

EGU2020-22104

<https://doi.org/10.5194/egusphere-egu2020-22104>

EGU General Assembly 2020

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Investigating the GDP-CO2 relationship using a neural network approach

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Exploiting a national-level panel of per capita CO₂ emissions and GDP data, we investigate the GDP-CO₂ relationship, using a data-driven approach. We conduct an in-sample analysis in which we investigate the shape of the GDP-CO₂ relationship. Utilizing the shape of the GDP-CO₂ relationship learned, we project CO₂ emissions through 2100, using the same set of GDP and population growth scenarios as used by the Intergovernmental Panel of Climate Change (IPCC) for their sixth assessment report due for release in 2021-22. Our analysis is carried out at two levels: at a global, and at the level of five large regions of the world. We consider a semiparametric model specification which places no restrictions on the functional relationship between GDP and CO₂, but which allows for country and time specific fixed effects. The nonparametric component of our model is specified as a feedforward neural network, ensuring universal approximation capabilities, theoretically. In a simulation study, we show that our model is able to capture various complex relationships in finite samples of realistic sizes.