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A warmer policy for a colder climate: Can China both reduce poverty and cap carbon emissions?

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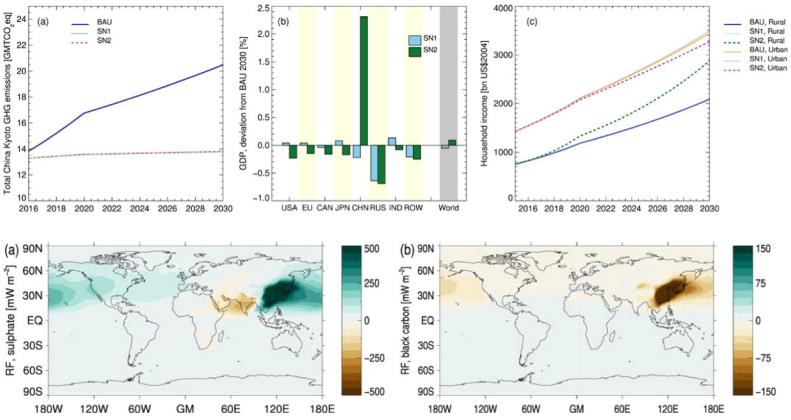
HIGHLIGHTS

- China can cap CO_2-emissions at 2015 level without harming economic growth.
- Poverty reduction is compatible with policy to cap CO_2 emissions.
- Rural poverty reduction financed by CO_2 tax revenue increases domestic consumption.
- One year of the global emissions is avoided.
- The global mean temperature is reduced by 0.03 (±0.02) °C.

GRAPHICAL ABSTRACT



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ABSTRACT

Reducing global carbon dioxide (CO_2) emissions is often thought to be at odds with economic growth and poverty reduction. Using an integrated assessment modeling approach, we find that China can cap CO_2 emissions at 2015 level while sustaining economic growth and reducing the urban-rural income gap by a third by 2030. As a result, the Chinese economy becomes less dependent on exports and investments, as household consumption emerges as a driver behind economic growth, in line with current policy priorities. The resulting accumulated greenhouse gas emissions reduction 2016–2030 is about 60 billion ton (60 Mg) CO_2e. A CO_2 tax combined with income re-distribution initially leads to a modest warming due to reduction in sulfur dioxide (SO_2) emissions. However, the net effect is eventually cooling when the effect of reduced CO_2 emissions dominates due to the long-lasting climate response of CO_2. The net reduction in global temperature for the remaining part of this century is about 0.03 ± 0.02 °C, corresponding in magnitude to the cooling from avoiding one year of global CO_2 emissions.

1. Introduction

The Working Group III report from the IPCC 5th assessment on climate mitigation (Edenhofer et al., 2014) was received with dissonant

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responses by climate experts and policy analysts when it was released in April 2014 (Schiermeier, 2014; Tol, 2014). Although some plainly stated that the analysis is already there, we only need action (The Economist, 2014), there were several critical comments pointing out that the report lacked specific guidance on how countries could lower their emissions.

Some countries are well prepared for a reorientation of their energy policy, with technological, economic and institutional capacity to transform. Other countries face the challenge to develop the economy and reduce poverty at the same time as a fossil energy system needs to be phased out. As argued in the post Working Group III debate (Schiermeier, 2014; Tol, 2014), several policy issues need to be solved together with the climate problem. In this context it was argued that technological progress and poverty reduction might prove to be more efficient in reducing emissions than an international treaty like the Kyoto Protocol.

A ranking of major factors contributing to historic avoided emissions was presented by The Economist (2014) as a guide to the actions that have done the most to slow global warming. The Montreal protocol from 1987 stands out above all policies as the climate mitigator no 1. Well behind follows growth in nuclear and hydro power production, and then comes the one child policy of China. Although merely an illustration, this ranking highlights the relevance of taking factors outside the sphere of dedicated climate policy into account, particularly for developing countries, where the society is in rapid transition along many dimensions. A major issue is therefore to explore the relationship between policy for development and policy for climate mitigation in emerging economies where poverty is still a challenge. Poverty reduction is a stated aim of both poor and rich countries, and the possibility that climate policy will add burdens to the poor is considered unacceptable.

Among emerging economies, China demonstrates will and actions to reduce the climate impact of their rapid growth. In their Intended Nationally Determined Contributions (INDCs) to the COP21 meeting in Paris (UNFCCC, 2015), China pledged to peak CO_2 emissions around 2030 and make their best efforts to peak earlier, reducing CO_2 emission intensity by 60–65% based on reference year 2005. Although China had rapid economic growth over the last three decades, the country is still ridden by huge income differences and serious poverty. It is timely to ask what kind of policies can be successful in achieving both climate mitigation and poverty reduction in China.

In the debate that surfaced after the IPCC AR5 Working Group III report, Victor et al. (2014) called for a return to the early phase of the IPCC when there was pluralism in national climate assessments, allowing better tailoring of climate policies to local circumstances and priorities. While arguing that IPCC still will be needed to merge national assessments into a global approach, he pointed out that national assessments would ensure that developing countries would include their broader policy perspective in projections.

China is now ranked among upper middle income countries (World Bank, 2015), but there is still widespread poverty with 70 million people living below the poverty line of USD 1.25 per day, corresponding to CNY 2800 per year in 2014 (NBSC, 2015b). China is the biggest emitter of CO_2 in the world and has the world's largest economy when GDP of countries are measured and compared in purchasing power parities (PPP), which better reflect the scale of resource use. During the rapid growth period China has become more unequal and the Gini coefficient for family income was as high as 0.5 in 2010 (Xie and Zhou, 2014). The urban average income is around 3 times higher than that of the rural population (NBSC, 2015a). The Chinese government aims at reducing the rural-urban income gap for at least three reasons. First, there is the urgent need to reduce poverty. Second there is the priority to maintain social stability threatened by the huge income disparities and by the serious urban air pollution generating widespread discontent (BBC, 2015; Munro, 2014; Tollefson, 2016). Third there is the need to strengthen domestic consumption as a driver of economic growth and reduce the dependence on export and large-scale public investment programs.

The need for rebalancing the economy was set on the agenda in 2005 when the consumption share of GDP was as low as 40% (Naughton, 2013; Pettis, 2013) and firmly restated during the National Peoples' Congress in March 2015 (National People's Congress, 2015). Over this decade the consumption share increased from 40 to about 50% (Ministry of Commerce, 2015), which is still a critically low level, leaving China extremely vulnerable to changes and shocks in foreign demand and domestic investments.

Giving the poor more purchasing power is an effective way of raising consumption. The government has implemented major reforms in terms of better access to health care and education, in particular in rural areas (Cai et al., 2014). The rural population of over 600 million and the rural work migrants of more than 200 million in the cities (NBSC, 2012) are practically without social security and save to compensate for that. Hence, both the poor and the wealthy save and the large financial surplus of the economy tends to flow into less productive, but politically strong industries, e.g. the state owned enterprises (Naughton, 2013). The state owned enterprises dominate the energy intensive industries and a transition from investment and export driven growth to more consumption based growth is expected to affect the industrial structure, with potential large implications for energy use and emissions of CO_2.

Our study considers climate policy separately and in combination with socio-economic reforms. By reducing poverty these reforms might support the transition towards a more consumption driven economic growth. Our study will show if there is synergy or trade-off between climate policy and the preferred socioeconomic development in China. We modify the China module of the global computable general equilibrium (CGE) model named GRACE (Aaheim and Rive, 2005), which has been used for various studies of global and regional climate and energy policy issues (e.g. Glomsrød et al., 2015; Liu and Wei, 2016; Underdal and Wei, 2015; Wei et al., 2015). The urban and rural economies are dealt with separately to trace the effect of the policy on the urban–rural income gap.

We first introduce climate policy in terms of a tax on CO_2 emissions from fossil fuel combustion. The CO_2 tax is endogenous and stabilizes China's CO_2 emissions at 2015 level towards 2030. The accumulated emission reductions from this policy correspond to one and a half times the current global CO_2 emission level. In another scenario we assess the effect of a similar CO_2 tax and avoided emissions in combination with policy for socioeconomic reforms targeting poverty among rural households. Our results cover the impact on economic growth, urban and rural income distribution, the consumption share of GDP, energy market development and emissions of greenhouse gases (GHG). Further, we assess the effect on the global mean temperature to illustrate the climate contribution of this policy reorientation in China.

Earlier studies have looked at the climate effect of hypothetical reductions in emissions (Aunan et al., 2009; Shindell and Faluvegi, 2010; Unger et al., 2009). To our best knowledge, our approach is the first to study the climate effect of relevant national development policies to see if further growth and poverty reduction can go hand in hand with climate mitigation.

Section 2 below presents and discusses the design and policy relevance of the business as usual and policy scenarios. Section 3 presents the set of economic and climate models used in our analyses, together with major data sources. The main structure and assumptions of the global multiregional CGE model are explained, followed by an overview of climate models used to assess the effect of policies on radiative forcing and the global mean temperature. Section 4 reports the impacts on the economy and energy use whereas Section 5 assesses the climate effect of stabilizing CO_2 emissions at 2015 level towards 2030. The last section concludes the paper.