Climate Econometrics

Research Summaries 2019

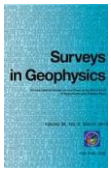
Climate Impact

Pacific Island Countries: An Early Warning of Climate Change Impacts. Luke Jackson and Caroline Anitha Devadason. *Report from the Secretariat of the Rockefeller Foundation Economic Council on Planetary Health.*

What's it about? It focuses upon the impacts from climate change and associated sea level rise on human health and livelihoods in Small Island states, particularly in the Pacific. The report shows that climate change is a present-day threat to key sources of government revenue (especially fishing) and that economic livelihoods in Pacific Island Countries are at risk from limited adaptation capacity. One stark Issue discussed is the currently limited rights of individuals forced to migrate due to climate change. Full article here. Blog here.

Climate Change, Flooding and Mental Health. Luke Jackson et al. *Report from the Secretariat of the Rockefeller Foundation Economic Council on Planetary Health.*

What's it about? The report considers the train of events (both human and natural) that lead to risks of mental health problems caused by coastal flooding. As a climate scientist, Luke was fascinated to explore the research done on mental health, and this report attempts to draw the storyline into something that could be tested to see if: 1) we could measure the impact of increasing coastal flooding (due to sea-level rise) on mental health problems over the 20th century; and 2) consider how mental health problems might change in the future due to increased climate change. One topical message that comes out is that rapidly cutting our carbon emissions will slow the current rate of sea-level rise, giving a bit more time to develop ways of better protecting our coastlines (though retreat must be a genuine option on any decision maker's table if a coastline is eroding quickly), which in turn will help limit flood-induced mental health problems. Full article here. Blog here.



Probabilistic sea level projections at the coast for 2100. Luke Jackson et al. in *Surveys in Geophysics.*

What's it about? The climate impact we refer to is sea-level rise and areas that are and will be most affected are already implementing mitigation and adaptation plans to tackle the risks they are likely to face. While cities like Miami and London have capacity and resources for sophisticated plans, poorer cities and low lying islands states are doing what they can. However, irrespective of the sophistication of adaptation policy, all coastal policy-makers rely on mean sea level projections. These can be global or local but all suffer from large uncertainties associated with incomplete knowledge about how the Earth system might change through time. To better understand what drives the uncertainty, Svetlana Jevrejeva, with Luke Jackson and colleagues reviewed the current methodology employed in making probabilistic sea-level projections. The projections considered in this review framework were based on climate change emission scenarios. While short term projections tend to project similar sea-level rises across all scenarios (from strong mitigation to business-as-usual), things get more complicated when passing 2050. Long-run projections diverge between low and high emissions scenarios primarily because it is difficult to determine what might happen to ice loss in Antarctica and Greenland, and in particular how sensitive this could be to escalating emissions. Full article here. Blog here.

Policy

Sensitive Intervention Points (SIPs). Ryan Rafaty et al. in *Science*.

What's it about? Ryan and colleagues propose a research and policy agenda to identify, model, and trigger "sensitive intervention points" (SIPs) in the transition to a post-carbon economy. They describe two broad classes of SIPs: 'kicks' and 'shifts'. From strategically targeting investments in low/zero/negative emission technologies with the fastest rate of unit cost reductions, to shifting the underlying dynamics of future policy decisions through legislation that creates new committees, builds accountability mechanisms, and 'locks-in' procedures that cumulatively ratchet-up policy ambition, to activating and mobilizing the pro-climate "silent" majority through movements, campaigns, and coalition-building, the article describes how our limited time and resources to mitigate climate change might be best mobilized over the next several decades. Full article here. Blog here.

Pitfalls in Comparing Paris Pledges. Sam Rowan in *Climatic Change*.

What's it about? Analysing Canadian and Russian greenhouse gas (GHG) emissions trajectories over 1990–2015, at the end of which period countries submitted their intended nationally determined commitments (NDCs) at the Paris climate conference, illustrates that

both governments' choice of reference year exerted a strong influence on the apparent percentage reductions of their targets. Specifically, their chosen reference years make the percentage reductions appear larger than alternative reference years, since national GHG emissions fluctuate throughout this period. If each country had selected the other's reference year, but still chosen to target the same absolute GHG emissions level in 2030 as in their original NDC, Canada's headline percentage emissions reduction would be only 16.5% from 1990 levels and Russia's would be an increase of 8.7–16.6% from 2005 levels. The choice of reference GHG emissions levels has major consequences for actual GHG emissions under the Paris Agreement and for measuring each country's claimed contributions to mitigating climate change. Full paper here. Blog here.

First-in, first-out: Driving the UK's per capita carbon dioxide emissions below 1860 levels. David Hendry in VoxEU.

What's it about? Using his own recently developed saturation estimation methods, David identifies three major policy interventions that have had an impact on CO_2 emissions levels in the UK since 1860: an Act of Parliament in 1926 that created the UK's nationwide electricity grid leading to a substantial increase in energy efficiency; the start of the switch from coal gas to natural gas in 1969 where the costs of conversion of equipment were funded; and the combination of the UK's Climate Change Act (CCA) in 2008 with the EU's renewable directive of 2009. What is different about this last combination of policies is their legal commitment to reducing emissions. The CCA requires the UK to reduce emissions by 80% below 1990 baseline levels, while the EU renewable directive requires 20% of energy consumed to be from renewable sources by 2020. David finds that these two most recent policies have played a key role in sounding the death knell for the UK coal industry and have been instrumental in the rapid decline of CO_2 emissions in recent years. Full article here. Blog here.

Economic Modelling

Card Forecasts for M4. Jennifer Castle, David Hendry and Jurgen Doornik. In *International Journal of Forecasting.*

What's it about? The M4 competition sought to discover the "best" forecasting devices by asking entrants to forecast 100,000 time series with data ranging from hourly to annually over horizons covering 48 hours – 6 years. David, Jennie and Jurgen entered the competition to test how their methods compared. 248 teams registered to participate, but only 50 managed to complete all the forecasts. Of those entrants, they ranked 9th overall on forecast accuracy and 3rd on interval forecasts, where the correct level of uncertainty has to be accounted for. They had the best accuracy for hourly forecasts. To do so, they developed two fast and robust methods (Delta, which dampens the sample average growth rates, and Rho, which estimates an adaptive autoregressive model) using the statistical software Ox and OxMetrics. They then calibrated their average (called Card). Full paper here. Blog here.

Econometric Modelling of Climate Systems: The Equivalence of Energy Balance Models and Cointegrated Vector Autoregressions. Felix Pretis in *Journal of Econometrics*.

What's it about? It is imperative to understand the two-way relationship between the economy and climate in order to make informed decisions about the best way to respond to climate change. Linking physical process models of the Earth's energy balance to an estimated econometric system of the observed outcomes provides such a basis. The paper establishes that link empirically, so can account for additional effects such as volcanic eruptions and El Niño. Knowing the uncertainties around the model's estimated parameters allows the model to provide projections of the economic damages of climate change, noting that integrated assessment models (such as Nordhaus' DICE model) rarely include uncertainties on important climate parameters. Full paper here. Blog here.