European Economic Review 99 (2017) 1–4

Contents lists available at ScienceDirect

European Economic Review

journal homepage: www.elsevier.com/locate/euroecorev

Editorial

Challenges in climate change economics

Economists have long argued that the best way to fight climate change is to levy a price on carbon emissions, either via a global specific carbon tax or a competitive worldwide market for emission permits. This price should be Pigouvian and equal the present value of current and future global warming damages and be the same throughout the world. Despite decades of climate negotiations, very little success has been achieved in implementing such first-best climate policies. This disappointing cleavage between theory and practice poses three important challenges to economists. First, global warming is the only truly global externality and therefore policy makers are confronted with huge free riding problems and countries choosing to protect jobs in fossil-based industries at home in favour of protecting the planet (such as the United States under President Trump). International climate agreements do not cover all countries of the world. So if only some countries price carbon, this will depress the world price of coal, oil and gas and thus some of the cuts in emissions will be offset by higher emissions elsewhere. These carbon leakage problems can be overcome to an extent by border tax adjustments or so-called "climate clubs" that punish third non-participating countries with a stiff trade tariff of around 5% (Nordhaus, 2015). Second, most politicians have a tendency to procrastinate and postpone carbon pricing so that their successors have to deal with the unpopular task of fighting climate change. Politicians also prefer the "stick" to the "carrot" and therefore choose to give huge renewable energy subsidies and green R&D subsidies instead of pricing carbon. Although such policies work eventually in locking up more carbon in the crust of the earth, they waste public money and induce rent seeking. Furthermore, both postponing climate policy and subsidising renewable energy induces coal, oil and gas producers to exhaust their reserves more quickly and thus to accelerate carbon emissions and global warming. These Green Paradox effects thus add on to the carbon leakage effects. As far as financial markets are concerned, there is a risk of stranded financial assets to do with irreversible investments if policy makers suddenly take credible and effective action to fight global warming. Third, the energy transition towards a carbon-free economy requires huge technological innovations.

This special issue collects some of the papers that were presented at the conference "Combating Climate Change, Lessons from Macroeconomics, Political Economy and Public Finance" held April 22-23 2016 at Tinbergen Institute Amsterdam and that deal with these types of challenges.

Much of the empirical work that has been done that has attempted to quantify the impact of climate change on the economy, and in particular the damages of global warming to world GDP which are necessary to calculate the worldwide social cost and price of carbon. But it must be remembered that such worldwide estimates are derived from a bottom-up approach of estimating damages at the local level. Local impact studies and especially those addressing what can be done at a local level to adapt to the impact of global warming, are important. Climate services include providing information on climate change to the general public or specific users. Such services can be crucial, in particular for agriculture. One specific example concerns coffee farming. Growth of coffee plants is threatened by coffee rust, which is highly dependent on weather conditions and which can only be prevented if timing is accurate, not too late and not too early. Filippo Lechtaler's and Alexandra Vinogradova's published article[1] "The climate challenge for agriculture and the value of climate services: Application to coffee-farming in Peru", which has been reprinted in this issue, addresses this problem (Lechthaler and Vinogradova, 2017). They constructed a theoretical model, to assess the value of climate services in general. They also described in much detail, the empirical value of climate services in the case of coffee farming in Peru, and showed that climate services are important for the design of climate adaptation strategies.

[1] The articles by Borissov et al. (2017), Brock and Xepapadeas (2017) and Lechthaler and Vinogradova (2017) have been published in a regular issue of this journal, but were part of the conference, and therefore summarized here.

http://dx.doi.org/10.1016/j.euroecorev.2017.06.003

Two papers address the first challenge by modifying the standard approach to international environmental agreements. Ngo Van Long, Quentin Grafton and Tom Kompas in their “A brave new world? Kantian–Nashian interaction and the dynamics of global climate change mitigation” challenge the Nash equilibrium concept as a way of modelling international negotiations on reductions in greenhouse gas emissions. This might explain why the countries of the European Union, various states of the United States, China, and other countries have taken initiatives to curb emissions. Their equilibrium concept revolves around the idea that a Kantian agent when contemplating to deviate from an action assumes that all other Kantian agents will follow. In their model there are also Nash-like agents and they show that the resulting equilibrium with perfect knowledge is Pareto-efficient.

Charles Mason, Stephen Polasky and Nori Tarui in their contribution “Cooperation on climate-change mitigation” also deal with the first challenge. They take account of the development over time of the stock of greenhouse gases when analysing the possibility of international climate agreements. They introduce a two-part dynamic punishing scheme: In stage one countries coordinate on an efficient abatement pattern; in stage two a country that has deviated from the equilibrium must curb its emissions whereas the other countries can boost their emissions for a prescribed period of time. If no deviations have taken place during this prescribed period, countries cooperate at the end of it. Else, one enters again a punishment phase. It is shown that this punishing scheme leads to less global warming.

The published paper by Kirill Borissov, Mikhail Pakhnin, Clemens Puppe (Borissov et al., 2017) asks the question what rate of extraction of a renewable or exhaustible resource (say, oil) will be chosen by society? If emissions are a by-product of extraction and consumption of oil, then it is shown that in a voting equilibrium with agents differing in the rate of time preference emissions are determined by the median discount factor. This approach provides an opportunity to speculate about Stern–Nordhaus debate, or, more specifically, about Nordhaus’s consumer sovereignty approach. According to Nordhaus, public and private investment should be evaluated with the same standards and hence the discount rate must be equal to the real interest rate. This argument is correct only if we assume a representative agent and therefore there is no problem with aggregating time preferences. If discount factors are heterogeneous, the problem of preference aggregation naturally arises.

Thomas Eichner and Rüdiger Pethig in their “Buy coal and act strategically” speak of the second challenge of convincing market participants to lock up coal, oil and gas reserves in the crust of the earth. They critically consider the seminal idea of a climate coalition buying up fossil fuel reserves from their owners put forward by Bård Harstad in his article “Buy coal! A case for supply-side environmental policy” (Harstad, 2012). They assume a world market for fossil fuel that is costly to extract. They consider two types of countries. Those that own fossil fuel deposits, do not sign international climate agreements and do not care about potential damages from carbon emissions; and countries that form an international climate coalition and care about climate change. The latter countries buy reserves in a certain range of extraction costs, entailing that the non-signatory countries will not exploit these resources (and these bought reserves will not be exploited at all by the buying countries). They show that, even with strategic behaviour of the signatories, this policy may be efficient. If it is not, a policy where the coalition might still exploit the reserves that have been bought makes the coalition better off.

In their published article “Climate change policy under polar amplification” (also reprinted in this issue), William Brock and Anastasios Xepapadeas discussed the first challenge of how to conduct a global climate policy when there are climatic differences across the planet (Brock and Xepapadeas, 2017). More precisely, they investigated the implications of polar amplification, which is the phenomenon that at high latitudes and especially at the poles average temperature change is higher than average overall temperature change. This has consequences for marginal damages in different regions of the planet and therefore also for optimal carbon taxes. They developed a two-region energy balance model that allows for calculating the optimal carbon tax in case of differential temperature increases and damages. Ignoring the polar amplification effect leads to an underestimation of the optimal tax with an associated welfare loss of 2% of steady state consumption.

Speaking of the second and the third challenge is that even though the cost of renewable energies is falling rapidly, there is a technological problem of storage. This is still the main obstacle to the large-scale introduction of solar and wind energy. Examples of energy storage are pumped hydro, compressed air storage and batteries. Itziar Lazkano, Linda Nostbakken and Martino Pelli in their investigation “From fossil fuel to renewables: The role of electricity storage” highlight that renewable energy technologies have made considerable progress, but that large-scale storage is crucial to make further gains. They address two interrelated questions. The first question is whether better storage opportunities have an impact on innovation in electricity generation with renewables as well as non-renewables. The second question is whether innovation in electricity generation leads to better storage technologies. Both questions are addressed in an empirical setting with 79 countries and for a period from 1963 till 2011. One of the outcomes is that better storage opportunities indeed enhance innovation in renewables technologies. But, maybe surprisingly, they also lead to innovation in conventional electricity production, because the producers are enabled to produce at a more constant rate. It is also shown that improved renewables technologies incentivise innovation in storage.

Hans-Werner Sinn in his keynote contribution “Buffering volatility: A study on the limits of Germany’s energy revolution” discusses in detail several problems related to the German ‘Energiewende’ or energy revolution. This is an ambitious project that aims to cut CO_2 emissions by 80% in 2050, compared to 1990, and to phase out nuclear energy by 2022. Sinn argues that due to the intermittency of wind and solar power, buffers are needed. He investigates the potential of pumped-storage