Carbon Lorenz Curves revisited. 
Do the Paris Agreement and its Nationally Determined Contributions reflect a more equitable future emissions pathway?

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Motivation and key research question / Motivation und zentrale Fragestellung
Climate change and its consequences threaten human development and are a good example of inequality, both in terms of contributions to greenhouse gas emissions causing climate change and in terms of how countries are impacted by climate change. This was the underlying reason for the debate about historic responsibilities of developed countries and the need for sustainable development, especially in developing countries. This paper looks into the equality dimension of the Paris Agreement and its Nationally Determined Contributions (NDCs) (UNFCCC 2015): A key question is whether the submitted NDCs lead to a more equitable emission distribution across countries and how they compare to pathways stabilizing climate change below 2°C compared with preindustrial levels.

Methodological Approach / Methodische Vorgangsweise
The Gini index and its geometric interpretation as Lorenz curves (Lorenz 1905) measure income distribution between population groups, e.g. distribution of average per capita income of different countries, weighted by population. They have also been used as a measure of inequality other than income, such as per capita CO₂ emissions (e.g. Pan et al. 2014, Heil and Wodon 1997, Groot 2010, Pan, Teng, and Wang 2014b,) and cumulative historic carbon emissions (Teng et al. 2011), reflecting historic responsibilities of developed countries. Pan et al. (2014) used this approach to analyze the level of equity of different emission allocation schemes.

We apply this approach to the Paris Climate Agreement, in form of the NDCs, to assess their carbon equity performance and to derive implications for the first revision. We will compare the GINI index of annual and cumulative national average per capita carbon emissions for the time frame 2015-2030 with and without NDCs and set this into perspective with the historic evolution of emissions equality (Figure 1). In addition, we compare the equity performance of the NDCs with equitable carbon budget allocation approaches stabilizing climate change below 2°C (Pan, Teng, and Wang 2014a, (Gignac and Matthews 2015, Chancel and Piketty 2015).

Results and Conclusion / Ergebnisse und Schlussfolgerungen
Over the past decades, with increasing economic development and energy use, global carbon equity has continuously increased in relative terms. Preliminary results show that the NDCs lead towards a more equitable future, though at a slower rate. We will investigate the details and changes in the country rankings due to mitigation ambitions set forth in the NDCs, such as investment in renewable energies. At the same time, per capita carbon emissions implicit in NDCs are distributed very unequally in the comparison with equivalent allocation schemes proposed in the literature.

As we are looking at differences among countries, one should not forget that big discrepancies within countries exist and are increasing. Emission levels per capita in certain socio-economic strata in developing countries or emerging economies match the levels of average emissions in industrialized countries.

The Paris Climate Agreement brought about a novel global climate governance with new roles and responsibilities. The NDCs and their role in the agreement show an increasing interest of Parties in this paradigm shift which is supported by the increasing emission equity. The dichotomy of developed and developing countries does not dominate the discussions anymore with developing countries becoming more empowered and active actors in climate mitigation.
Figure 1: Carbon Lorenz curves for annual national per capita CO2 emissions, historic, in 2020 and 2030 in a high NDC scenario.

Literatur


