Climate Econometrics

Research Summaries 2020

Climate Impact

"Food security in drylands under a changing climate". Lisa Thalheimer, *Policy Brief for European Cooperation in Science and Technology* (2020).

It is estimated that up to 44% of all the world's cultivated systems are in dryland areas where crops are at a risk of declining by 10-25% by 2050 from climatic events like increasing temperatures, longer droughts or floods. Such extremes put both food and water security at risk, while increasing migration amongst pastoralist populations who are most vulnerable to climate shocks. Forced and unexpected migration brings the risk of an unstable diet which can lead to malnutrition, chronic disease, and mental health problems. To combat these, effective governance will play a vital role in mitigating the impacts of climate change and helping to sustain the balance of food security and energy security policies. Climate-smart technologies and climate resilient innovations will also be necessary to help drylands communities adapt to the impacts of climate change. Article here.

"Decarbonising the future UK economy". David F. Hendry & Jennifer Castle, *VoxEU* (2020).

It may come as a surprise that many of the early power sources derived from renewable technology. While much of the modern world is powered by fossil fuels, the falling cost of renewable energy sources in addition to improved storage methods should substantially

reduce oil and gas use in electricity production. There is still a long way to go if the UK is to reach its net zero emissions target by 2050. A complete overhaul of the system through encouraging increased renewable sources, switching natural gas distribution to one that is hydrogen based, investing in new technologies such as graphene-nanotubes to power electric vehicles, and imposing border carbon taxes are just some ways this can be achieved. While it will be important to consider the local costs of potential job losses in the industries likely to be affected, the global pandemic provides an opportunity to tackle some climate issues and usher in a green recovery. Article here.

"Forecast accuracy matters for hurricane damage". Andrew Martinez, *Econometrics* (2020).

Tracking the path of a hurricane as well as the key factors influencing how destructive a storm will be, such as rainfall, storm surge, and wind speed, allows forecasters to tell communities how to respond to an incoming storm. Mis-forecasting can be a costly error, but improvements have been made over time, resulting in an estimated $82 billion in avoided damages between 1970 and 2015. With intensity and unpredictability of storms expected to increase due to climate change, maintaining investment in research, as well as long-term adaptation, is crucial. Full article here. Blog here.

"Revoking coal mining permits: An economic and legal analysis". Ryan Rafaty, Sugandha Srivastav & Björn Hoops, *Climate Policy* (2020).

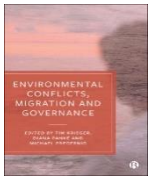
The Hambach forest has been a central battleground where climate activists and incumbent mining interests have clashed for nearly eight years in response to the electricity company Rheinisch-Westfälisches Elektrizitätswerk's (RWE) plans to mine lignite well beyond 2030. One option for Germany is to use the Federal Mining Act to revoke the permit based off the quantifiable social costs to the area. Natural capital accounts quantifying the hidden costs of air pollution, CO_2 emissions and disruptions to ecosystem services can and should be used to bolster the case against continued mining. A major takeaway from the Hambach case is that policymakers should consider the full range of their legal options when it comes to ensuring a timely and just coal phase-out. Full article here. Blog here.

"Comparing urban coastal flood risk in 136 cities under two alternative-sea level projections: RCP 8.5 and an expert opinion-based high-end scenario". Luis M. Abadi, Luke P. Jackson, Elisa Sainz de Murieta, Svetlana Jevrejeva, Ibon Galarraga, *Ocean and Coastal Management* (2020).

Projections of future sea-level rise are uncertain because of limitations in scientists' ability to model the Earth system in its entirety. By using different types of future emissions pathways, we can model a range of sea-level responses, which is useful to explore the possible exposure of coastal cities to future flooding (e.g. storm surges). This paper looks at two different, published sea-level projections made for the same emissions pathway and uses a novel statistical model to map the range of possible future city-based sea-level projections onto present-day exposures. A comparison between projected exposures for the most-likely future sea level of the two projections shows little difference, but for low probability future sea level the difference between the two projections results in vastly different exposures. The emphasis of studying levels of risk typically used in financial settings (e.g. Value-at-Risk) highlights the importance of improving published sea-level projections so that their low probability outcomes converge to avoid under/overestimation of risk. Furthermore, using this approach to determine coastal flood risk can help with better coastal governance. Full article here.

"The paradox of stagnant real wages yet rising 'living standards' in the UK. Jennifer Castle, David Hendry and Andrew Martinez, *VoxEU* (2020).

It is no surprise that real wages have tracked productivity this millennium, as productivity drives real wages, and the two series have in fact moved closely together since 1860. However, over the period 2007-18, something unprecedented happened – both stagnated for the first time in almost 160 years, while over the same period unemployment fell to a record low. One concern is whether enforcing the rapid drop in the UK's CO_2 emissions has impacted GDP growth. This is unfounded, as real GDP and real GDP per capita have risen substantially. The increase in employment is far greater than population growth, so is the likely driver of lower productivity as total output is spread over a larger number of employees. Full article here.



"Climate change, conflicts and migration". Lisa Thalheimer and Christian Webersik, *Environmental Conflicts, Migration and Governance* (2020).

Some studies of the potential impacts of climate change on conflict have found that increased temperatures or reduced rainfall can lead to armed conflict. However, this work challenges that view, arguing instead that armed conflict weakens the capacity of institutions and people to prepare and adapt to climate change. For Somalia's pastoral and

farming communities, local conflict is destroying their ability to effectively cope with extreme weather by altering migration patterns, and governance to address systemic risks must improve to efficiently manage natural and renewable resources. Resolving underlying armed conflict presents a key step to reduce critical vulnerabilities to climate change – both to allow for improved resource management as well as secure migration as an adaptation strategy for pastoral communities. Book here. Blog here.

Technology transfer and innovation for low-carbon development. Miria A. Pigato, Simon J. Black, Damien Dussaux, Zhimin Mao, Miles McKenna, Ryan Rafaty & Simon Touboul, *World Bank* (2020).

The demands of climate change mitigation require that a profound structural and technological transformation takes place globally on a par with the Industrial Revolution, but within just a few decades. Most future emissions are expected to come from developing countries, making it vital that mass deployment of low carbon technology (LTC) is prioritized in these burgeoning economies. Even if every advanced high-income country were to immediately (and irreversibly) reduce its CO_2 emissions to zero *tomorrow*, it would still only allow for an extra 10-15 years before developing countries would need to rapidly decarbonize. Measures to increase LCT transfers to developing countries can reduce economic inequality and advance emissions reductions. They should be at the forefront of new stimulus spending and trade negotiations as governments align COVID-19 responses with their commitments to climate change mitigation. Book here. Blog here.

"A Short History of Macro-Econometric Modelling". David F. Hendry, *Journal of Banking, Finance and Sustainable Development* (2020).

Macro-econometrics has a surprisingly rich history, starting with the first recorded collection of 'National Wealth and Income' data in the Domesday Book, ordered by England's King William I around 1087-88. The creation of more data and precursors to models developed over the centuries, leading to inevitable debates about the best approaches, but achievements were made in many areas. Seven groups of contributors have been key in the development of empirical macroeconomic models: *conceptualizing the macro-economy as a system, creating aggregate data, solving technical econometric problems, making tools for empirical analyses, providing operational implementations of those tools, empirical modelling and forecasting using them, and analysing feasible policies.* However, such achievements have also been accompanied by failures, with a key problem being systematic forecast failures, almost certainly due to unanticipated large shifts like wars, major depressions, sudden policy changes and pandemics. Although our understanding remains incomplete, many advances continue to be made by all seven groups of contributors. Full article here.

"Improving normalized hurricane damages". Andrew Martinez, *Nature Sustainability* (2020).

Analysing the historical damage of all hurricanes to make landfall in the United States since 1900 shows that after accounting for building cost inflation, recent damage from individual hurricanes is considerably less than the costliest storms in the early 20th century and indicates there is an even higher probability of extremely damaging hurricane seasons in the future. The decline in the costs of damages is likely from a combination of adaptation measures such as: improved building techniques, construction of sea walls, better forecasts, and recent hurricanes not directly striking large and vulnerable population centre. If hurricanes Harvey and Irma were more like the Galveston and Great Miami hurricanes, losses would be much greater. Full article here. Blog here.

"The picture from above: Using satellite imagery to overcome methodological challenges in studying environmental displacement". Alison Heslin & Lisa Thalheimer, *Oxford Monitor of Forced Migration* (2020).

As the world gets warmer and climate and conflict shocks intensify, focus is being put on what effects environmental and climatic changes will have on migration patterns. Communities located within "climate change hotspots", such as coastal or pastoral communities, find themselves at risk of displacement. Understanding the displacement process can be difficult, and often, ground data collection is inconsistent and limited in spatial coverage. Satellite imagery can be a supplementary tool to monitor and forecast displacement events as they happen, and assess the vulnerability of regions to environmental displacement, e.g., due to land degradation which is easily captured in remote sensing products. It could be particularly helpful in places such as Somalia where existing conflict and associated risk to on-ground data collection and ground truthing make it difficult to fully understand what might be happening and provide life-saving early warnings.

"Funding inclusive green transition through greenhouse gas pricing". Thomas Sterner, Ryan Rafaty, et al., *ifo DICE Report* (2020).

Under the landmark 2015 Paris Agreement, 195 countries committed to climate stabilisation targets and emissions reductions that require urgent and transformative investments in renewable energy, electricity and heating, buildings, transport systems, industrial processes, and negative emissions technologies, among others. Economists have long held that pricing

carbon (or CO_2 emissions) is a powerful lever to achieve these goals at minimal cost. However, there remains a large chasm between the carbon price levels that have been implemented and those that would be required to deliver the scale and speed of the changes required. The latter will vary greatly across countries depending on initial economic and technological conditions. Furthermore, realizing the full potential of carbon pricing will require methods of adequately addressing opposition from citizens and industrial lobbies that are most exposed to carbon costs but least able to adapt. In this study, we describe the as yet untapped potential of carbon pricing policies and consider means of overcoming gridlock. For the developing country context, we discuss advantages of using the revenues from carbon pricing to subsidise, for example, weatherization of low-income homes or enhanced access to affordable public transport, which achieve multiple policy objectives simultaneously. Full article here.