TOLL GATES AND MONEY PUMPS:

Why carbon taxation could be a simple, fair and transformative policy instrument

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Autonomy

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EXECUTIVE SUMMARY

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- This study looks at the possible impacts of a carbon tax and dividend scheme upon incomes across society. In its simplest formulation, such a scheme taxes individuals according to their carbon consumption and pays out the revenue to all individuals within a defined geography. It is comparable to a form of Universal Basic Income, funded by carbon taxes.

- This study models such a scheme at three different scales: Global, European and the nation state.

GLOBAL

A global carbon tax dividend would disproportionately benefit countries in Latin America, South Asia, Sub-Saharan Africa and many other countries in the Global South.

Such a global scheme, if tuned properly, would effectively end extreme poverty globally and would also serve to lift more than a billion people above more ambitious poverty lines of **$3.2** and **$5.5** a day.

3.8bn people would see their income increase by at least **10%** with a global carbon dividend scheme.

The global scheme would see individuals in the group of heavily indebted poor countries (HIPCs) receive a total of **$438bn** in dividends annually, outperforming today's schemes for development assistance and debt relief combined.

Emerging economies such as Brazil and India would also profit substantially from such a global carbon dividend, receiving a net gain of more than **$37bn** (1.9% of GDP) and **$696bn** (24% of GDP) respectively for Brazil and India.

EUROPE

A carbon tax dividend scheme limited to Europe would most benefit Bulgaria, Croatia and Romania, but would also significantly benefit the poor (lower income deciles) in most European countries.

NATIONAL

At the national scale, a national carbon tax-dividend scheme in Brazil would have huge economic effects, increasing the income of the bottom **10%** by more than **72%**, while the top **1%** would lose around **10%** of their income.

In the UK and Germany, national carbon dividend schemes would benefit **70%** of the respective populations, who would receive net contributions from the top **30%** of the population - with the majority of contributions coming from the top **1%.**

CONTEXT AND BACKGROUND

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Humanity is facing a rapidly exacerbating climate crisis, driven by anthropogenic greenhouse gas (GHG) emissions. To reduce emission levels, economists have long called for the introduction of carbon pricing, either through direct taxation or through emission trading schemes, in order to discourage carbon use. The basic argument is that such a taxation is required to remedy one of the central market failures of our time: that without state intervention, no immediate costs are attached to emitting GHG emissions despite the immense environmental, economic (and potentially existential) costs associated with them. This leads economic actors to, for instance, prefer marginally cheaper energy sources to sustainable alternatives - the costs of GHG emissions are thus externalised. There are fears however that pricing them in through taxation might adversely affect social stability, with the French so-called Yellow Vests serving as a warning of the political and social price that might be attached to trying to fix the climate crisis in ways that entail increased consumption costs (Chancel 2021).

Our governments seem to be stuck between a rock and a hard place: either let climate change run its course, and postpone action for another few years, or risk upsetting huge parts of the electorate. The result is the standstill that still characterises much of policy making around ecological sustainability. Thus, we need to search for ways to combine ecological and economic sustainability: we need incentives to consume less carbon and rewards for those that already do.

WHAT IS A CARBON TAX?

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The basic idea of a carbon tax is to introduce a tax charged for every ton of carbon emissions 'consumed' by the production of a good or service. Ideally the introduction of such a tax would act as a 'stick', leading to lower carbon emissions by deterring consumption of a particular kind via higher costs. It also would bring in significant revenue, which can be redeployed in a number of ways.

It should also be noted that using taxation to reduce carbon emissions - whether they be levied upon companies or on individuals - will ultimately affect consumers themselves at the end of the day. 'Upstream' emitters such as car companies or oil firms will push the new costs accrued from targeted taxes downstream to their customers.

MONEY PUMPS:

The importance of the dividend component

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> *"The principle behind carbon dividends is straightforward. The amount that each person pays is based on his or her use of a limited resource: the atmospheric space for carbon emissions. The amount that each receives is based on common ownership of the resource. From each according to use, to each according to equal ownership." (Boyce 2019: 82)*

As is well established, normal consumption tax schemes can often be regressive (Mathur/Morris 2014; Wang et al. 2016). By taxing a certain form of consumption (e.g. sugar, alcohol, carbon, etc.), such schemes inevitably deduct a larger proportion of the incomes of lower earners, simply because there is a smaller pot from which this consumption draws (Boyce 2019). An extra £1,000 in tax per year means something very different to someone on the minimum wage than it does to someone earning six figures. This underlines the importance of the dividend component of any carbon taxation scheme: we need money pumps to protect lower earners and emitters from being financially worse off (Barnes 2021).

A carbon tax affects some cohorts of the population more than others. A solid body of research has evidenced a correlation between higher income, higher consumption and higher emissions on national and global levels (Chancel/Piketty 2015; Oxfam 2015; Hardadi et al. 2020; Oswald et al. 2020; Oxfam 2020). As emissions are polarised roughly in line with socio-economic polarisation, schemes that would tax everyone's GHG emissions and then distribute the income via a dividend amongst the population, could potentially be hugely transformative (Bach et al. 2019; Kalkuhl et al. 2021; Gechert/Dullien 2021).[1] Support for a system of carbon dividends is particularly strong within the field of economics, inspiring the largest public statement of US economists in history, rallying 4 Former Chairs of the Federal Reserve, 28 Nobel Laureate Economists and thousands of rank-and-file colleagues behind the demand for carbon dividends (Akerlof et al. 2019). At the same time, evidence is mounting that an inclusive redistribution generated from carbon taxation is key to gaining political support for ambitious policy making (Klenert et al. 2018).

Beyond academia, an increasing number of prominent actors are calling for proposals along these lines too. From David Miliband's proposal of tradeable personal carbon allowances in 2006, or the Green New Deal for Europe campaign demanding a tax-and-dividend system, to the contemporary German Greens' Energiegeld, redistributive carbon pricing has increasingly gained traction in politics. Crucially, the idea has also gained popularity with parts of the labour movement, who have been long wary of additional indiscriminate consumption taxes, with the Macroeconomic Policy Institute of the German Hans-Böckler-Foundation, the premiere trade union think tank in Germany, demanding the introduction of a tax-and-dividend system to ensure a retributive implementation of CO2-taxation (Gechert/Dullien 2021).

1 This is the another reason why an individualised carbon taxation scheme would likely be progressive.

In the following, we will model such a tax-and-dividend system based on Lucas Chancel's updated database (2021) on global emission distributions. We will do so by investigating how the introduction of a tax-and-dividend system might lead to redistribution on the global, regional and national levels. Our modelling is based on the assumption that carbon taxation is levelled indiscriminately on all consumption based on its emission intensity, with all revenue generated through that taxation being equally redistributed amongst the population in full. Ideally, this would take place on a monthly basis through direct money transfers from the taxing authorities to the population at large.

To allow for a direct feedback loop to consumers, the GHG-share of commodities would need to be labelled explicitly on purchased products, providing individuals as well as companies transparency over the environmental impact of their consumption.[2] This transparency in combination with the increased relative costs of carbon-intensive consumptions would provide a powerful incentive for both private as well as institutional consumers to "green" their consumption.

2 The carbon indexing of products should follow established methodologies for environmental impacts assessment within sustainability studies such as life cycle assessment (LCA), as defined in ISO standards ISO 14040 and ISO 14044. To avoid double-taxation, environmental costs that are produced throughout the use phase of the product, e.g. through energy use of electronic equipment, should be excluded.

NOTE Needless to say, carbon taxation is just one of the instruments at our collective disposal to tackle the climate crisis: it is no magic bullet. As is suggested by many Green New Deal proposals, governments should actively intervene to help transform industries, invest into new technologies and phase out old, unsustainable ones (such as combustion engines or coal plants), take decisive action to protect biodiversity, create hundreds of thousands of decent jobs in climate protection and (re-)shape markets (DiEM25 2017; Mazzucato 2021). Yet, in an economy in which prices are central to economic coordination and individual behaviour, not using price signals as a lever - as long as they can be implemented in a socially advantageous way - to shape the market is at best negligent and at worst dangerous. In turn, state intervention might be needed to help individuals adapt to their changing behaviour however, for instance by providing subsidies for home isolation and updates to heating systems or by providing public transport as a universal basic service (Portes et al. 2017).

METHOD AND KEY QUESTIONS

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Our database focuses on consumption-based CO2-equivalent emissions and income per capita decomposed into eleven groups: the bottom nine deciles, the top ten percent excluding the top 1%, and the top 1% itself. We cover 169 countries totalling 7.6bn people. The consumption based emissions were obtained from Chancel (2021) for the year of 2019. The income shares were obtained from UNU-WIDER, World Income Inequality Database (WIID)[3], released in May 2021.[4] We derived the gross per capita income by applying the income shares provided by UNU-WIDER to the nominal GDP per capita for the year of 2019 provided by the World Bank.[5] We assume that the relationship between income and emissions is monotonic, consequently the individuals inside each emissions group per country are the same ones inside the income group per country.

3 We gathered the most timely data available for income shares by the most recent version of the World Income Inequality latest Database (WIID).

4 It can be found here: https://doi.org/10.35188/UNU-WIDER/WIID-310521

5 This conversion was necessary to derive a dataset for income distribution in nominal values, rather than purchasing power parity adjusted ones. We opted for nominal values since we assume a nominally constant CO2-price across economies in order to avoid so-called carbon leakage.

CARBON PRICING

In our modelling, we investigate what the economic effects of generalising the Swedish carbon price, currently the highest in the world at $137 per metric ton of CO2-equivalent (Destatis 2021), would be on a global level.[6] In a second step, we investigate the impacts of a slightly higher carbon price of €195 (roughly $225), which is the discounted rate suggested by the Federal Environment Agency of Germany to be used in the context of advanced economies (UBA 2020: 8). What effect would this have on a European level and in the context of national tax-and-dividend schemes in Germany and the United Kingdom? Further, we provide another deep-dive on the distributional effect of a $137 (Swedish carbon price) carbon tax-and-dividend scheme for Brazil, to illustrate the effects of such a national tax-and-dividend scheme in an emerging economy.[7]

6 We are choosing this carbon price because is already being applied in reality today and because it fairly precisely fits into the lower end of the carbon price bandwidth indicated by IPCC to be needed by 2030 to stay below 1.5°C-warming (IPCC 2018: 152).

7 Not only does our more detailed analysis cover both developed and emerging economies - the countries differ in respect to their specific accumulation regimes (industrial manufacturing-led in Germany, service based economy in the UK, extractivist economy in Brazil) and the levels of national inequality.

FINDINGS 1: GLOBAL

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The introduction of a global carbon tax and dividend at $137, the price already established in Sweden today, would be transformative. In total, $2.69tn would be raised annually through such a tax and redistributed evenly. While countries in South America, Sub-Saharan Africa, South-Asia and many other parts of the Global South would profit immensely, most developed economies would only see proportionally relatively small losses. The preliminary result is illustrated below:

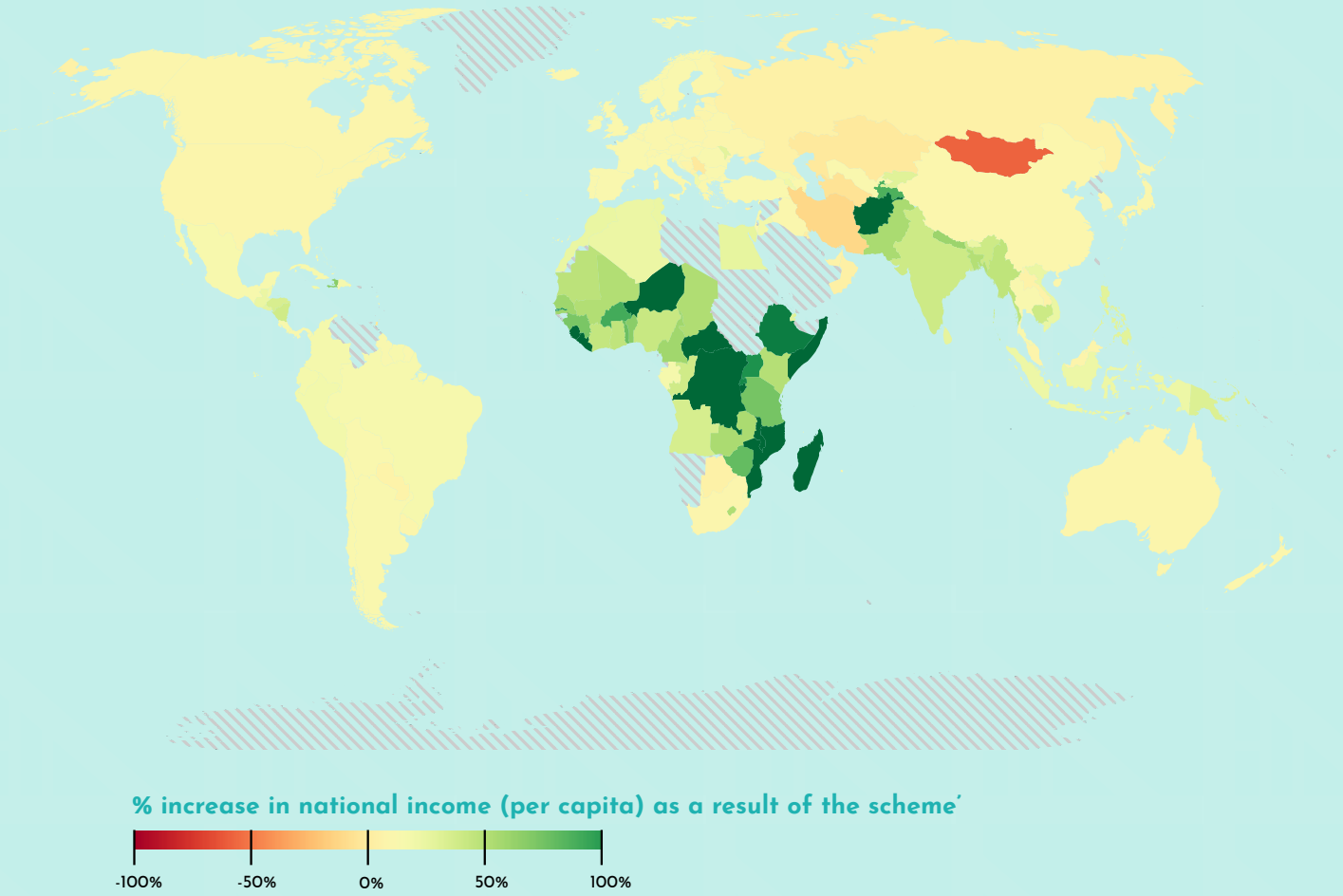

Fig 1. A map of 169 countries, where % loss/gain of GDP per country, as a result of a global carbon tax and dividend scheme is displayed according to colour. We have here used the amount of US$ 137 as a carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

Countries such as Burundi, Somalia and Sierra Leone would see a net carbon dividend[8] equal to 274%, 181% and 129% of their respective GDP, while many upper middle-income countries, such as Sri Lanka (13%), Guatemala (10%) and Algeria (9%), would still profit from the substantial redistributive effects of such a policy. The picture gets even clearer however if the country-based data is disaggregated. Those that stand to gain the most through such a global scheme are the poorest of the global poor, living in countries such as the Central African Republic, Benin and Zimbabwe, as illustrated in the table below.

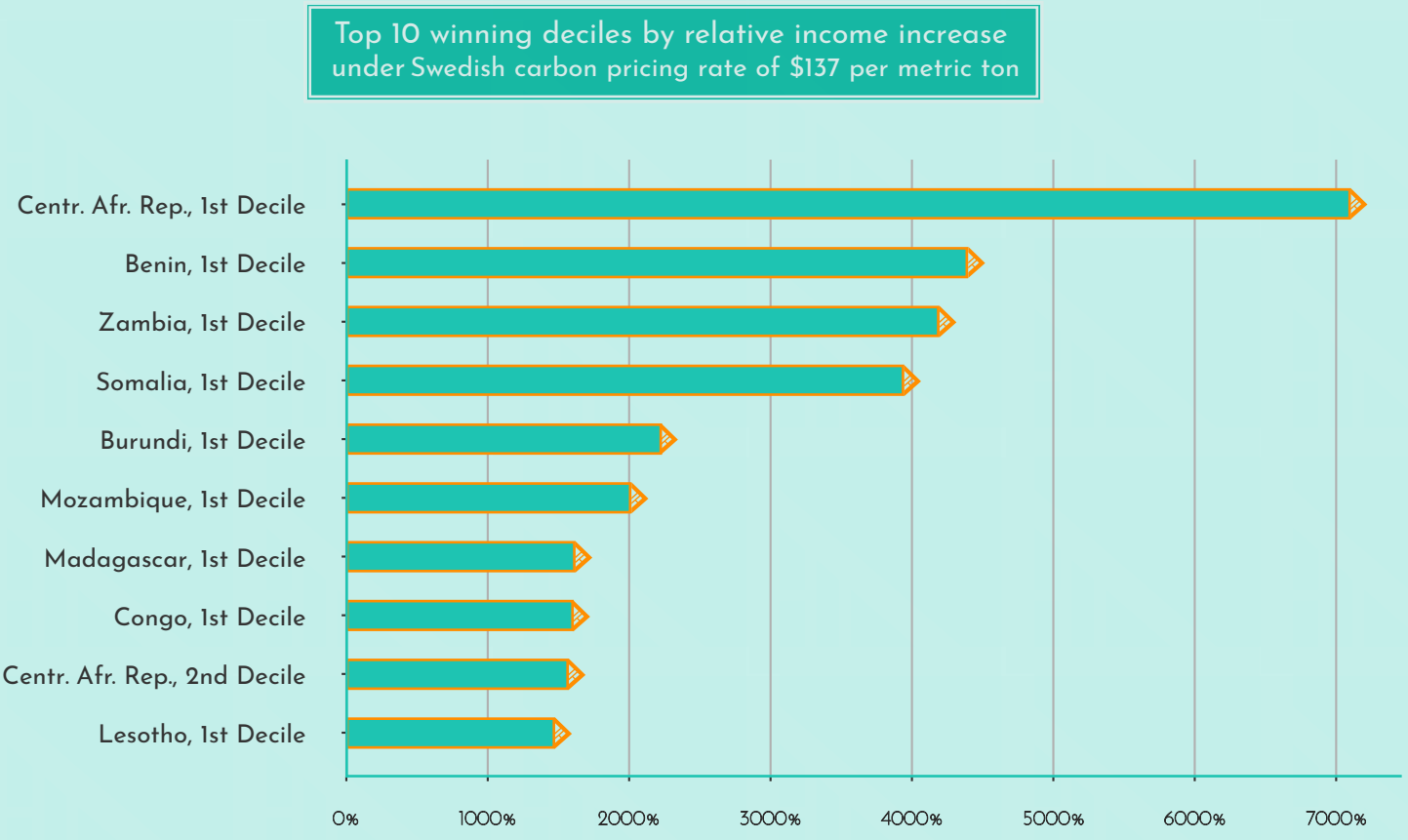

Fig. 2a Top ten winners (income groups in various countries) by relative gain (% increase in income) from a global carbon tax and dividend scheme. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021)

8 In the following, the term dividend refers to the net amount of money transferred to countries or specific income deciles within countries, i.e. after the reductions in income through CO2e-based taxation have been subtracted from the absolute dividend.

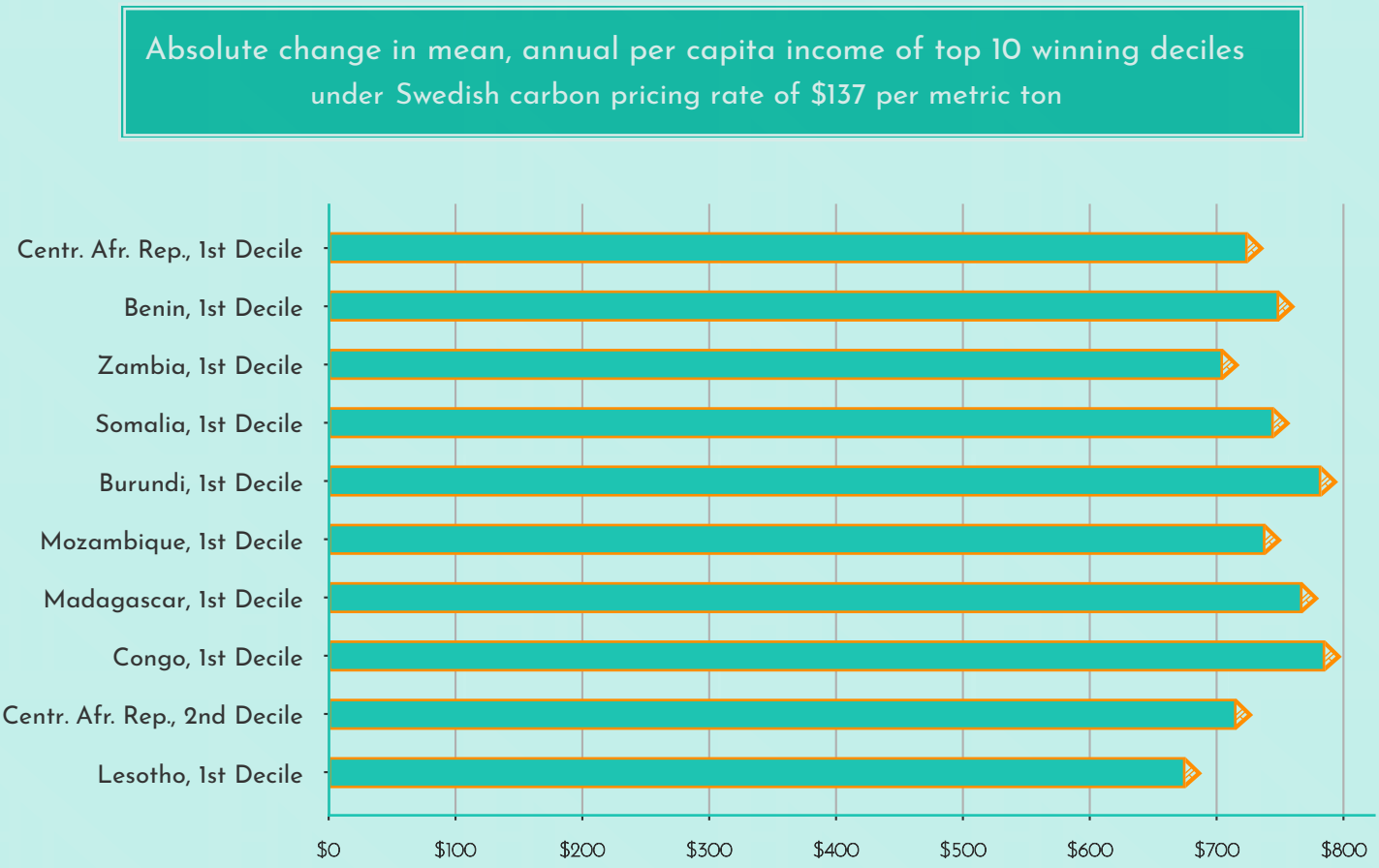

Fig. 2b The absolute increases in income for the same groups as in Fig. 2a, after a global tax and dividend scheme. The X axis is in US dollars. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

The top winners of such a global scheme would see their per capita income skyrocket, increasing dozens of times over, while every second person in the world (3.8bn people) would experience a substantial increase of their income of 10% or more.[9] In absolute terms, the dividend could come close to $800 a year for those parts of the global population that are responsible for almost no emissions.

Such a global scheme would effectively end extreme poverty, defined as $1.9 per person per day, as, according to our calculations, combined pre-existing per-capita incomes and carbon dividends would by far exceed the extreme poverty threshold across the board. But the effects of such a global scheme in fighting global poverty would not end there. Another 371m people would be lifted above the national poverty line typically found in lower middle-income countries of $3.2 a day and 820m would be lifted above the poverty line typically found in upper middle-income countries of $5.5 a day. A total of 636m people would be protected from falling below the international extreme poverty line by their carbon dividend alone, establishing elements of a global safety net.

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9 According to our data, the bottom 10% in income in the Central African Republic would receive a dividend equivalent to 70 times their annual income in such a global scheme. The bottom 10% of Benin, Somalia and Zambia would receive more than 40 times their current income through such a scheme. This is based on extremely low levels of per capita incomes of only $10.2 a year per person at the bottom of the Central African Republic and of $17 for the bottom 10% in Benin. Average nominal GDP per capita for the Central African Republic was $467.9 in 2019 according to the World Bank - the extremely low per capita income in the lowest income decile might be explained through extreme levels of inequality within the country, the fact that large households might rely on only a small number of family members lucky enough to receive an income, purchasing power disparities (meaning that $10.2 in nominal terms transfer to a higher consumption potential within the country) and a higher importance of self-sufficiency (e.g. through subsistence farming) that might distort the dataset. All this cannot belie the extreme levels of material deprivation suffered in this part of the global population and the transformative effect of such a global scheme however.

While $800 per person annually might not look particularly impressive compared to incomes in the Global North, even relatively low amounts of money can have a transformative effect on lives in the Global South: in 2008, a Basic Income Grant trial was run in the neighbouring Namibian villages of Otjivero and Omitara. A basic income of $15 was paid per person per month for a year (Osterkamp 2013). Even though the trial was quite limited in terms of duration and the amount of money distributed, the effects were decisive. The share of people below the poverty line dropped from 76% to 37%, labour market participation increased from 44% to 55%, child malnutrition fell from 42% to 10%, school drop-out rates fell from almost 40% to 5% and household debt fell (Haarmann et al. 2009)

The funds mobilised through such a scheme are also particularly impressive when compared to existing measures of global redistribution. Take, for instance, the group of heavily indebted poor countries (HIPC) with a total population of 715m, eligible for debt relief by the International Monetary Fund and the World Bank due to their particularly high levels of poverty. The global scheme would see the population of this group of states receive a total of $438bn in dividends annually, outperforming today's schemes for development assistance and debt relief combined.

According to the OECD, official development assistance (ODA) mobilised by the Development Assistance Committee (DAC) amounted to $152.8bn in 2019 (OECD 2020) while the IMF's debt relief programme mobilised a grand total of $76bn debt-service relief since its inception in 1996 (IMF 2021), bringing the annual total of debt-relief and development aid paid under these schemes to just over $155bn annually - or just over one third of the dividend that the HIPC would receive under the carbon dividend scheme we have modelled here. Our scheme also greatly exceeds the $100bn that was promised by the countries of the Global North to help countries in the Global South adapt to climate change and mitigate its effects (Timperley 2021). In light of massive global carbon inequalities and the externalisation of the costs of climate change onto the global poor, such a global scheme would provide a vehicle through which to transform global financial flows - helping to highlight the debt that the Global North owes to the Global South. What form these flows could take is obviously an open question, and our modelling here merely demonstrates the strong redistributional effects of taxation upon carbon consumption.

It is becoming increasingly clear that those that will be hit by the worst effects of global climate change are largely not its creators. There are two overlapping cohorts of the global population that are particularly at risk: the poor in the Global South and children (Xu et al. 2020; Unicef 2021a). Such a global scheme would not only implement a form of global climate justice but would also provide people in the Global South with much needed funds to finance climate adaptations and allow them to meet their most basic needs - in effect materially implementing a "right to stay" (Paul/Gebrial 2021).

At the same time, those that would be the greatest net-contributors to the global scheme can largely afford to take the hit.

Fig. 3 Top ten losers (income groups in various countries) by absolute decline in income as a result of a carbon tax and dividend scheme. We have here used US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

As we can see in Figure 3, the greatest burden in absolute numbers would fall upon the rich in Luxembourg, Kuwait and Singapore. The relative losses in income for the top 1% of these countries would however be relatively limited and dwarf in relation to the gains of the global poor.[10]

10 The top 1% of Mongolia represent a clear outlier in our data, standing to lose disproportionate losses of more than 100% of their income - which is, of course, technically impossible. This can be explained through the fact that even the richest Mongolians only make relatively modest incomes by global standards and that the Mongolian lifestyles are extremely emissions intensive. See our discussion of Mongolia below.

This is largely true across most of the economies in the Global North, as the majority of costs have to be covered by the rich while the poor even stand to profit from such a global scheme as they already emit less than the global average.

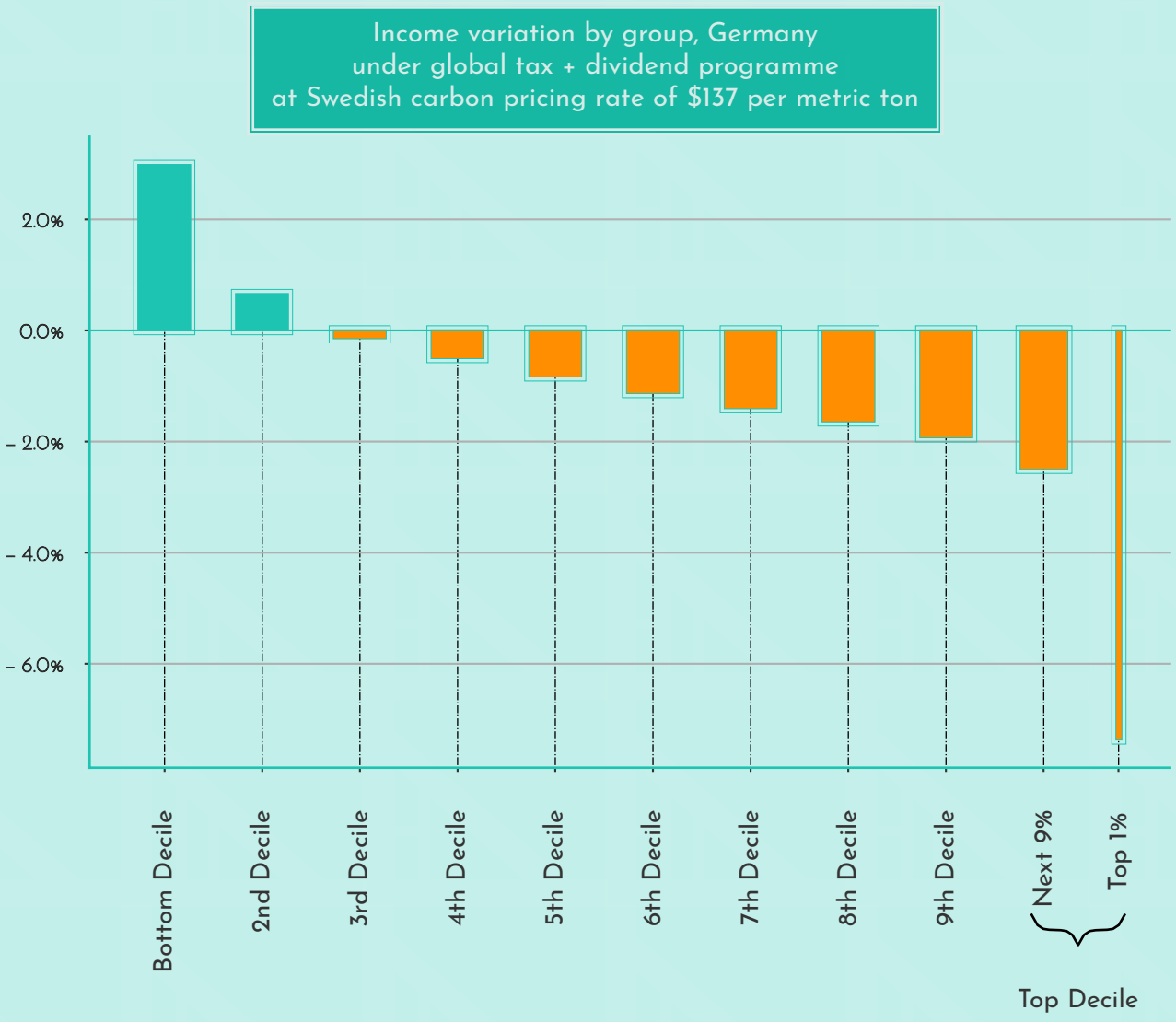

Fig. 4 Relative income variation in Germany under global scheme by income group. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

In Germany, for instance, the bottom 10% would see their income increase by more than 2%, with the bottom 20% still receiving a marginal dividend from the scheme. Losses to medium income groups are limited, with only the top 20% of society seeing losses of more than 2% of their gross per capita income. What is more, even within these 20%, the losses are very unequally distributed, as the highest losses fall upon the top 1% of society (more than 6%). In other words: the very rich, who can afford to lose some income, and who cause vastly disproportionate emissions, even on a national level, would pay. Things look even better for the UK: lower average emissions translate into higher income gains for the bottom 10% (3%), whereas losses for the top 1% would be limited to 4.8%.

On an everyday basis, consumer prices would increase moderately under such a global scheme.

To give two examples: the costs of driving 1000 km with an average petrol-powered car would increase by $24.78 - or 2.5 cents per km - and the costs of a High-End Smartphone would increase by around $11.37.[11]

At the same time, these increased consumer costs would partly be counteracted by the carbon dividend paid out globally and indiscriminately.

11 The assessment for cars is based on the UK Government GHG Conversion Factors for Company Reporting provided by the Department for Business, Energy & Industrial Strategy (2021). The one for the smartphone is based on the LCA provided by Apple (2021) for an iPhone 13 with 512GB storage. This is a slight overestimate however, since Apple's assessment also covers the use phase of the product, whose emissions would, under our scheme, be taxed independently through taxation on energy consumption.

EMERGING ECONOMIES

Emerging economies such as India and Brazil would profit - between moderately and substantially - from such a global carbon dividend, receiving a net gain of more than $37bn (1.9% of GDP) and $696bn (24% of GDP) for Brazil and India respectively. As these two examples illustrate, the effects of such a global scheme would differ quite significantly, depending on existing emission levels. But these numbers obfuscate the fact that such a global scheme would be hugely redistributive even where the absolute numbers seem fairly insignificant.

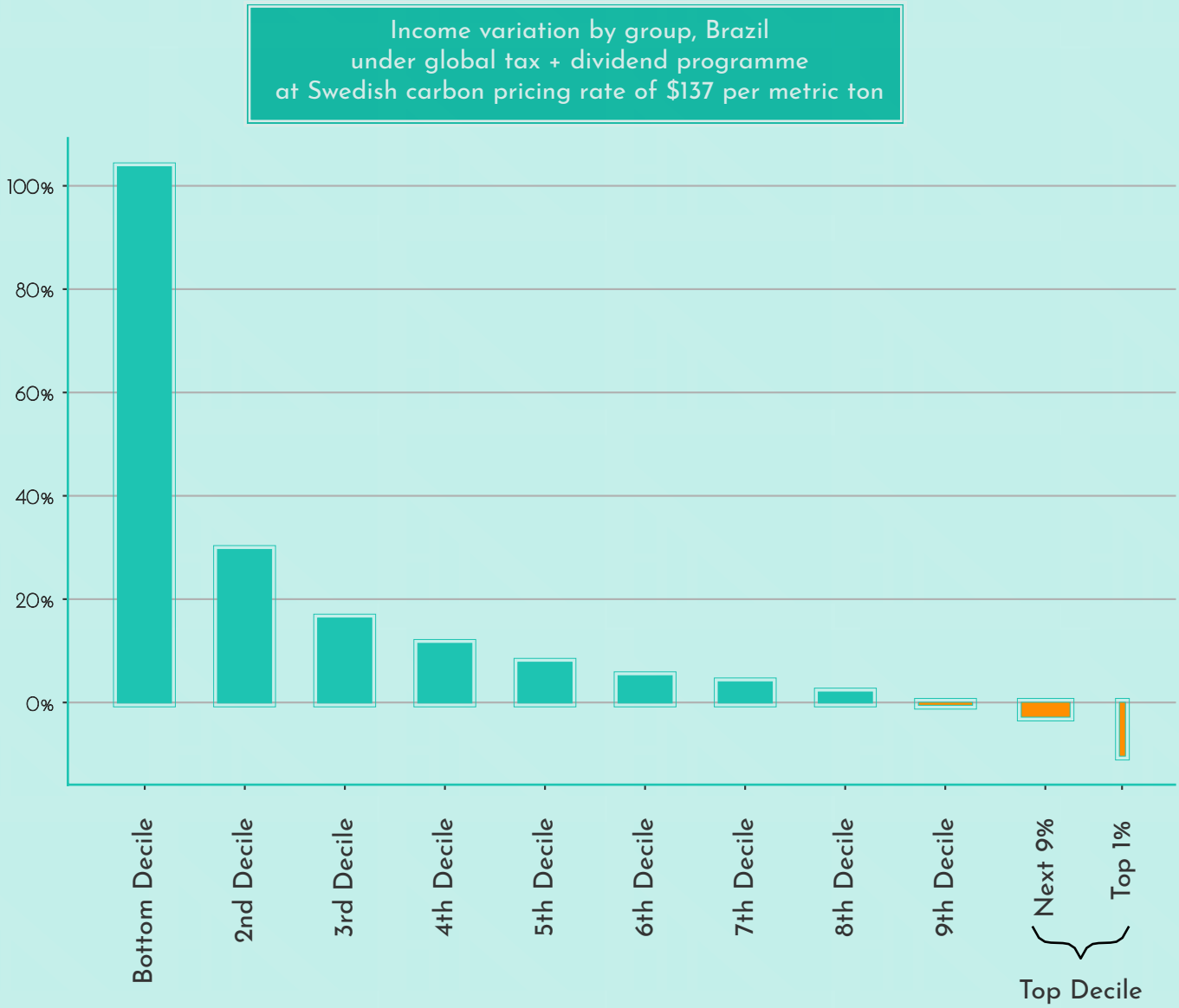

Fig. 6 Relative income variation in Brazil under global scheme by income group. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

Even though Brazil would only see a relatively modest carbon dividend on a national level, the income of the bottom 10% would double, whereas the bottom half of society would see their incomes increase by over 30% on average. Only the top 10% would end up as net-contributors to such a global scheme, with the top 1% facing the most significant, although relatively limited, income losses.

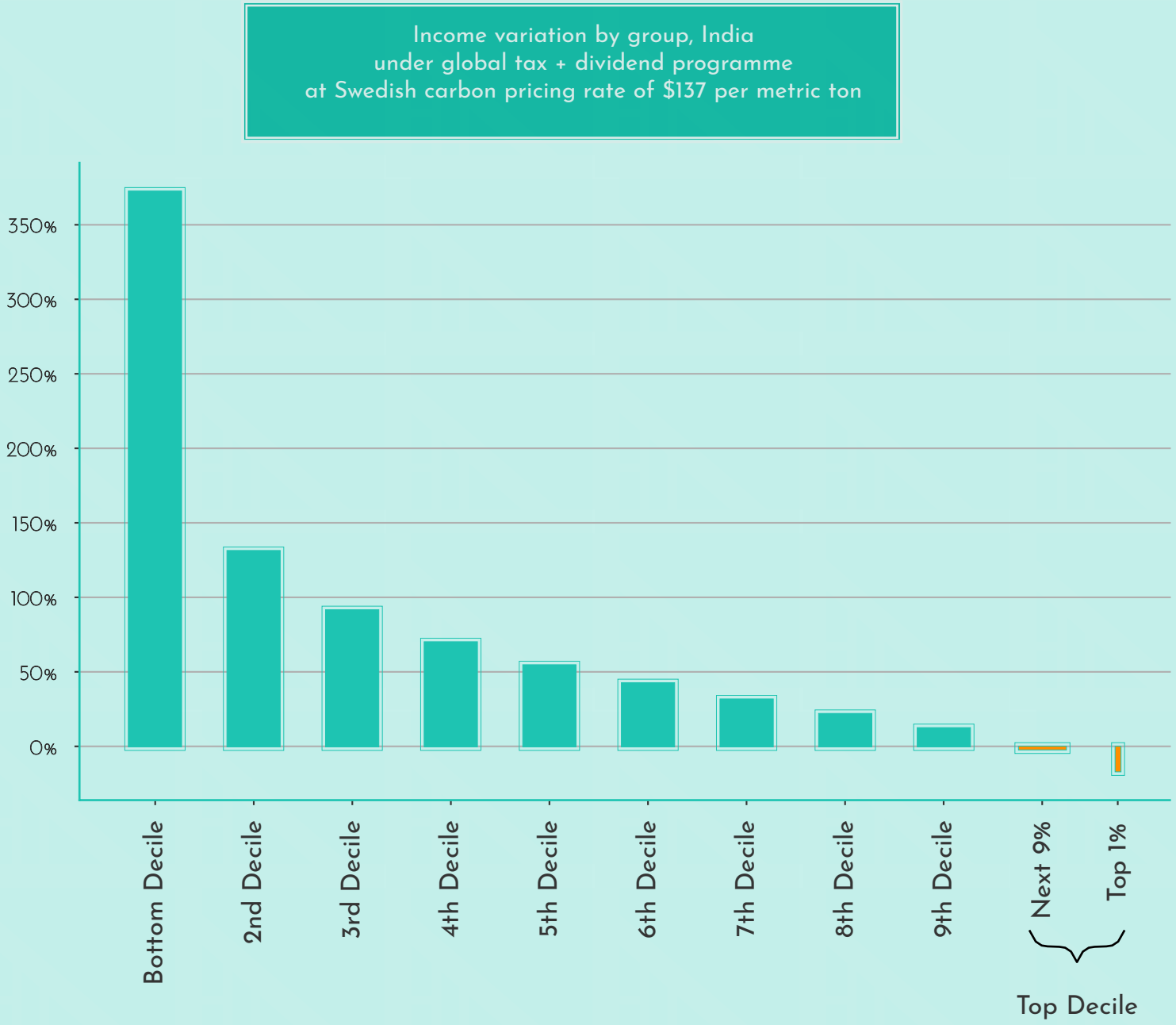

Fig. 7 Relative income variation in India under global scheme by income group. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

In the Indian case (Fig. 7), the global carbon dividend would be an extremely effective policy to tackle poverty. The bottom 3 deciles would profit particularly strongly, with the dividend corresponding to 3.7x the income for the first decile (the bottom 10%), 1.3x for the second decile and would double the income of the third decile. In our income class aggregation, only the top 10% of India would pay carbon taxes, while the income interval from the 90% to 99% would lose almost none of their income (0.005%) and the top 1% would lose 16% of their income. The bottom 50% of India would see an increase of 1.4 times their income on average.

Not only could such a global scheme take hundreds of millions of people out of (relative) poverty in emerging economies, it could also help to turn the tide on the enormous economic dependencies burdening them, helping to bring them on a more equal footing with their counterparts in the Global North. Take for instance the Indian case: the total external debt (private and state) of India amounted to $560.9bn in 2019 (World Bank 2021). This amounts to roughly 80% of the dividend Indians would receive on an annual basis according to our modelling. In other words: the dividend of a single year would be enough to pay off all foreign debt (and then some). Although our scheme stipulates that the carbon dividend would go to individuals, and although it might be politically challenging to tax an income that is effectively already a tax-refund itself, even moderate levels of VAT alongside substantial economic growth driven by the expansion of private consumption might give the governments of emerging countries leeway to pay off foreign debt, to expand their welfare systems and to invest in green infrastructures.

Aside from such a scheme organising massive redistribution towards emerging and developing economies, it would also curb the massive income inequalities within national economies too: even the lower income deciles in contributing economies largely either profit from such a scheme or are hardly affected negatively. What is more, in the Global North as well as the Global South, such a scheme would constitute a massive economic incentive towards greening the economy, driving out fossil fuel from much of energy production and ensuring that as living standards rise in the Global South, it is accompanied by a prioritisation of sustainable energies over new coal plants, and green infrastructures over a development model that mimics the historic development that took place in the Global North.

Still, such a global scheme would be no silver bullet. There are some economies - usually characterised by a combination of low GDP and a fossil-fuel intensive, extractivist accumulation regime, who would suffer significantly under such a scheme. For example, Mongolia (-63% of GDP), Iran (-22% of GDP) and Turkmenistan (-16% of GDP), would be big losers, seeing economic stress applied across the income spectrum. The international community should provide assistance to these countries to help them adapt to the necessities of fighting climate change. Correspondingly, nation states with strong income inequalities, relatively low income levels and relatively high emission levels, might need to provide additional support to lower income deciles, working-poor, pensioners and unemployed, to prevent any hardships from such a taxation scheme and to ensure public support.

FINDINGS 2: EUROPEAN UNION

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In a second step, we investigate the effects of a tax-and-dividend scheme on a European scale. Since economic and political integration is much more advanced within the EU than on a global level, a European scheme is significantly more practically feasible.[12] The EU 27 countries have a total population of around 447m people, emitting roughly 9.6 tons CO2e per capita in 2019. In this tax-and-dividend scheme for a region of advanced economies, such as the EU, we follow the carbon price suggested by the Federal Environment Agency of Germany (UBA 2020: 8) of roughly $225.

12 The European Union Emissions Trading System as well as the collective approach to climate diplomacy of EU countries form part of this integration, providing reasonable grounds for a shared approach to carbon taxation. Such a European-wide tax-and-dividend scheme would however not take into account global inequalities in emissions that would have to be accounted for differently, for instance through contributions to climate adaptation funds. Furthermore, such a regional scheme would require robust policies to prevent carbon leakage and regional deindustrialisation, for instance through CO2 border adjustments (see Felbermayr 2019, Bellora/ Fontagné 2020, Sund 2020).

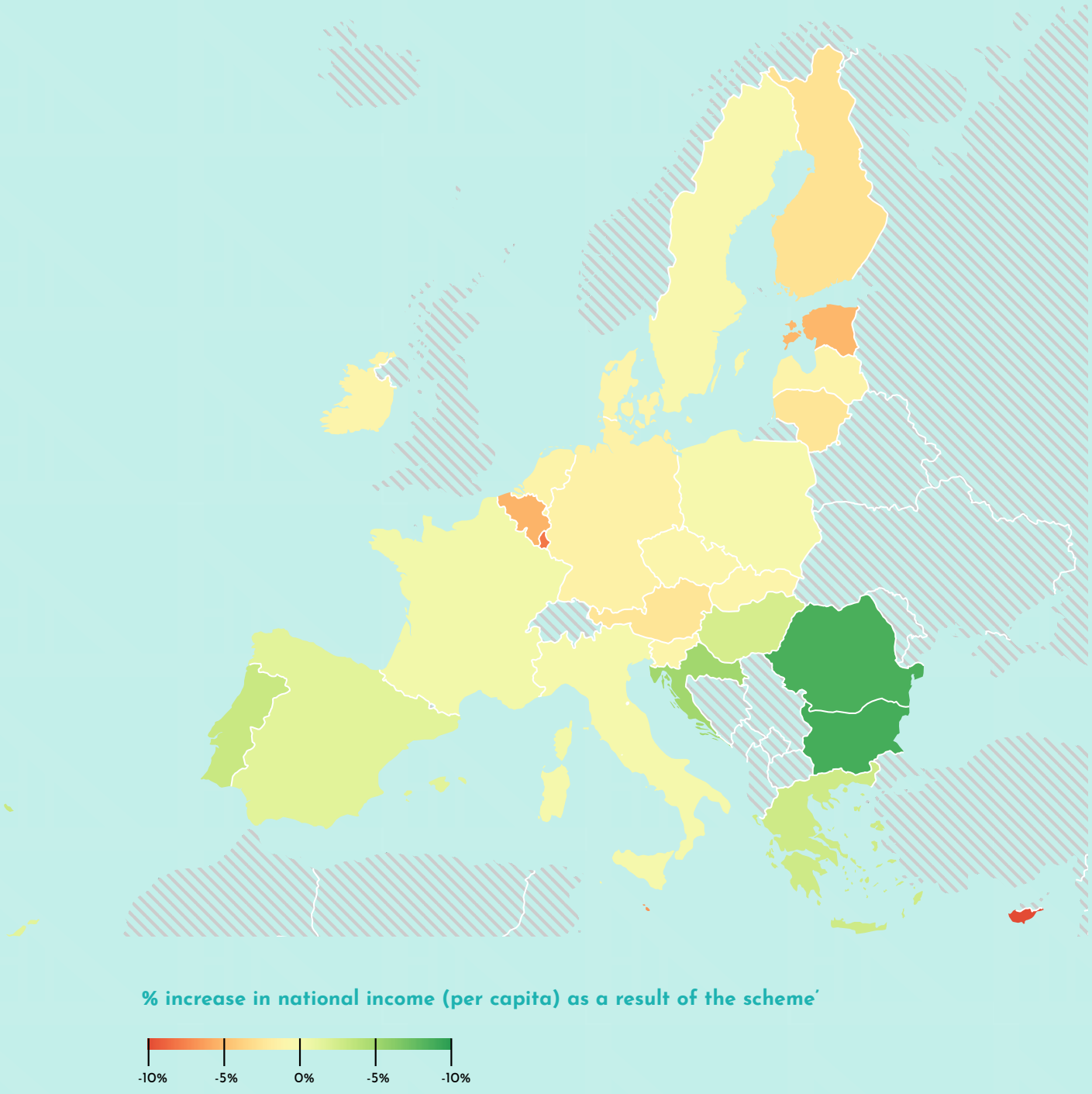

Fig 8. Relative income increases and decreases for individuals within various EU countries, as a result of a carbon tax and dividend scheme. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

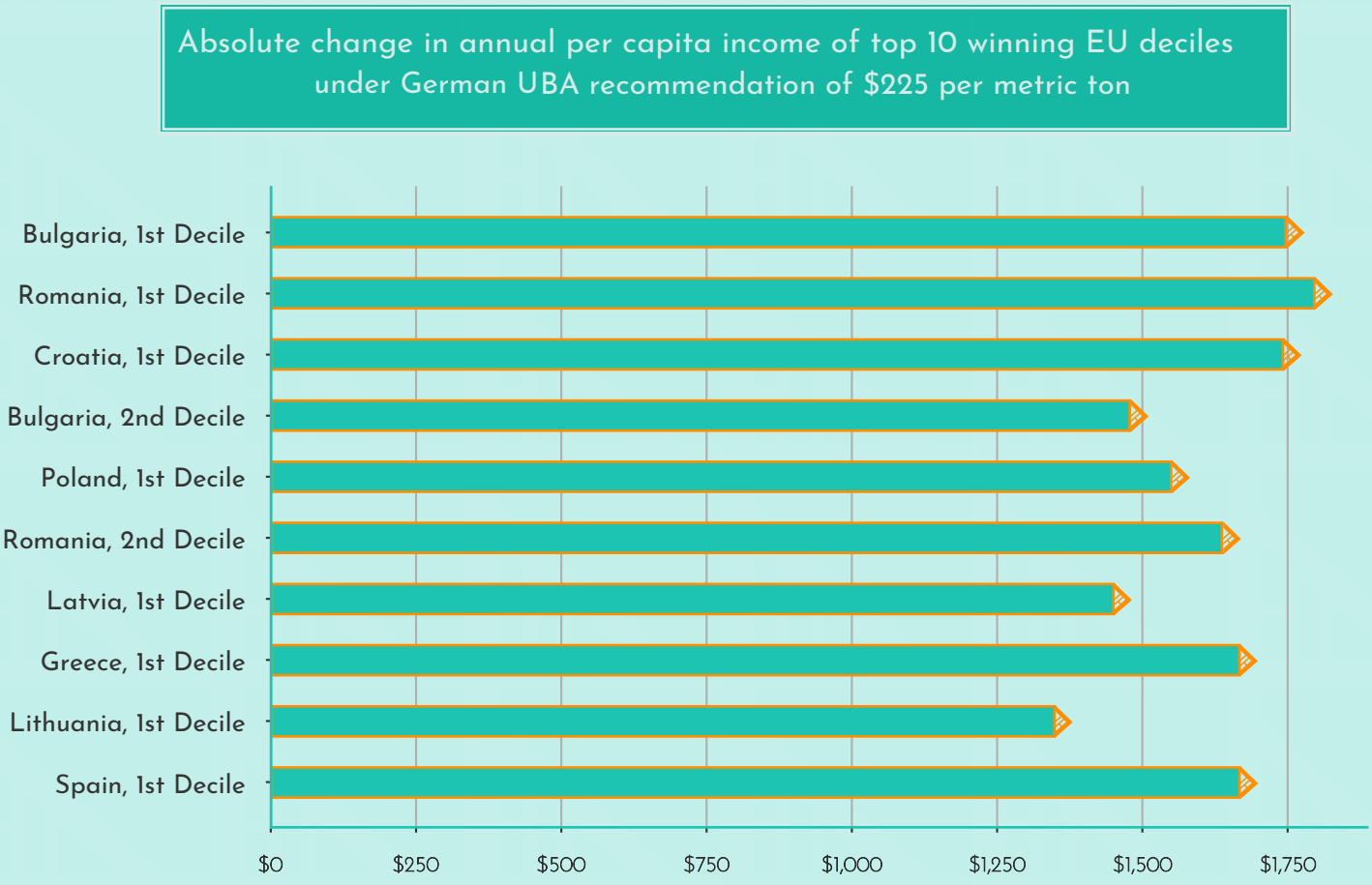

Fig. 9a Top ten winners and amounts received from a carbon tax scheme, in absolute numbers by income group by EU country. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

On a national level, the top contributors to an European implementation of a tax-and-dividend scheme, per capita, would be Luxembourg, Belgium and Estonia, whereas Bulgaria, Romania and Croatia stand to gain the most. But the positive effects of such a European scheme would not be limited to these countries, but would also extend (to a lesser degree) to the poor of many countries, even in Luxembourg, who would gain an increase of roughly 1.5% of their income. On a national level, even individuals within countries with quite a high living standard such as France and Sweden would profit from such a scheme.

Top 10 winning deciles by income relative variation, EU Tax + Dividend Scheme under German UBA recommendation of $225 per metric ton

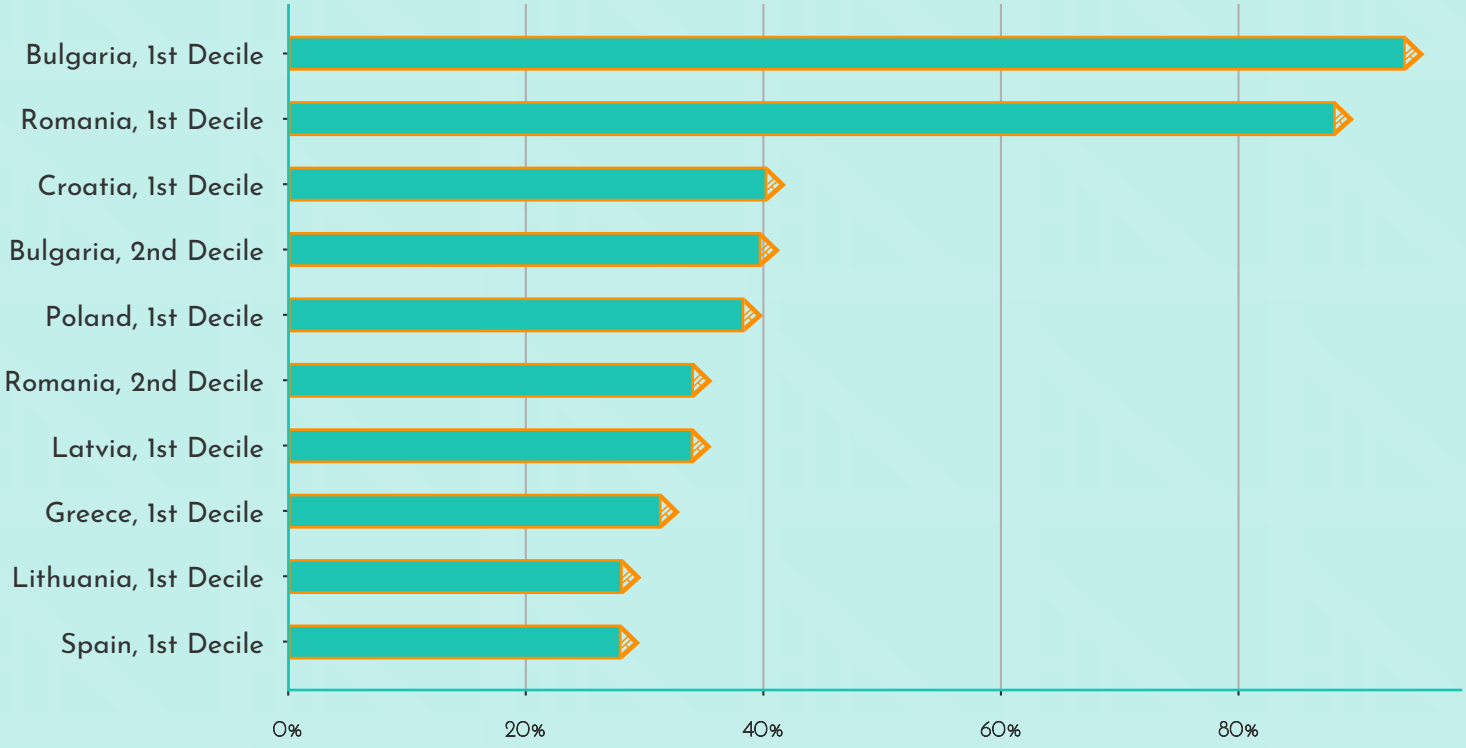

Fig. 9b Top ten winners (income groups in various EU countries) by relative gain (% increase in income) from an EU carbon tax and dividend scheme. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021) , WIID (2021) and World Bank (2021).

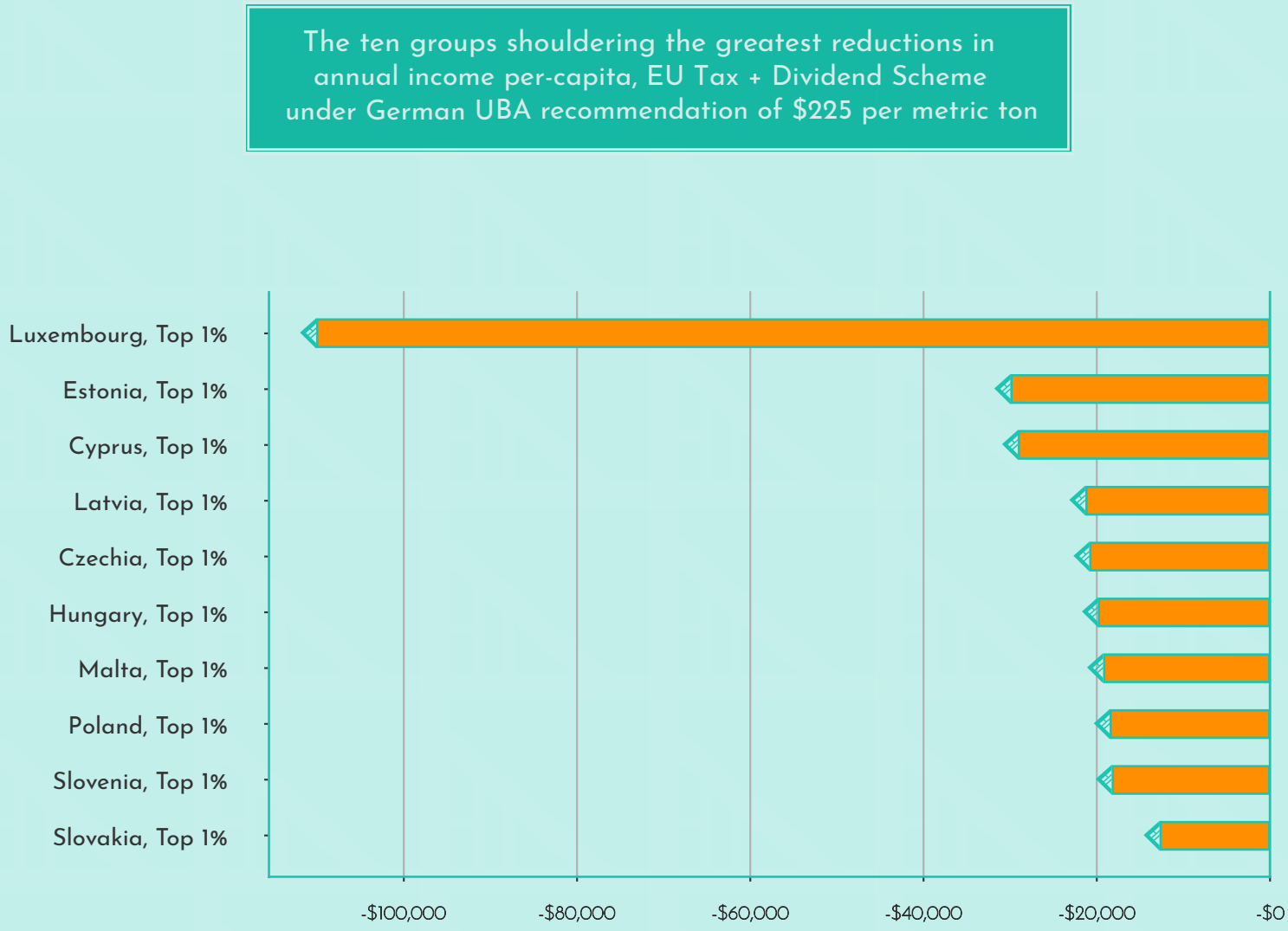

Fig. 10a Top ten losers (income groups in various countries) by absolute decline in income as a result of an EU carbon tax and dividend scheme. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

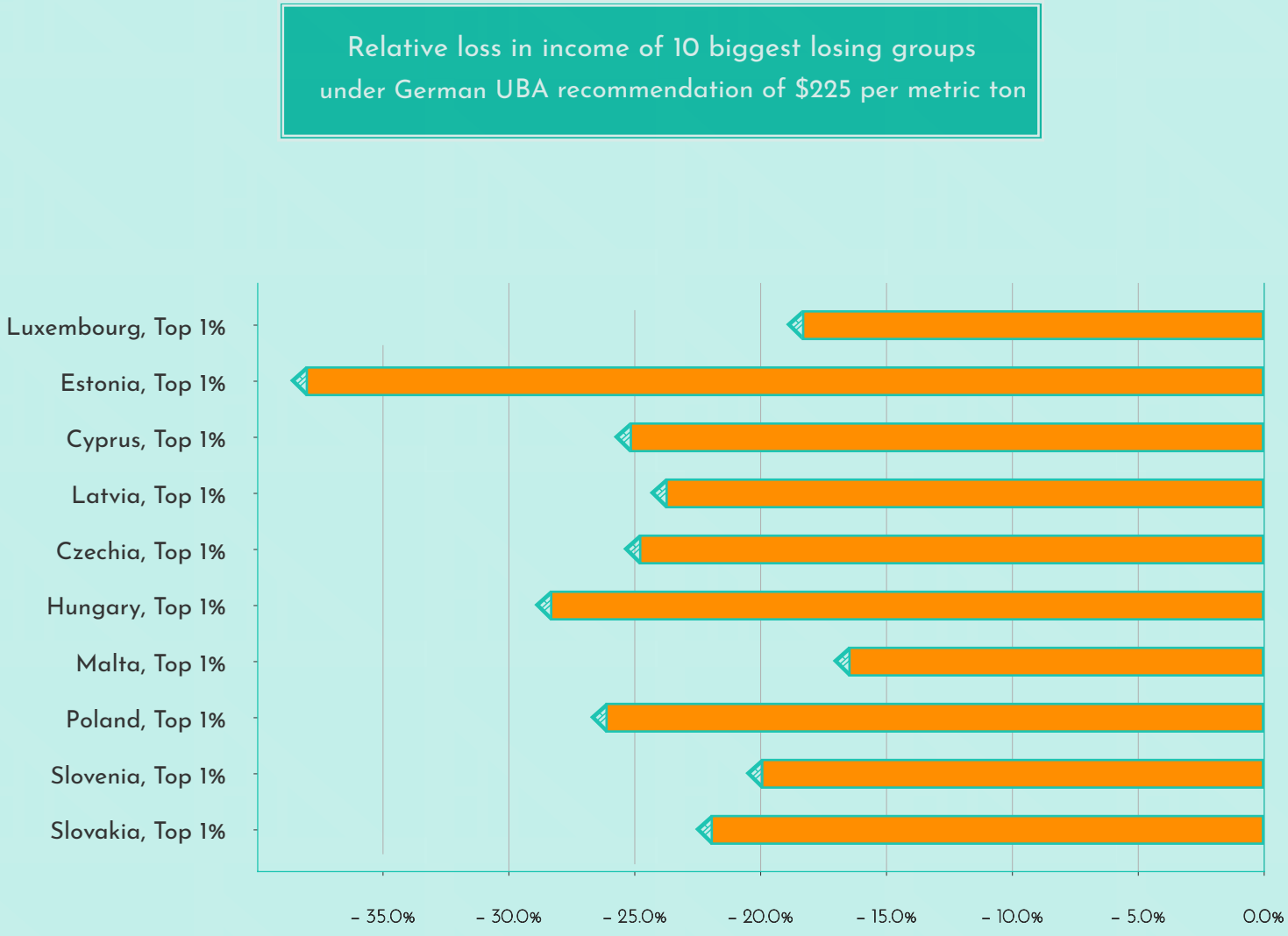

Fig. 10b Top ten contributors by relative numbers, by income group and EU country, as a result of an EU carbon tax and dividend scheme. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

As with the global scheme, the impact of an European scheme is also much more pronounced when disaggregating the data. The poorest parts of the population in Bulgaria and Romania would see their incomes almost double, but the poor parts of countries such as Greece or Spain would also see increases of more than 20% of their income. The monthly dividend would stand at around $180 per month per person in absolute terms, with annual net dividends of up to $1,750 for the lowest emitting Europeans. The top 1% of the EU countries would be hit the worst, losing more than 35% of their population's income in Estonia, and more than 25% in Poland and Hungary. The clear, top contributors to the scheme in absolute terms would be the top 1% in Luxembourg however, contributing more than $100,000 annually to the scheme. As such, a European scheme could advance convergence within the EU and within member states at the same time. And here, too, the relative burden for the continent's rich would be bearable, given their high incomes. Additionally, funding from the EU's Green New Deal Initiative could and should be mobilised to help countries who would be burdened the most from such a scheme such as Belgium and Estonia (approx -4% of GDP) and Luxembourg (approx -6% of GDP) adapt.

FINDINGS 3: NATIONAL

(BRAZIL, GERMANY, UK)

FINDINGS 3: NATIONAL (BR,DE,UK)

Finally, we will evaluate national tax and dividend schemes for Brazil, Germany and the UK. We will do so by using the Swedish carbon price of $137 for Brazil and the higher rate suggested by the Federal Environment Agency of Germany to be used in the context of developed economies (UBA 2020: 8) of roughly $225 for Germany and the UK.

BRAZIL

For Brazil the average emissions for consumption in 2019 were 5 tons per capita, hiding the fact that the top 1% emit an amount not far from their counterparts in high income countries such as the UK. Since in Brazil income is highly concentrated within the top deciles, 80% of the population would benefit from the carbon dividend scheme. The income of the bottom 10% would for instance be increased by more than 72% and there would be at least 10% increases in income for the bottom 40% of the population. At the same time, the top 1% would lose less than 10% of their gross income. Thus, such a national scheme would contribute to improving the shape of the highly asymmetric Brazilian income redistribution, while at the same time not unreasonably impacting the richest 1% of society, who would contribute only 10% of their income to this scheme.

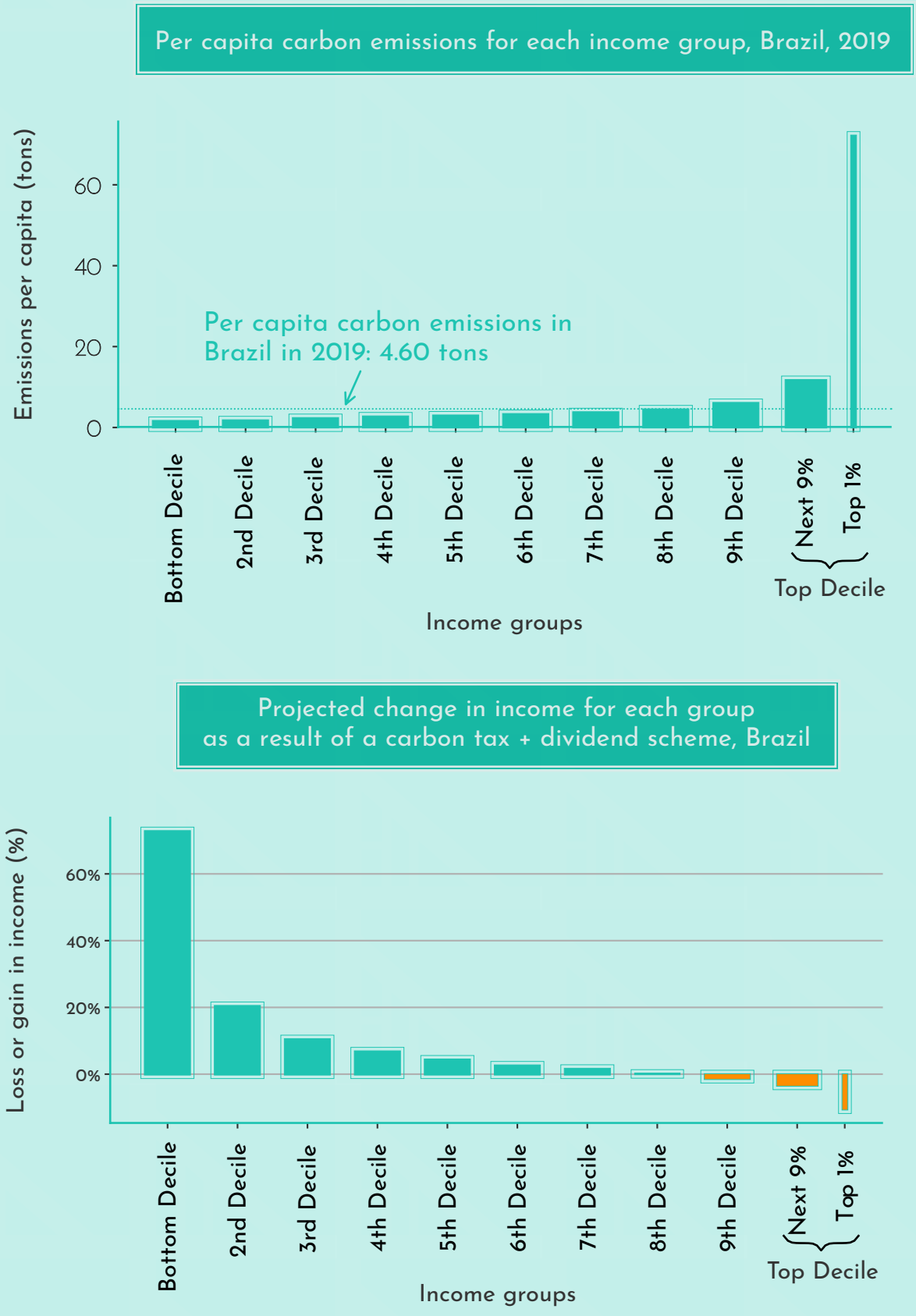

Fig. 11a Emission per capita for each class in Brazil. Fig. 11b income variation per capita for each member of each group in Brazil. We have here used the amount of US$ 137 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

UK The UK average emissions for consumption in 2019 was 9.9 tons per capita. Despite inequality in the UK being lower than a country like Brazil, almost 70% of the UK population would benefit from the carbon tax dividend scheme, while the top 20% would be the effective contributors towards carbon dividends. The impact for those in the bottom 10% would be an increase in income of almost 14%, while the tax impact on incomes for the top 1% would be around 7%.

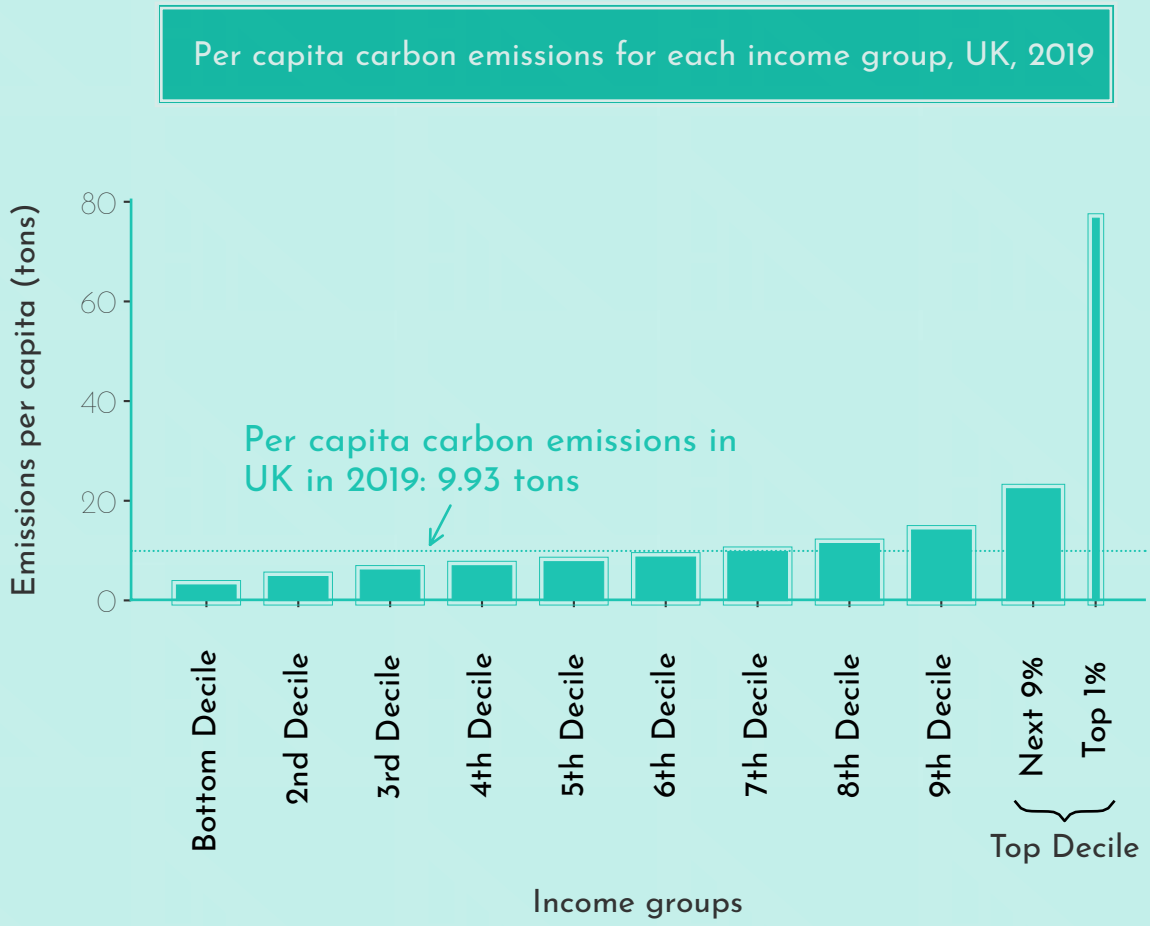

Fig. 12a Emission per capita for each class in the UK.

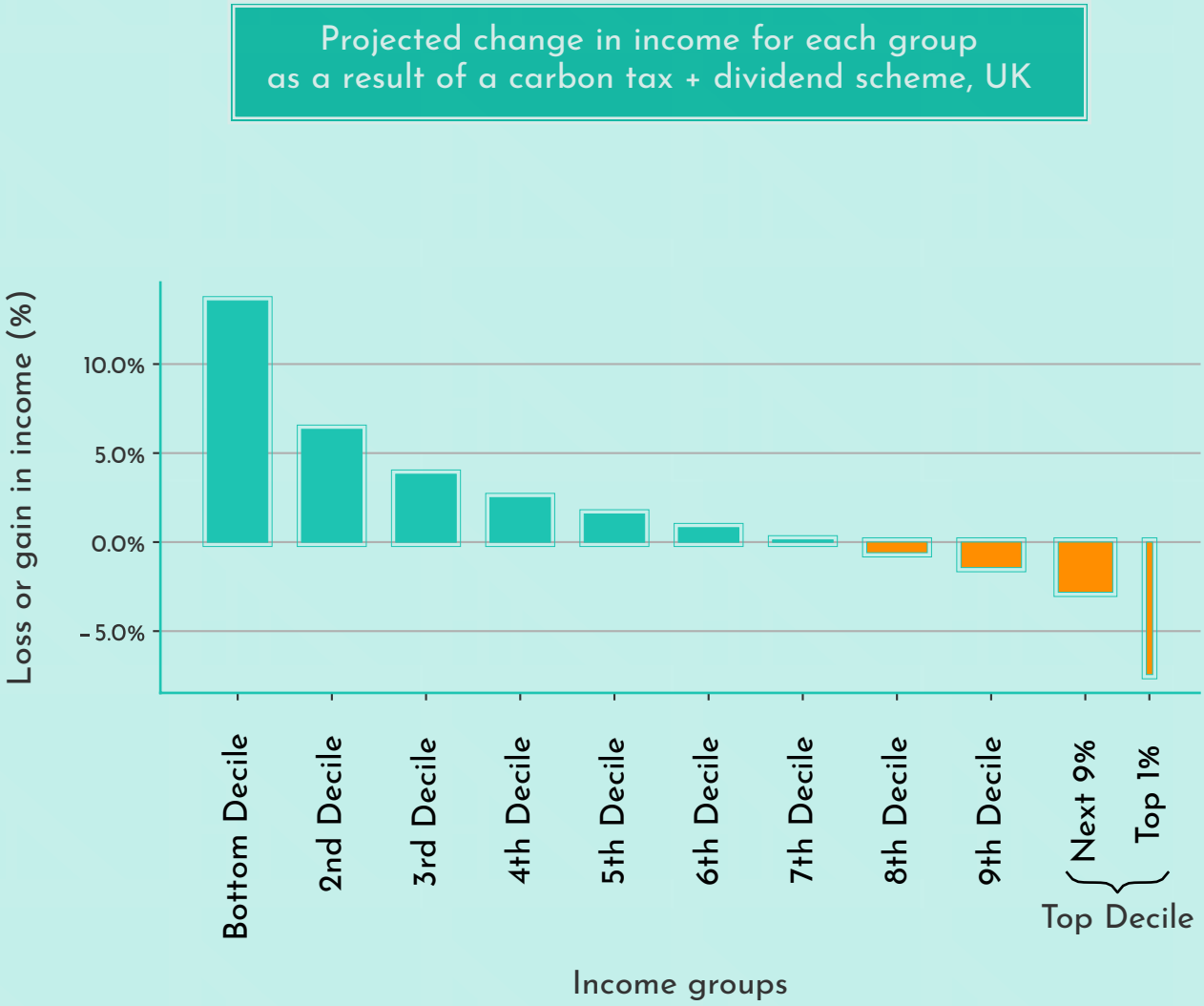

Fig. 12b income variation per capita for each member of each group in the UK. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

GERMANY

Finally, for Germany average emissions measured through consumption are around 11 carbon ton per capita for 2019. This is higher than the UK and the EU27 average. While a national carbon tax-and-dividend scheme would reduce the income of the top 1% by 12%, it would increase the bottom 10%'s income by almost 15%. Like in the UK, the dividend fund would receive net contributions from the top 30%, while 70% of the German population would receive at least some dividend.

Per capita carbon emissions for each income group, Germany, 2019

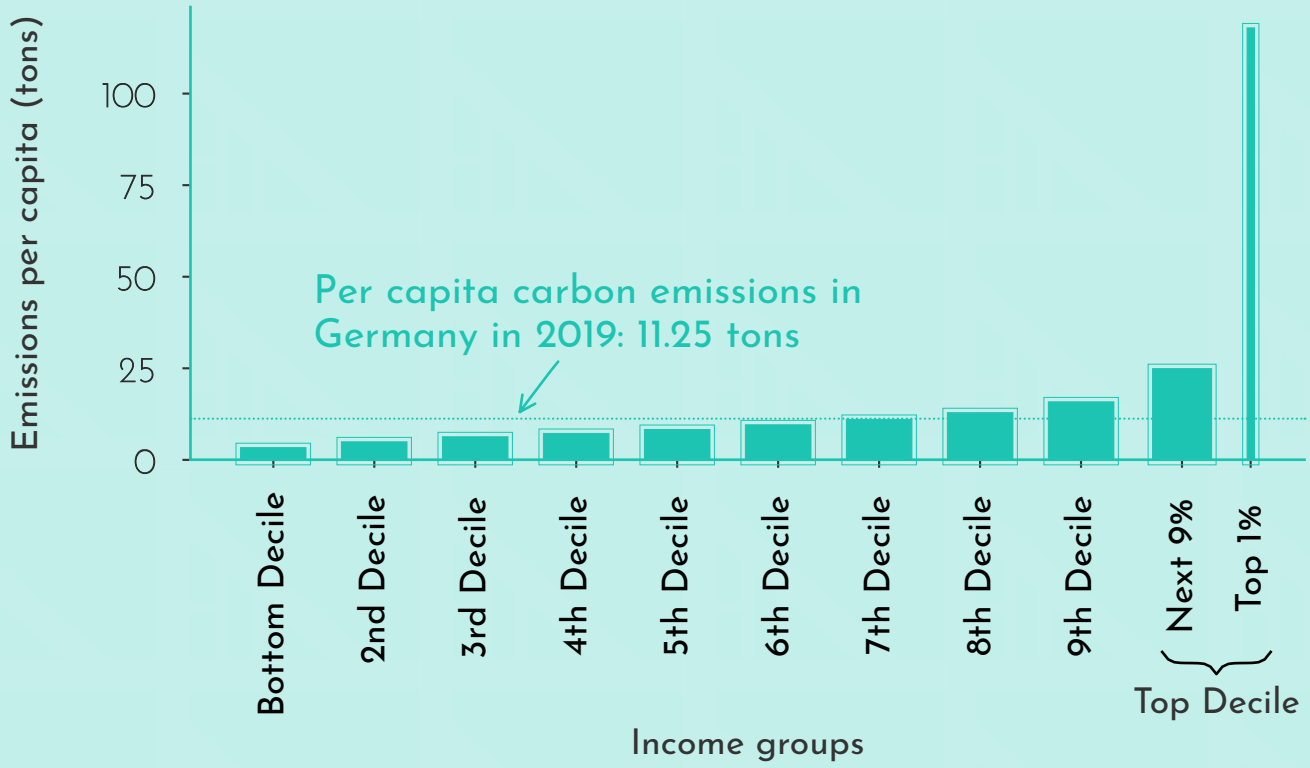

Fig. 13a Emission per capita for each class in Germany.

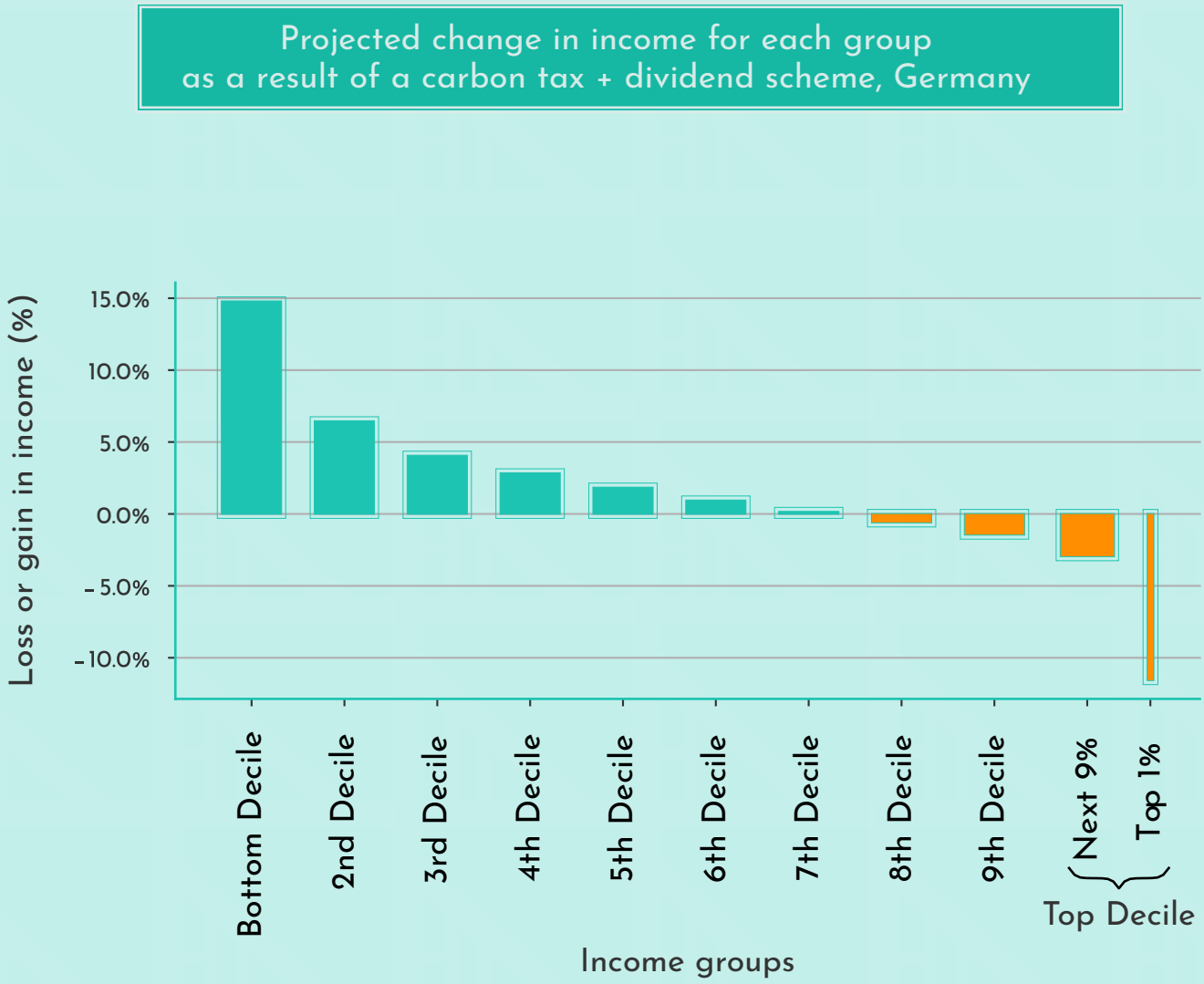

Fig. 13b income variation per capita for each member of each group in Germany. We have here used the amount of US$ 225 as carbon price to model the projected results. Source: Autonomy calculations based on Chancel (2021), WIID (2021) and World Bank (2021).

FINAL NOTE

Why carbon dividends can help deliver ecological and economic justice

FINAL NOTE

As illustrated above, a universal tax-and-dividend system for CO2e-emissions would be transformative - on an economic and social level as well as in terms of the consequent ecological effects. In fact, the redistribution facilitated by such schemes increases as carbon prices increase; social and ecological justice mutually reinforce one another. As a global policy, it could wipe out extreme poverty and easily dwarf the scope of any existing development aid and debt relief schemes, illustrating that, in this sense, it is the Global North that owes an immense debt to the populations in the Global South, not the other way round. It would also go a long way to alleviate the disastrous impacts the Covid pandemic has had on the world's poorest and most vulnerable, with for instance an additional 100m children falling into poverty, and prevent global disparities from deepening as richer countries recover while poorer countries fall even further behind (UNICEF 2021b). Such a global carbon dividend scheme could end the bitter reality of mass hunger and destitution and be a key building stone of a fairer, more sustainable and more inclusive post-pandemic economy.

Implemented within a fairly economically homogeneous framework such as the EU, it could help slow down and possibly reverse economic disintegration and facilitate a transfer of economic resources from the continent's rich to its ecological trailblazers and the less affluent. Implemented nationally, it could significantly reduce social inequality while at the same time providing an unprecedented impulse to green the economy, as producers are forced to disclose the hidden ecological costs of their products. As such, a tax-and-dividend system might provide a way to reconcile ecological and social sustainability and rally popular support behind a demand for social and ecological transformation.

A Global Carbon Dividend scheme could also constitute a stepping stone towards the introduction of a more comprehensive, far-reaching UBI - implementing a global infrastructure for roll-out and, more importantly, materially recognize and implement the right to equal use of our planet.

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APPENDIX: KEY DATA SOURCES

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