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How climate change mitigation could harm development in poor countries

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Abstract

Avoiding dangerous climate changes requires emission reductions in not only industrialized, but also developing countries. This opinion piece argues that even if the 'full incremental costs' of abatement in developing countries would be covered by industrialized countries, the former's development prospects could be hampered by climate change mitigation due to the following reasons: First, financial inflows have the potential to induce a 'climate finance curse' similar to adverse effects related to natural resource exports. Second, increased use of more expensive low-carbon energy sources could delay structural change and the build-up of physical infrastructure. Third, higher energy prices could have negative effects on poverty and inequality. We conclude that these considerations should not be seen as an indication that one should abstain from emission reductions in developing countries. However, until developing countries' most severe concerns can be

appropriately addressed, attention should be focused on measures that promote human well-being while saving emissions.

INTRODUCTION

In the past, economic development has been closely related to burning fossil fuels, a major source for greenhouse gas (GHG) emissions that are known to cause climate change [1]. Consequently, industrialized countries rank among the highest emitters of GHGs, at least on a per-capita basis. On the other hand, countries of the global South can be expected to witness the most severe impacts from climate change with adverse consequences for their development prospects [2]. Whether and how adaption to these impacts can be managed is uncertain and subject to profound political and scientific debate [3,4].

At the same time, reducing emissions only in industrialized countries is not sufficient to achieve ambitious climate change mitigation e.g. in line with the 2°C goal adopted in the UNFCCC; rather, avoiding dangerous climate change will make it necessary for developing countries to also reduce (or slow the increase of) their emissions . To date, however, in many cases emission intensive fossil fuels constitute the least expensive source of energy, being significantly cheaper than low carbon alternatives like renewables or nuclear energy [5]. Even in countries currently featuring high costs of fossil energy, relying on proven conventional technologies rather than on low-carbon energy sources might be the cheapest option to add new generation capacities [6], especially if costs required to ensure grid stability for high shares of renewable energy are taken into account [7].

This raises the question whether – next to the impacts of climate change – climate change mitigation might have adverse consequences for the development and prosperity of poor nations. This possibility highlights a major dilemma, namely whether there is a trade-off between 'dangerous climate change' and 'dangerous emission reductions'.

The debate whether poor countries can be required to take a different, i.e. less carbon-intensive development path than developed countries in order to ensure adequate living conditions for the generations to come, even if it might undermine their ambitions to catch up economically with industrialized countries, is not new. Already in 1991, Robert Solow [7] highlighted that it is ethically unjustifiable to deny development and in particular access to cheap energy - which today still goes along with carbon-intensive fuels [5] - to the world's poor. And indeed, in the last two decades, successful poverty alleviation and economic growth in China and a few other developing countries have gone hand in hand with a large scale carbonization and convergence to developed countries' energy demand [9,10].

It is therefore of little surprise that international climate negotiations are stuck in a dead-lock: despite numerous possible co-benefits on the national and local levels – such as reduced air pollution and increased energy security [11]– developing countries are reluctant to adopt binding commitments to reduce their emissions out of concern to impede their development prospects . This is for instance reflected in the assessment by India's former environment minister Jairam Ramesh that the failure to agree on binding global reduction targets at COP-15 in Copenhagen in 2009 has protected the right to continued economic growth for India, China, South Africa and Brazil [12].

With the United Nations Framework Convention on Climate Change [13] requiring industrialized countries to cover the 'agreed full incremental costs' of mitigation measures, these concerns over dangerous emission reductions might at first sight seem overstated. However, as will be discussed in the remainder of this opinion piece, even if appropriate North-South transfers to finance emission reductions in developing countries could politically be achieved there are further possible pitfalls that are frequently overlooked in the current debate. In particular, we analyze how climate change mitigation could have adverse impacts on economic development by (i) inducing a 'climate finance curse', (ii) delaying structural change and build-up of physical infrastructure, and (iii) affecting poverty and inequality.

MITIGATION COSTS IN DEVELOPING COUNTRIES

When aiming to avoid dangerous climate change, it is inevitable that at least some emission reduction efforts are also undertaken by developing countries. It has repeatedly been shown that developing countries imitating development pathways of today's developed countries would make ambitious climate change mitigation unachievable [14].Looking at least-cost mitigation scenarios[1], it is obvious that developing countries will need to reduce their emissions as compared to today, even though to a lesser extent than developed countries. Comparing emission reductions to baseline emissions, i.e. without climate policy (cp. Figure 1), developing countries will need to substantially reduce their emissions, even to a higher extent than Annex I countries.

[Figure 1 about here]

Even though low-carbon energy sources can be competitive in off-grid applications [16], they are probably more expensive than fossil fuels in order to achieve full-scale industrialization [5]. More efficient energy use could offer a further option to reduce emissions at low costs. However, despite its significant technical potential, important barriers (such as hidden costs or information asymmetries) limit the potential of energy efficiency improvements as a low-cost mitigation option [17]. Hence, if the costs of reducing emissions were to be covered fully by those countries actually carrying out mitigation, substantial costs could arise in developing countries [18]. These costs could

[1] Scenario results play an important role in the international debate on climate change mitigation and are in the core of past (AR4, [1], SRREN, [5]) and future (see e.g. [15] for a discussion of scenarios in the forthcoming AR5) IPCC reports.

be even higher if action on climate change mitigation is delayed further, or if the use of certain technologies (such as CCS or nuclear power) is restricted. Assuming the burden of these costs would very likely create conflicts with poor countries' development objectives (e.g. poverty reduction), and even in cases in which low-carbon technologies would be less expensive in the long-term, e.g. due to learning effects, policy makers might rely on the cheapest option in the short-term.

From an ethical perspective, it hence seems indefensible to require poor countries to engage in what can be regarded as 'dangerous emission reductions'. Rather, some argue that in the future economic benefits associated with GHG emissions should accrue to those that have not yet benefited from them in the past [19]. This is reflected in the UNFCCC's principle of "common but differentiated responsibilities" implying that the burden to mitigate (and adapt to) global climate change should be allocated differently between developing and developed countries, with the latter taking a greater responsibility.

Perhaps the most straightforward way to combine cost-efficient abatement of GHG emissions with equity considerations is an international carbon market [20]. So far, the most prominent international response to climate change targeting mitigation has been the Kyoto Protocol, which establishes an international carbon market for a number of developed countries[2] . This market could arguably be expanded by including developing countries as well[3]. Trading of emission permits would then ensure economic efficiency by equalizing mitigation costs across countries, while equity considerations could be addressed by the choice how to allocate these permits. That is, a country expected to face relatively high mitigation costs could be compensated by a larger share of the global 'carbon budget' [23][4]. In fact, most analyses of market-based instruments to tackle climate change implicitly or explicitly assume such a global carbon market to be in place [24,25].

The scheme to allocate emission allowances could be related to specific normative principles, either based on equality (e.g. equal per capita allocation schemes), compensation (e.g. historical emissions) or grandfathering (e.g. an allocation based on current emissions)[5]. Developing countries would then receive financial transfers from selling emissions allowances to developed countries in all ethically justifiable allocation schemes. Jakob et al. [27] show that for some regions, those transfers account for up to roughly 15% of GDP in model calculations. These large transfers are the main reason why the available literature [24,25,28] concludes that mitigation of climate change can be achieved at low net costs or even gains for developing countries.

[2] Developing countries only participate through an offset mechanism, the Clean Development Mechanism.

[3] Note that recently a number of developing countries have announced domestic emissions trading systems [21]. A global carbon market could emerge from bottom-up linking of such schemes [20], as is currently discussed for e.g. Australia and the EU ETS [22].

[4] Alternatively to a global carbon market, developing countries might be compensated for their abatement efforts, e.g. via the Green Fund established under the UNFCCC.

[5] It is difficult to justify a pure grandfathering approach from an ethical perspective, even though it can be argued that the protection of socio-economic systems could be justified in a transitional period from the status quo to, e.g. an equal per capita allocation [26].

FINANCIAL INFLOW PROBLEMS

As discussed above, an international permit trading scheme might induce large financial inflows. Absorbing large financial inflows has historically proved to be non-trivial and has often led to negative impacts on long-term economic growth in recipient countries. Negative effects have frequently been observed in relation to inflows from natural resource revenues – a phenomenon which has been labeled 'resource curse' in the literature [29-32] – but also from development assistance and foreign direct investment. It is therefore a crucial question whether proposed climate transfers can be translated into macro-economic gains, stimulating consumption growth in the long run, or whether in analogy to the 'resource curse' comparable negative effects also apply for revenues stemming from carbon permits [33].

In order to shed some light on this question, it is important to understand the drivers of negative impacts. The literature how resource incomes can become a curse identifies three channels: First, 'Dutch Disease', generally describing the appreciation of the real exchange rate of a resource exporting country and related negative effects due to crowding-out of the manufacturing sector [34,35]. Second, the quality of institutions and rent seeking, with large windfall gains related to financial inflows encouraging rent-seeking, which can hurt innovative activity and thus growth in the long run [36], especially in countries with low institutional capacity. Third, volatility, as an economy that largely depends on volatile resource revenues exhibits macroeconomic variability, again negatively influencing long-term growth prospects [31,32].

Analyzing similarities along the three channels, Kornek et al. (2013) [37] conclude that rents induced by climate policy can indeed be expected to lead to comparable (i.e. negative) effects as resource rents. Even though exact effects regarding sectoral responses to financial inflows resulting from selling emission permits are country-specific, depending on a country's endowment with capital and labor, spending effects resulting from additional revenues to an economy will most likely occur in any case; thus 'Dutch Disease' effects might well be comparable to conventional resources. Second, countries that are expected to benefit most from allocation schemes proposed on an equity base, e.g. India or countries in Sub-Saharan Africa, do not witness an institutional quality that – historically – was necessary to avoid rent-seeking. Third, the volatility of prices in the EU ETS is comparable to the volatility of prices of natural resources that have been found to be linked to the resource curse in the past [31,32][6] and countries that would receive the lion's share of the climate rent (i.e. in Sub-Saharan Africa or India) do generally not have sufficiently well-developed financial markets to deal with volatility [30,31].

[6] An international carbon market guaranteeing a maximum flexibility in space (e.g. by a maximum number of countries joining [38]) and time (e.g. by banking and borrowing [39]) could ease concerns with respect to volatility of permit prices.

Different alternatives to an international carbon market to compensate developing countries for their mitigation costs while keeping the amount of windfall-profits (i.e. the rent transfer that might occur in addition to the costs of mitigation) at a low level are currently under discussion. These include approaches to either cover exclusively the incremental investment costs of low-carbon energy sources, or macro-economic mitigation costs in the form of reduced aggregate consumption (even though the latter remain a largely theoretic concept difficult to conceptualize in practice). These costs would need to be provided by the international community, e.g. by an international fund, such as the currently discussed Green Climate Fund. In any case, implementing such direct transfers could turn out rather problematic, as no satisfactory mechanisms to ensure they are used cost-effectively or even that they achieve real emission reductions exist [27].

INDUSTRIALIZATION AND STRUCTURAL CHANGE

Even if mitigation costs in developing countries were compensated by payments from industrialized regions, increased energy prices related to low-carbon technologies could have profound impacts on countries' future development.

It is well known that economic growth is not simply an expansion of economic activity, but involves structural changes in the economy in the form of shifts from the agricultural sector towards first the industrial and – at later stages – the service sector [40]. Hence, today's rich countries have based their wealth on successful industrialization, which was closely related to changing patterns of energy use [41,42][7]. Recent empirical evidence suggests that developing countries that have caught up with industrialized countries have been following development pathways that bring them ever closer towards the latter's energy use patterns without any sign of economic activity becoming 'de-coupled' from energy consumption [10]. One reason to expect a close correlation between economic growth and energy use is accumulation of physical capital, which is commonly thought of as energy-intensive. For instance, consider the following statement by economic historian Eric Hobsbawm [44], pronounced more than half a century ago: "It is evident that no industrial economy can develop beyond a certain point until it possesses adequate capital-goods capacity. This is why even today the most reliable single index of any country's industrial potential is the quantity of its iron and steel production" (p.42). Taking into account e.g. China's substantial accumulation of energy-intensive capital goods during the past decades [45], nothing suggests that the above statement should be invalid for present days. Rather, one would readily expect other developing countries aiming to parallel China's success in terms of economic growth and poverty reduction to embark on an equally energy- and carbon-intensive development path. Consequently, higher energy prices that result in higher prices of capital goods could well distort incentives away from capital accumulation and thus delay successful industrialization.

Further, historical patterns suggest that in the future a substantial fraction of energy-intensive capital goods will be devoted to public infrastructure, such as buildings, roads, and railways, as such infrastructure investments have repeatedly been found to be closely correlated with economic growth [46,47]. Consequently, increased energy prices could have adverse impacts on economic

[7] For instance, Bardini (1997) [43] identifies a lack of coal endowments as the main reason for Italy's delayed industrialization.

growth by crowding out infrastructure investments. This is in line with Steckel et al. (2013) [48],who cast doubt on the internal consistency of future scenarios of greenhouse gas mitigation in developing countries that project high rates of growth in combination with no (or only modest) increases in energy consumption, highlighting the crucial role of building up (energy-intensive) physical infrastructure in the growth process.

Finally, increased energy prices in combination with other market failures prevalent in developing economies could create or exacerbate a 'poverty trap'. For instance, investing in an electricity grid might only be worthwhile if the associated fixed costs can be shared between a sufficiently large number of costumers. For these customers, in turn, switching from traditional forms of energy to electricity might only be meaningful if the latter's price is sufficiently low. In such a setting featuring 'backward-forward linkages' à la Hirschman [49], the economy can end up in multiple equilibria: the social optimum, in which everybody is connected to the grid, as well as an inferior one, in which no one is [36]. Which equilibrium is selected then depends on the individuals' ability to coordinate their actions. Hence, as any individual actor will have less incentive to adopt modern energy, more expensive energy in combination with coordination failures could make it more likely to end up in the inferior equilibrium.

POVERTY AND INEQUALITY

Besides affecting a country's aggregate growth performance, higher energy prices could also have impacts on more broadly defined measures of human development, such as poverty and inequality.

For instance, numerous studies have identified a close correlation between per-capita energy consumption and the UNDP's Human Development Index (HDI) for low-income countries [48, 50] and others have highlighted that there are minimum energy requirements for a decent level of development on the individual level [51] as well as on the level of the macro-economy [52].

Furthermore, countries that have been the most successful in reducing poverty (measured by the share of the population living on less than 1.25 USD per day) have also witnessed the largest increases in per-capita energy use, as displayed in Fig. 2. Energy is also frequently associated with the achievement of the UN Millennium Development Goals [53]. In fact, in the year 2009, more than 1.4 billion people lacked access to electricity, and about 2.7 billion relied on traditional biomass for cooking [14]. Arguably, providing access to clean, reliable and affordable energy will be a key element of any development strategy aiming at poverty reduction and sustainable development [54]. Even though some renewable energy technologies have the potential to provide cost-efficient energy access in areas not yet connected to the national electricity grid [16], climate measures in developing countries could result in higher prices for modern forms of energy, either because (a) the externality related to GHG emissions from fossils fuels (such as kerosene or LPG) has been priced in by means of e.g. a carbon tax, or (b) because other, low-emitting but more expensive, energy sources (such as solar or wind power) are used. In both cases, higher prices for energy could undermine energy access, thus trapping the poorest segments of society in their current patterns of energy use, which are often inefficient and unsustainable [5].

[Figure 2 about here]

With regard to distributional effects, most studies for OECD countries find regressive impacts of higher energy prices [55], as poorer households spend a larger share of their income on energy. For developing countries, however, the empirical evidence is more mixed: even though some studies identify progressive effects [56] others emphasize that the distributional effects of changes in energy prices would crucially depend on which types of fuels are affected in which way, as energy use patterns show substantial variation across income groups [57]. In addition, one should not overlook that even a progressive outcome could in fact increase poverty levels if the revenues through e.g. a carbon tax are not appropriately redistributed [58]. Hence, any policy intervention that increases energy prices runs the risk of negatively impacting the poorest if it fails to deliberately incorporate pro-poor measures [59].

CONCLUSION

This opinion piece has highlighted several mechanisms through which climate change mitigation could hamper poor countries' development prospects. Most obviously, ambitious emission reductions would require substantial cuts in emissions not only in industrialized, but also in developing countries. Covering the costs of emission reductions would tie up funds in developing countries that could otherwise be employed to reduce poverty. As we have pointed out, this potential problem would require a scheme (such as a sufficient allocation of emission permits in an international carbon market, or direct transfers) through which developing countries can be compensated for their mitigation costs by industrialized countries.

Past climate negotiations have shown that establishing such an agreement is a highly challenging task. Even under the optimistic assumption that an appropriate compensation scheme was in place, climate change mitigation could turn out harmful for developing countries for three reasons: First, the resulting financial inflows from sales of emission permits might result in a 'climate finance curse' analogous to the 'natural resource curse' frequently observed in the context of natural resource exports, particularly for countries with weak institutions. Second, increased energy prices related to higher costs of low-carbon energy sources could – even if they are compensated by transfers – have dynamic effects on economic growth by delaying structural change and investments in (often energy-intensive) infrastructure. Third, increased energy prices can also be expected to affect individual energy access and have distributional consequences, including the possibility that the poor are made worse off if revenues from a carbon tax or emissions trading scheme are not distributed progressively.

These considerations should not be regarded as a potential excuse to forgo emission reductions in developing countries. As we have argued above, mitigation in developing countries is essential to minimize the risk of dangerous climate change. However, in order to guarantee equitable climate stabilization that does not turn out detrimental for the poorest people on the planet, scientists and policy-makers need to examine in how far the mechanisms discussed above pose real threats to development and identify appropriate instruments to prevent possible adverse impacts. These threats are not equally distributed over all developing countries: for some developing countries that have appropriate institutions and policies in place, transformations of their energy systems could even open up avenues of industrial development. Others, however, may be prone to the adverse effects described above. Future research needs to identify such 'vulnerable' countries where climate mitigation measures put development objectives in jeopardy.

Yet, delaying mitigation in fast growing developing countries bears the risk of creating a lock-in into a carbon-intensive fossil fuel based energy system [60, 61]. Hence, until the most serious concerns for developing countries as well as policies to address them are identified, a number of measures that seem uncontroversial from a development perspective can contribute towards human well-being while at the same time saving emissions. These include reforming fossil fuel subsidies, green industrial policies, promoting energy efficiency, or fostering energy access in off-grid areas.

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Figure captions

Figure 1: Physical abatement between a BAU scenario (bold) line and a 450 ppm CO2 only climate stabilization scenario (dotted line) in Annex I and non-Annex I countries based on data used in [18].

Figure 2: Change in energy use per capita (blue) and CO2 emissions per capita (red) over change in poverty rates. Poverty is measured at the $1.25 PPP poverty headcount ratio. Changes are measured for selected developing regions as average annual growth rates for the period 1981 – 2008 in per cent. Data Source: World Development Indicators