YouTube. Please, check for example <https://www.youtube.com/watch?v=686vFV1hngU>

7. OECD Environmental Performance Reviews: Brazil 2015, p. 22.

8. Costa, Klug and Paulsen (eds.), Licenciamento Ambiental e Governança Territorial: registros e contribuições do seminário internacional, Rio de Janeiro: Ipea, 2017 (Environmental Licensing and Territorial Governance: contributions from an international seminar, unfortunately in Portuguese only).

Juniors ask Seniors



What is the most important advice you would give to young researchers starting a career in environmental and resource economics?

Feel assured that you have chosen a most important and intellectually exciting branch of enquiry in the social sciences. That confidence will see you through when you observe that the top 20 journals in economics don't pay heed to the field.

How do you get the ideas for your research questions?

Observation of a phenomenon and conversation with colleagues and friends. I'll give three examples:

(i) Many years ago, while walking in Calcutta I observed a woman with an infant, sitting on the footpath, begging. The infant's face was covered with flies, but she wasn't swatting them. That seemed strange to me until some time later I realised the baby was so undernourished that she had no strength to fend off the flies. Some months later, in Stanford, I mentioned this to Debraj Ray, who as it transpired, had already been thinking about the place of nutrition in the workings of the labour market in poor countries. In fact he had been lecturing on it. So we just chatted about the phenomenon and in due course produced a two-part paper in the *Economic Journal*, uncovering the link between undernutrition and poverty traps.

(ii) Travelling by train from Calcutta to Santiniketan (which is where my parents used to live in retirement) I used to observe that every village we passed had a pond and all the huts were built round the pond. The proximity of living quarters, and in turn their proximity to the pond suggested to me a huge number of issues, for example the place of natural capital in rural life in the world's poorest countries, and the way villagers create and protect social capital. That led to a near-40-year exploration on my part. I still work on the subject, because there are any number of bits and pieces that have to be looked into and connected to one another. Comprehensive research in the social sciences is rather like trying to put together a jig-saw puzzle that has ill-shaped, even missing, pieces. To do good theory you need to be bold and conjecture what the missing pieces may amount to. You then make predictions on what the data will reveal if only you ask of them.

(iii) When he was a post-Doc in Cambridge in the mid 1970s, Eric Maskin used to visit my family in London on a frequent basis. On one occasion we discussed a draft paper by Michael Rothschild and Joseph Stiglitz, on the non-existence of equilibrium in markets for insurance with adverse selection, and realized we didn't understand the paper. But we recognised the paper was of the utmost importance, so we dug into it and

discovered that the model could be re-written as a game with discontinuous payoff functions. We now understood Mike's and Joe's paper. We then proved a theorem regarding the existence of equilibrium in mixed strategies in discontinuous games. Eric's and my collaboration has always been leisurely, so it took us all of 12 years to publish the paper.

Out of 10 papers you start writing, how many do you never finish?

I don't think I have ever not finished a line of enquiry I have started (which is or course not the same as saying that I have always finished a paper I had started writing!). Sometimes I am unsatisfied with the way I have modelled a phenomenon, at other times referees have pointed (even if indirectly) a better direction. The paper I publish is different from the one I submitted originally, but it addresses the same problem.

Which research areas or questions in environmental and resource economics do you personally think deserve more attention?

The population - consumption - environment nexus. To me that's about as important and intellectually exciting a field of enquiry as there is. And because most economists avoid working on it, I have enjoyed a leisurely life trying to understand it. My book with Geoff Heal ("Economic Theory and Exhaustible Resources") was a start, but it had nothing to say about the population side of things (we simply assumed a stationary population, which was a good working assumption for the problems we wanted to study). I studied the nexus very tentatively (it was almost like a reconnaissance) in my 1982 book, "The Control of Resources". (That book's a personal favourite of mine. It must have been one of my most original works, because the few economists who skimmed through it didn't know what to make of it. Scott Barrett is a lonely exception. He likes it so much that he thinks I have been

going downhill ever since!) That book was followed some years later (1993) by "An Inquiry into Well-Being and Destitution," which probed into the phenomenon of absolute poverty in poor countries and its links with the state of the local resource base. I am now 75, so the expected number of years I have left possessing the ability to think usefully is small; which is why I have spent the past 3 years exclusively on the nexus and have delved as deeply into it as I am capable of. Last year I published a joint paper with my younger daughter Aisha (who works in the UN Population Division in New York) on "Socially Embedded Preferences, Environmental Externalities, and Reproductive Rights" in Population and Development Review, and last week I completed the final version of an analysis of those aspects not covered in my paper with Aisha, in my Arrow Lecture ("Birth and Death"), which will be published shortly. In fact Columbia University Press will be reprinting the paper with Aisha in the monograph containing my Arrow Lecture, so the volume will offer as complete an analysis of the nexus as we currently have.

What has been the main motivation for your research throughout your career?

Pleasure, I guess. I have never taken myself seriously enough to think I could make a difference to choices over public policy, nor even to what my professional colleagues work on or think about (and I have had rational expectations about both). We usually don't realise that economics is a very beautiful subject. I mean, the tools we have inherited from our intellectual parents and ancestors are very powerful. If we take them seriously, have faith in them, and treat them well, they yield startling revelations about the workings of the social world. And you can't beat the feeling you get on discovering an intimate connection between seeming unrelated social variables and phenomena.

How do you choose the sessions

that you attend at EAERE/WCERE conferences?

Like most colleagues I would guess - on the basis of topics and people presenting papers.

How do you deal with very critical reviews of your papers?

If the Editor's accompanying letter is discouraging, I (or "we" in the case of joint papers) simply revise the paper on the basis of the adverse comments, and submit it elsewhere. But in times past Editors displayed their personalities, which made life easier. Debraj Ray and I submitted our paper (mentioned above) to the Economic Journal. The main referee disliked the paper so much, that the report was in six, single spaced A4 pages. Today an editor would simply return the material to authors and ask why they had wasted the journal's time. In our case the Editor was Charles Feinstein, who didn't understand mathematical economics, but could sense something was not right: the referee has gone for overkill. So he asked Ray and me to meet the criticisms and resubmit. We did that, which required an expansion of the paper by 50%. Feinstein published it in two parts. I don't think we should expect such inspired editorship today.

What was the funniest experience you had when you gave a lecture or a talk at a conference?

I don't recall ever having had what you would call a funny experience; but discomfitting, certainly. Once I arrived at the podium to deliver a public lecture, only to discover that I had forgotten to bring my slides! I had to rework the lecture on the hoof, so to speak, to make it seem natural that I had no slides.

What is the your first thought when you register for the EAERE/WCERE conference and see the option to offset the emissions from your trip?

Another, entirely desirable, chore to be got through!

Which career / job did you have in mind when you finished high school?

A university teaching post. My father was a university professor of economics. I liked and admired him hugely. I don't believe I had ever had any doubt that I would try to obtain a teaching post in a university.

Which book are you reading at the moment?

Aside from detective thrillers, I read a lot of science-for-the-inexpert. Over the years I have spent much time learning ecology. I needed to do that for my work on the nexus I spoke of earlier. On that I have been fortunate to receive, in addition, instructions from Paul Ehrlich, Peter Raven, and Simon Levin, among others. Most recently I have spent much of my leisure reading material on the Earth Sciences. So as to consolidate my understanding, I am currently reading "Earth" by Frank Press and Raymond Siever. It's astonishingly good.

If you could select a person (alive or deceased) to have dinner with, who would that be?

I am afraid I would select two (or none): My father and mother, who died in 1992 and 2001, respectively.

*Sir Partha Dasgupta, was born in Dhaka (at that time in India) and educated in Varanasi (Matriculation 1958 from Rajghat Besant School), Delhi (B.Sc. Hons, in Physics, 1962, University of Delhi), and Cambridge (B.A. Hons. in Mathematics, 1965, and Ph.D. in Economics, 1968) at the University of Cambridge). He is the Frank Ramsey Professor Emeritus of Economics at the University of Cambridge; Fellow of St John's College, Cambridge; and Professor at the New College of the Humanities, London. He taught at the London School of Economics during 1971-1984 and moved to the University of Cambridge in 1985 as Professor of Economics, where he served as Chairman of the Faculty of Economics in 1997-2001. During 1989-92 he was also Professor of Economics, Professor of Philosophy, and Director of the Program in Ethics in Society at Stanford University; and during 1991-97 he was Chairman of the (Scientific Advisory) Board of the Beijer International Institute of Ecological Economics, Stockholm. Since 1999 he has been a Founder Member of the Management and Advisory Committee of the South Asian Network for Development and Environmental Economics (SANDEE), Kathmandu. In 1996 he helped to establish the journal *Environment and Development Economics*, published by Cambridge University Press, whose purpose has been not only to publish original research at the interface of poverty and the environmental-resource base, but also to provide an opportunity to scholars in developing countries to publish their findings in an international journal.*

*Professor Dasgupta's research interests have covered welfare and development economics, the economics of technological change, population, environmental and resource economics, the theory of games, the economics of undernutrition, and the economics of social capital. His publications include *Economics: A Very Short Introduction* (Oxford University Press, Oxford, 2007). A collection of his scientific papers have been published in a two-volumes set, under the title, *Selected Papers of Partha Dasgupta: 1, Institutions, Innovations, and Human Values and 2: Poverty, Population, and Natural Resources* (Oxford: Oxford University Press, 2010).*

*Professor Dasgupta is a Fellow of the Econometric Society (1975) and the Society for the Advancement of Economic Theory (2013), Fellow of the British Academy (1989), Fellow of the Royal Society (2004), Member of the Pontifical Academy of Social Sciences (1997), Fellow of The World Academy of Sciences (TWAS) – previously, the Third World Academy of Science - (2001), Fellow of the Society for the Advancement of Economic Theory (2013), Fellow of the Association of Environmental and Resource Economists (2017), Member of Academia Europaea (2009); Foreign Member of the Royal Swedish Academy of Sciences (1991), Foreign Honorary Member of the American Academy of Arts and Sciences (1991), Foreign Associate of the US National Academy of Sciences (2001), Foreign Member of the American Philosophical Society (2005), Foreign Member of Istituto Veneto di Scienze, Lettere ed Arti (2009); Honorary Fellow of the London School of Economics (1995), Honorary Fellow of Trinity College, Cambridge (2010); Honorary Member of the American Economic Association (1997), Honorary Professor at the University of Copenhagen (2008-2010), Andrew D. White Professor-at-Large (2007-2013) at Cornell University, and Distinguished CES Fellow 2011, Ludwig-Maximilians-Universitat, Munich. He is a past President of the Royal Economic Society (1998-2001), the European Economic Association (1999), Section F (Economics) of the BA (British Association for the Advancement of Science) Festival of Science (2006), and President of the European Association of Environmental and Resource Economists (2010-11). He was named Knight Bachelor by Her Majesty Queen Elizabeth II in her Birthday Honours List in 2002 for “services to economics”; was co-winner (with Karl-Goran Maler of the Beijer International Institute of Ecological Economics, Stockholm) of the 2002 Volvo Environment Prize and of the 2004 Kenneth E. Boulding Memorial Award of the International Society for Ecological Economics; was recipient of the John Kenneth Galbraith Award, 2007, of the American Agricultural Economics Association, the Zayed International Environment Prize (Category II: Scientific and Technological Achievements), 2010, the lifetime Achievement Award from the European Association of Environmental and Resource Economists, 2014, the 2015 Blue Planet Prize for Scientific Achievement, and the 2016 Tyler Prize for Environmental Achievement. Dasgupta has received a Doctorate, *Honoris Causa*, from Wageningen University, 2000; Catholic University of Louvain, 2007; Faculte Universitaire Saint-Louis, 2009; University of Bologna, 2010; University of Tilberg, 2012; Harvard University, 2013; and University of York, 2017.*



The European Association of Environmental and Resource Economists (EAERE) is an international scientific association which aims are:

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- _to develop and encourage the cooperation between university level teaching institutions and research institutions in Europe.

Founded in 1990, EAERE has approximately 1200 members in over 60 countries from Europe and beyond, from academic institutions, the public sector, and the private industry. Interests span from traditional economics, agricultural economics, forestry, and natural resource economics.

Membership is open to individuals who by their profession, training and/or function are involved in environmental and resource economics as a science, and to institutions which operate in fields connected with the aims of the Association.

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