Rethinking Climate Responsibility –
From Theory to Measurement to Practice

D I S S E R T A T I O N
of the University of St.Gallen,
School of Management,
Economics, Law, Social Sciences,
International Affairs and Computer Science,
to obtain the title of
Doctor of Philosophy in International
Affairs and Political Economy

submitted by

Tim Simon Herr

from

Germany

Approved on the application of

Prof. Dr. Klaus Dingwerth

and

Prof. James Warren Davis, PhD
Dr. Dominic Roser

Dissertation no. 5223

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The University of St.Gallen, School of Management, Economics, Law, Social Sciences, International Affairs and Computer Science, hereby consents to the printing of the present dissertation, without hereby expressing any opinion on the views herein expressed.

St.Gallen, May 16, 2022

The President:

Prof. Dr. Bernhard Ehrenzeller

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Berlin, July 2021
Tim Simon Herr

Abstract English

This PhD thesis sets out to rethink climate responsibility in line with a new *Economic Activity Principle*. The *Economic Activity Principle* holds that agents should be viewed as climate responsible for and in proportion to their economic emissions that are A) inconsistent with a sustainability threshold, B) emitted above an economic capability threshold, and C) emitted after a knowledge threshold. The sustainability threshold follows from the Paris Agreement's temperature limits which aim to prevent dangerous climate change. The economic capability threshold aims to protect the goals of equity and development. And the knowledge threshold ensures that once there is agreement on sufficient knowledge, ignorance can no longer serve as justification for evading climate responsibility.

The *Economic Activity Principle* is designed here such that the resulting climate responsibility concept derives from and serves the central goals of effectiveness and equity in the international climate governance regime. I identify the national level of agency as the appropriate level for bearing climate responsibility as nations are the only agents capable of simultaneously fulfilling all climate responsibility requirements developed and defended here. Overall, the thesis provides a normatively defensible, practically useful, and empirically measurable concept of climate responsibility. Its results show that current ways of thinking about climate responsibility based on countries' territorial emissions misrepresent climate responsibility by placing undue burdens on poorer and predominantly export-oriented countries.

Zusammenfassung Deutsch

Die vorliegende Dissertation überdenkt Klimaverantwortung im Sinne eines neu entwickelten Verantwortungsprinzips, dem *Economic Activity Principle*. Dem *Economic Activity Principle* zufolge werden Akteure für diejenigen und proportional zu denjenigen ihrer ökonomischen Emissionen als klimaverantwortlich betrachtet, die A) nicht mit einem Nachhaltigkeitsgrenzwert vereinbar sind, B) oberhalb eines ökonomischen Fähigkeitsgrenzwerts, und C) nach einem Wissensgrenzwert emittiert wurden. Der Nachhaltigkeitsgrenzwert leitet sich aus den Temperaturgrenzwerten des Pariser Klimaabkommens ab, die wiederum darauf abzielen, einen gefährlichen Klimawandel zu vermeiden. Der ökonomische Fähigkeitsgrenzwert schützt Gerechtigkeitsgesichtspunkte und Entwicklungsaussichten. Und der Wissensgrenzwert gewährleistet, dass mit der einvernehmlichen Erklärung zu hinreichendem Wissen Unwissenheit nicht länger als Begründung für die Ablehnung von Klimaverantwortung dienen kann.

Das *Economic Activity Principle* ist so ausgearbeitet, dass das aus ihm heraus resultierende Klimaverantwortungskonzept sich einerseits aus den Effektivitäts- und Gerechtigkeitszielen im internationalen Klimaregime ableitet und sie andererseits unterstützt. Ich betrachte die nationale Ebene als angemessen, um Klimaverantwortung zu tragen, da Nationalstaaten die einzigen Akteure sind, die gleichzeitig alle hier entwickelten und verteidigten Verantwortungsvoraussetzungen erfüllen.

Insgesamt legt diese Dissertation ein normativ vertretbares, praktisch nützliches, und empirisch messbares Klimaverantwortungskonzept vor. Die hier ausgearbeiteten Ergebnisse zeigen, dass die derzeitige Art Klimaverantwortung auf territorialer Grundlage zu denken, Klimaverantwortung verzerrt darstellt, insbesondere da sie ärmeren und vorwiegend exportorientierten Ländern unverhältnismäßige Bürden auferlegt.

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List of Abbreviations

CBDR-RC	Common but differentiated responsibilities and respective capabilities
CBE	Consumption-based Emissions
CERF	Climate Equity Reference Framework
CR	Climate Responsibility
EE	Economic Emissions
EEIOA	Environmentally Extended Input-Output Analysis
GDP	Gross Domestic Product
GTAP	Global Trade Analysis Project
IBE	Income-based Emissions
IPCC	Intergovernmental Panel on Climate Change
MRIOA	Multi-regional Input-Output Analysis
NDC	Nationally Determined Contribution
OWID	Our World In Data
SBSTA	Subsidiary Body for Scientific and Technological Advice
TE	Territorial Emissions
UNFCCC	United Nations Framework Convention on Climate Change
WIOD	World Input-Output Database

1. Introduction

1.1. The ubiquity of climate responsibility

Two months before finishing this dissertation on climate responsibility, I decided to buy a car. Around the same time, countries all over the world were outbidding each other with new, ever more ambitious climate policies while scientists, activists, and many others continued criticising that even those ambitions, let alone their actual implementation, were still far from enough. My decision was fraught with delicate deliberations and conflicted contemplations. Not so much about the price, make, or model of the car to buy. But mostly about the different qualities and quantities of climate responsibility the decision would entail.

What were the pros and cons? I tried to weigh the advantages of spontaneous visits to geographically distant friends and family, quicker, independent, more comfortable commutes, and spontaneous weekend trips into nature against a ceteris paribus increased carbon footprint, unnecessary driving just because it was now an option, and the potential lost revenues for other modes of transport I could and would choose if I did not buy the car. Eventually, I thought the decision was justifiable from an environmental standpoint if we, as family using the car, chose a second-hand vehicle with the least carbon intensive propulsion system available[1], only (or at least mostly) took the car for trips previously covered in rental cars, and replaced (though perhaps not fully) potential future holidays involving air travel with vacations on campsites nearby. On balance, the reasoning appeared sensible. It felt rational.

But was it? What kinds of further considerations should have gone into the decision? And to what result should they have led? What role did unconscious emotions and habits play in the outcome? Our private and professional lives are bursting with bigger and smaller decisions like the one just described. What we choose to do or not to do – even our very existence – has environmental effects, contributes to or helps mitigate global warming, and so either restricts or extends our own and others' future option spaces, i.e., freedom.

Climate responsibility comes with having and exercising the power to make such decisions and with the resulting causal consequences. But although we have known about and agreed upon this general connection between climate-changing

[1] Running on compressed natural gas generated from waste or renewable sources.

anthropogenic action and climate responsibility, we have yet to find out and agree upon what climate responsibility should mean exactly.

Individuals typically do not take decisions and actions with the purpose of changing the climate for the worse but in order to pursue and reach positive goals. These include the provision of sustenance just as well as the pursuit of happiness. But smaller or larger environmental effects and with them greater or lesser climate responsibility arise along the way. Individuals have some room for manoeuvre within which they can make more or less environmentally friendly choices. How to eat, how to travel, or how to dress involve consumptive choices or at least habits which – just like the prime example of buying a car – can come at higher or lower environmental costs. At the same time – and this is too often neglected in public, political, and scientific discourse – individual climate responsibility is not just about private, consumptive choices. It also drastically depends on our professional, productive choices. What skills and knowledge to acquire, what career paths to take, and what smaller-scale choices to make along these paths drastically impacts the environmental traces an individual life will leave behind. Climate responsibility lurks everywhere.

However, such individual climate changing decisions and actions, private or professional, are not taken in a vacuum. They are instead embedded in complex, historically grown, and often path-dependent structures, including habitual and often unconscious patterns, which restrict or at least incentivise decisions. What socio-economic backgrounds and circumstances, what family and country, as well as what year an individual is born in, crucially determines the available menu of options from which he or she can make more or less environmentally friendly consumptive and productive choices. Climate responsibility in its moral dimension can prescribe what actions we ought or ought not to take. But "ought" implies "can"[2] meaning that the call of climate responsibility ends where individuals are insuperably constrained in their choices – be it out of poverty, actual lack of consciousness and knowledge[3], or simply because climate friendly alternatives really are not and cannot be readily made available.

[2] Markus Kohl, 'Kant and "Ought Implies Can"', *The Philosophical Quarterly*, 65.261 (2015), 690–710 <www.jstor.org/stable/24672780>; Michael Rohlf, 'Immanuel Kant', *The Stanford Encyclopedia of Philosophy*, 2016 <https://plato.stanford.edu/archives/spr2016/entries/kant/>.

[3] I will address in chapters 4 and 5 that denial should not count as excuse.

1.2. Climate responsibility as essentially contested concept[4]

Even if individuals have environmentally friendly alternatives available but consciously decide against them, it is still not clear what part of the resulting climate responsibility can and should be shouldered by whom. Returning to the example of buying a car, individual consumers make an often conscious and apparently rational, other times purely unconscious and emotional choice among the available options presented to them. Car manufacturers in turn take their productive decisions to make these options available. They act within competitive labour and resource markets as well as a dense network of regulatory and legal rules which are created in turn by politicians depending on the votes of or other forms of support by their electorates.

Given this complex yet still simplistic model of economic interactions, who should be regarded as climate responsible (and to what extent) when I go to the petrol station to get biogas? Is it I, is the clerk selling me the gas, or is it the powerplant that supplied the gas? Or is it perhaps the car manufacturer that built the car, the political structures and actors which shaped the rules and markets within which these decisions were taken or the voters and broader societies who ultimately chose to put these actors and structures in place? And what role and responsibility rests with which actors of the international community convening in the annual "Conferences of the Parties" to negotiate international climate agreements, policies, and their implementation?

A major problem with climate responsibility seems to be that no-one, at none of the levels of agency discussed so far, really knows what climate responsibility is or how it should be divided. At the same time, everyone seems to have a strong opinion about it. Political scientists currently observe an overall "Rise of Responsibility in World Politics", and environmental governance is among the most important fields experiencing it[5]. There appears to be agreement that climate responsibility is hugely important. Beyond that, however, the term is used to mean many, often contradictory things. There are, for example, those who think climate responsibility lies with consumers, those who think it lies with corporations and their

[4] Walter Bryce Gallie, 'Essentially Contested Concepts', in *The Importance of Language*, ed. by Max Black (Ithaca and London: Cornell University Press, 1969), pp. 121–46.

[5] Hannes Hansen-Magnusson and Antje Vetterlein, *The Rise of Responsibility in World Politics*, ed. by Hannes Hansen-Magnusson and Antje Vetterlein (Cambridge: Cambridge University Press, 2020) <https://doi.org/https://doi.org/10.1017/9781108867047>; Robert Falkner, 'Global Environmental Responsibility in International Society', in *The Rise of Responsibility in World Politics*, ed. by H. Hansen-Magnusson and A. Vetterlein (Cambridge: Cambridge University Press, 2020), pp. 101–24 <https://doi.org/10.1017/9781108867047.008>.

owners, and those who think it lies with institutional structures, countries, or supra-national levels of agency. Some people think climate responsibility implies they should stop flying, eating meat, driving anything but their bicycles (if at all), and even switching on the lights. To some, acting climate responsibly often even leads to the bottom line of not having any children since this would increase the number of mouths to feed on this planet, as well as the corresponding resource-use, and greenhouse gas emissions. Other people with a different disposition on climate responsibility think there is nothing wrong with enjoying the just described pleasures so long as no authority tells them to stop and so long as a great enough number of others continue doing the same. To them, climate responsibility – if it even exists – means abiding by the law. Beyond these two opposing groups, there is a large and often relatively confused rest engaging in their own climate responsibility trade-offs such as "it is okay to fly, but I should compensate the resulting emissions", or "if I choose not to have children, I am entitled to (at least part of) their hypothetical emissions". On the professional side, there are similar trade-offs such as "it is okay to fly, as long as the destination is not a safari with customers in an endangered rainforest but the next climate conference negotiating how to save the rainforest".

All these examples show that there is no unique or narrow answer to what climate responsibility is and to who should end up bearing how much of it and why. Instead, understandings of and debates about climate responsibility represent a broad and colourful array of often inconsistent emotions, sketchy rationalisations, and blatant contradictions. In its apparent disagreeability, climate responsibility currently shows characteristics of an essentially contested concept.[6]

1.3. Climate responsibility and the goals of the Paris Agreement

Disagreement over climate responsibility ranges from the individual up to the international level. And yet, the Paris Agreement offers ambitious ingredients with which I think greater agreement on climate responsibility can be reached. The Paris Agreement can be regarded as current state of affairs when it comes to broad agreement on climate responsibility. By the beginning of 2021, 191 of the 197 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are also parties to the Paris Agreement[7]. In 2015, it was signed by all but two of them at the

[6] Gallie.
[7] United Nations, *Paris Agreement*, 2015 <https://doi.org/FCCC/CP/2015/L.9/Rev.1>.

21st Conference of the Parties (COP21) in Paris. According to the UNFCCC secretariat[8]

> *"The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change"*

Furthermore, the Paris Agreement reconfirms the principles guiding the UN Framework Convention at several points, stating for example in Article 2 that

> *"This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities"*[9]

The Paris Agreement has been celebrated as one of the greatest successes in international climate negotiations, bringing together an unprecedented number of countries who now agree on more ambitious temperature limits for climate change than ever before[10]. Its main strength is the broad agreement on highly ambitious temperature limits. In contrast to its preceding climate treaty, the Kyoto Protocol, the Paris Agreement does not insist on assigning mitigation burdens to individual countries in a top-down manner. Instead, it established a bottom-up approach[11] to burden-sharing under which countries submit voluntary nationally determined contributions. This approach to burden sharing boosted wide participation in spite of persistent differences regarding questions of equity. It also enabled the agreement on very ambitious goals for the international community as a whole, instead of prescribing particular countries their own targets. While the Kyoto Protocol dictated emission targets but left out temperature goals, the Paris Agreement established temperature limits but left individual emission targets voluntary. At the same time,

[8] UNFCCC Secretariat, 'The Paris Agreement', 2021 <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> [accessed 9 January 2021].
[9] United Nations, *Paris Agreement*.
[10] Maria Ivanova, 'Good COP, Bad COP: Climate Reality after Paris', *Global Policy*, 7.3 (2016), 411–19 <https://doi.org/10.1111/1758-5899.12370>.
[11] Robert O Keohane and Michael Oppenheimer, 'Paris : Beyond the Climate Dead End through Pledge and Review ?', 4.3 (2016), 142–51 <https://doi.org/10.17645/pag.v4i3.634>.

the Paris Agreement reconfirms the UNFCCC's equity principle of common but differentiated responsibilities and respective capabilities (CBDR-RC), according to which industrialised countries must take the lead in climate mitigation[12].

Fundamentally, climate negotiations have their main purpose in finding agreement on climate responsibility, specifically the principle of CBDR-RC, because climate change poses a threat to fundamental values we hold and goals we pursue. Climate change increases the likelihood of extreme weather events, crop failures, and species extinction, among other negative consequences. Described in more abstract terms, climate change poses a threat because it encroaches current living standards and endangers further human development. Preventing dangerous climate change, therefore always aims at protecting standards of living as well as securing and enabling further human development. The international climate regime strives to achieve this by formulating an *effective* and *equitable* response to the threat of climate change.

Looked at in this light, the first goal characteristic of the international climate regime is *effectiveness* in the prevention of "dangerous climate change", i.e., in not breaching the Paris Agreement's temperature limits[13]. Dangerous climate change implies temperature increases of such proportions that future generations are forced into morally bad choices, i.e., experience severe limitations on their liberties. Examples include the prolongation or creation of poverty and the prevention of further human development. Dangerous climate change also implies irreversible damage to the planet's ecosystem. Following the successive assessment reports of the IPCC[14], the international community has adopted the 2°C and 1.5°C temperature limits of the Paris Agreement as likely being effective in avoiding dangerous climate change[15].

The second goal characteristic of the international climate regime is *equity* in the response to climate change. Fairness principles aim to avoid undue burdens to

[12] Lavanya Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics', *International and Comparative Law Quarterly*, 65.2 (2016), 493–514 <https://doi.org/10.1017/S0020589316000130>.

[13] Darrel Moellendorf, 'A Normative Account of Dangerous Climate Change', *Climatic Change*, 108.1 (2011), 57–72 <https://doi.org/10.1007/s10584-010-0007-3>; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change* (New York: Cambridge University Press, 2014).

[14] IPCC, 'Climate Change 2014 Synthesis Report Summary Chapter for Policymakers', *IPCC*, 2014 <https://doi.org/10.1017/CBO9781107415324>; IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. by Core Writing Team, Rajendra Pachauri, and Leo Meyer (Geneva, 2014) <https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf>.

[15] United Nations, *Paris Agreement*.

living standards and development prospects, especially of the currently poor. They are central to ensure that living standards are not endangered unduly both by climate change and by the response to climate change – which aims at the protection of future living standards.

While the abovementioned strengths of the Paris Agreement make it one of the greatest achievements in climate negotiations, it certainly has serious weaknesses. The first and most humbling is that the NDCs submitted by member countries to the Agreement are incompatible with the temperature goals agreed upon[16]. Even if every country which pledged climate action under the Paris Agreement were to fulfil its promise, the resulting reduction in greenhouse gas emissions would most likely lead to much higher temperature increases than agreed upon in Paris. Furthermore, while the Paris Agreement determines that NDCs may only be adjusted upward, meaning that countries which have ratified the agreement may not weaken their ambitions once they submitted an NDC, there is no necessity for them to increase ambitions either. While there is certainly hope that countries will tighten their NDCs to bring them in line with the ambitious temperature goals, this hope will not be fulfilled automatically or with certainty.

The second serious shortcoming of the international climate regime is that the current pledges are unfair if industrialised countries do not ramp up their efforts[17]. While the Paris Agreement garnered support for highly ambitious temperature goals and reaffirmed the principle of CBDR-RC, the actual pledges by countries are neither in line with the ambitious goals nor with the equity principles subscribed to. Depending on how the remaining emissions gap between the current pledges and those necessary to achieve the temperature goals is closed, the distribution of efforts among rich and poor countries cannot be described as fair. In short, commitments by industrialised countries typically fall short of what could be considered their fair shares, while commitments by poorer countries and emerging market economies typically meet or overfulfil what should be considered fair[18].

[16] Joeri Rogelj and et al., 'Paris Agreement Climate Proposals Need a Boost to Keep Warming Well below 2 C', *Nature*, 534.7609 (2016), 631–39 <https://doi.org/10.1038/nature18307>.

[17] Christian Holz, Sivan Kartha, and Tom Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5°C-Compliant Global Mitigation Effort', *International Environmental Agreements: Politics, Law and Economics*, 2017 <https://doi.org/10.1007/s10784-017-9371-z>; CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs' (Manilla, London, Cape Town, Washington et al.: CSO Equity Review Coalition, 2016) <civilsocietyreview.org/report2016>.

[18] CSO Equity Review, 'After Paris: Inequality, Fair Shares, and the Climate Emergency' (Manilla, London, Cape Town, Washington et al., 2018) <http://civilsocietyreview.org/report2018/>; CSO Equity Review, 'Fair Shares: A Civil Society Equity Review of INDCs' (Manilla, London, Cape Town, Washington, et al.: CSO Equity Review Coalition,

The international climate regime suffers from the non-binding character of the pledges submitted under the Paris Agreement as well as its inability to make pledges more equitable. In its current form, the regime is thus neither effective nor equitable, meaning it fails to fulfil its most important goal characteristics as enshrined in the UN Framework Convention and Paris Agreement. Its ambitious goals and principles are only vaguely defined and remain essentially contested such that implementation lags behind. The international community has found agreement on the overall goals of the climate regime as well as on the main goal characteristics a response should exhibit. But disagreement remains over how to close the remaining gap between ambitious negotiation text and actual climate policies and their implementation[19].

The actual pledges made under, and the general implementation of the Paris Agreement have thus been criticised as being ineffective and unfair. A well-known example of such a critique is the climate equity reference framework (CERF). It is one of the most sophisticated, most widely discussed, and most comprehensive equity references against which countries' pledges and the overall climate regime can be evaluated. Christian Holz et al.[20], for instance, used the CERF calculator to compare pledged NDCs of countries to fair efforts under the CERF. While contributions like the climate action tracker[21] show that the pledges promised by countries are not enough to achieve the temperature goals agreed upon, the evaluation of the pledges under the CERF reveals that the current pledges submitted are far from equitable and that closing the remaining emissions gap fairly would require substantively more commitment by industrialised countries.

Overall, the above discussion shows that the climate regime still fails to fulfil the two most important and most fundamental goals of the international climate regime. It fails to avoid dangerous climate change (because the pledges are insufficient in relation to the size of the emissions reductions required by the temperature

2015) <http://civilsocietyreview.org/report/>; CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.

[19] Daniel Edward Callies and Darrell Moellendorf, 'Assessing Climate Policies: Catastrophe Avoidance and the Right to Sustainable Development', *Politics, Philosophy & Economics*, 20.2 (2021), 127–50; Darrell Moellendorf, 'Responsibility for Increasing Mitigation Ambition in Light of the Right to Sustainable Development', *Fudan Journal of the Humanities and Social Sciences*, 13 (2020), 181–92 <https://link.springer.com/article/10.1007/s40647-020-00277-4>.

[20] Christian Holz, Sivan Kartha, and Tom Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5 C-Compliant Global Mitigation Effort', *International Environmental Agreements: Politics, Law and Economics*, 18.1 (2018), 117–34 <https://doi.org/10.1007/s10784-017-9371-z>.

[21] Climate Action Tracker, 'Global Temperatures' (Climate Action Tracker, 2016) <http://climateactiontracker.org/global.html>.

goals). It also fails doing so while simultaneously protecting current living standards and enabling further development. A major obstacle to further progress under the climate regime appears to be disorder in and disagreement over conceptualisations of climate responsibility.

1.4. Rethinking climate responsibility

This dissertation thus aims to bring some order to what climate responsibility means. I think we need to rethink climate responsibility and discard some of its uselessly unspecific, normatively dubious, contradictory, and not even lexically orderable usages while bringing more structured, defensible, and tangible meaning to the rest. This implies reconceptualising and measuring climate responsibility in a way that is *normatively defensible*, *empirically measurable*, and *practically useful*. The main chapters 4 through 6 will discuss in greater detail what this implies. For now, it suffices to say that the qualifier of *normative defensibility* means that the resulting climate responsibility concept should be based on widely agreed-upon normative ideals, rather than resting on shaky and too controversial normative ground. *Empirical measurability* means that the major components comprising the new concept of climate responsibility developed here must be empirically measurable, meaning that they can be systematically operationalised, and that empirical data of sufficient quality exists or could be made available. *Practical usefulness*, as third qualifier of the new climate responsibility concept, is somewhat less specific and so in somewhat greater need of explanation. As used here, practical usefulness means that the new concept of climate responsibility I develop extends and follows from but does not contradict prior climate agreements in their major goals. It builds on rather than demolishing existing tentative conceptualisations of climate responsibility. This does not mean that the new concept is easy to agree to politically[22]. On the contrary, its consequences would be so substantially different from business-as-usual ways of thinking climate responsibility that making it politically feasible remains a daunting, perhaps impossible task. Still, its normative justification and empirical estimation are derived from existing agreement and in that sense practically useful.

Rethinking climate responsibility as proposed in this dissertation means rethinking it in socio-economic terms. This means that climate responsibility should

[22] See also subsection 6.3.2, section 6.4, and chapter 7

be understood first and foremost as arising out of economic choices, behaviours, and interactions. But the resulting climate responsibility must in turn be qualified by the social circumstances within which the economic actions occur as well as by the social consequences entailed.

In a nutshell, agents' climate responsibility as conceptualised and measured according to the Economic Activity Principle[23] is proportional to the unsustainable consumptive and productive choices agents made above an economic ability threshold and past a knowledge threshold.

The components contained in this reconceptualisation of climate responsibility build on the fundamental goals, goal characteristics, and major agreements of the international climate governance regime. We can see that the Paris Agreement's central aim and its reconfirmation of CBDR-RC provide major inputs for how I conceptualise climate responsibility. From the principles of equity and CBDR-RC follows that "responsibilities", i.e., contributions to climate change, as well as "respective capabilities", i.e., countries' economic situation should be taken into consideration when conceptualising, measuring, and distributing climate responsibility. From the temperature limits set by the Paris Agreement follows what should be viewed as unsustainable, namely emissions pathways inconsistent with the temperature limits.

Reconceptualising and measuring climate responsibility means delving into the broad and multidisciplinary research field of climate justice. Addressing it in its entirety requires the ability to look at it from many different perspectives, and an awareness of its numerous dimensions. Climate justice is about ideals versus reality, about fairness in processes, distribution, and outcomes. Dominic Roser and Christian Seidel[24] offer a comprehensive albeit introductory overview over the ethical questions surrounding climate change. They divide the research field of climate justice into three main questions: 1) do we have a duty to do anything at all in the face of climate change? 2) assuming that we are obliged to do something, how much should we do? and 3) how should these duties be distributed[25]. Most research on

[23] Developed in subsection 5.3.6
[24] Dominic Roser and Christian Seidel, *Climate Justice - An Introduction*, 1st edn (New York: Routledge, 2017).
[25] Roser and Seidel, p. 4.

normative questions of climate change can be classified in terms of these fundamental questions. Contributing to all of them would require more than what would be healthy for a dissertation. If a dissertation still sets out to contribute to this large field, it must explain which specific areas it takes issue with, why they need to be addressed and how it intends to address them.

In my dissertation, I take the first two of Roser and Seidel's questions as relatively uncontroversial. By contrast, the third of Roser and Seidel's main questions of climate justice, "who should do what", remains largely unsettled despite a large and growing body of literature devoted to it and even though most countries have pledged contributions under the Paris Agreement. This thesis therefore focuses on how climate responsibility should be conceptualised, measured, and distributed – a sub-question of Roser and Seidel's third main question of climate justice. I argue that a normatively defensible, empirically measurable, and practically useful reconceptualisation of climate responsibility in the international climate regime holds potential to be a relevant contribution.

This dissertation aims for breadth, and depth. This means comprehensively and thoroughly reconceptualising and measuring climate responsibility. Comprehensive means speaking to normative defensibility, empirical measurability, and practical usefulness. Thorough means addressing all of these in depth and not regarding one as more important than the others. To make this contribution, I formulate and address the following research questions:

A) What is a normatively convincing background concept of climate responsibility?
B) How can and should the background concept of climate responsibility be systematised to be practically useful and measurable?
C) How can and should the systematised concept of climate responsibility be operationalised and measured?

1.5. Measuring climate responsibility – main results

The main results of applying the *Economic Activity Principle* are depicted in Figure 1-1, Figure 1-2, and Figure 1-3 as well as the corresponding Figures and further discussions in subsection 6.3.2. They show the profound effects it would have on the USA's, EU28's, and China's climate responsibility shares to rethink climate responsibility as proposed in this dissertation.

In Figure 1-1, we see that the choice of emissions indicator matters a great deal for what share of global emissions countries end up with under the current territorial emissions accounting system, as opposed to consumption-based emissions accounting and income-based emissions accounting[26]. If emissions are used as unqualified basis of climate responsibility, countries' respective climate responsibility shares in the costs of responding to climate change vary significantly depending on the emissions indicator chosen.

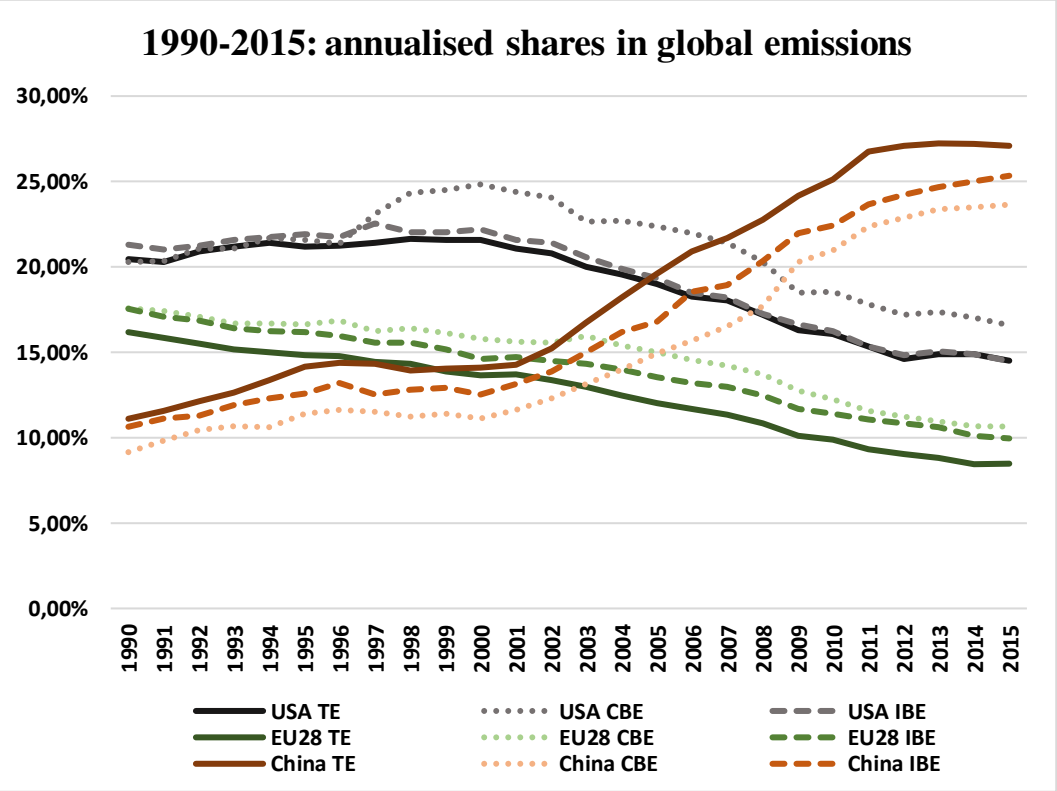

Figure 1-1: 1990-2015 - Annualised shares in global territorial emissions (TE), consumption-based emissions (CBE), and income-based emissions (IBE) for the USA, the EU28, and China

[26] For the corresponding discussion about the differences between these approaches, see section 2.3, subsection 3.3.3 and chapter 6.

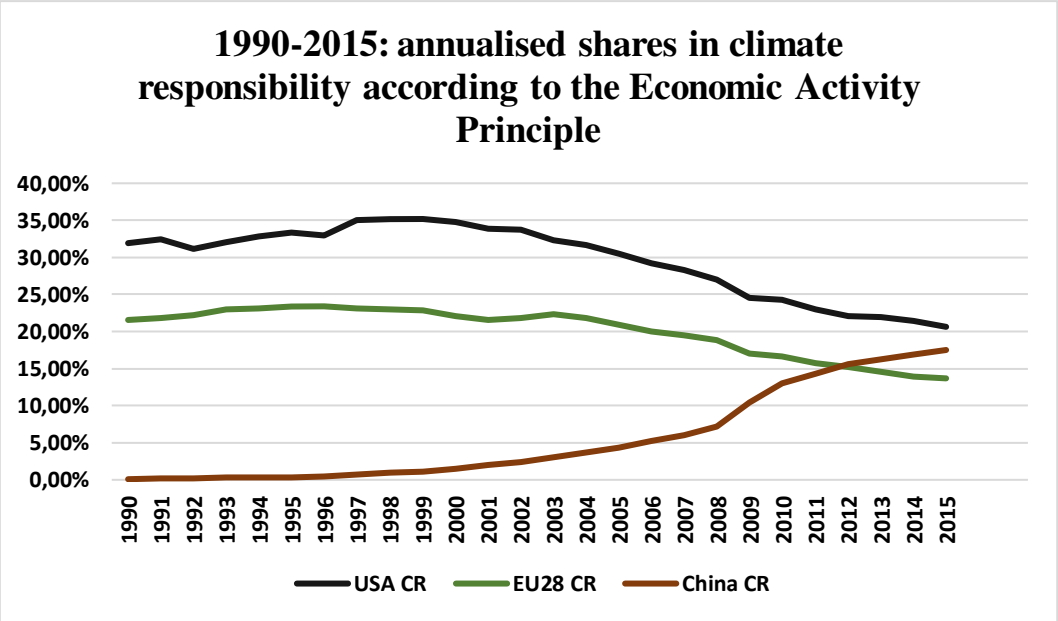

Figure 1-2: 1990-2015 - Annualised shares in climate responsibility (according to the Economic Activity Principle) for the USA, the EU28, and China

Figure 1-2 adds further crucial elements of the *Economic Activity Principle*. The results shown are arrived at by measuring countries' emissions as the average of their consumption- and income-based emissions (referred to here as economic emissions) and by including the proposed economic capability and knowledge thresholds. Including the two thresholds means that only those emissions associated with incomes above US$ 7500 per annum, per capita (adjusted for purchasing power) are included and only those emitted after 1990. Chapters 4 through 7 will go into more depth to derive, explain, and defend these components. The main take-away at this point is that China's climate responsibility share drops significantly when the thresholds are included as opposed to only measuring emissions.

Figure 1-2, however, still depicts annualised shares while the *Economic Activity Principle* suggests measuring all economic emissions above and past the respective thresholds as input into countries' climate responsibilities. This means that a cumulative share as depicted in Figure 1-3 is most in line with the *Economic Activity Principle*.

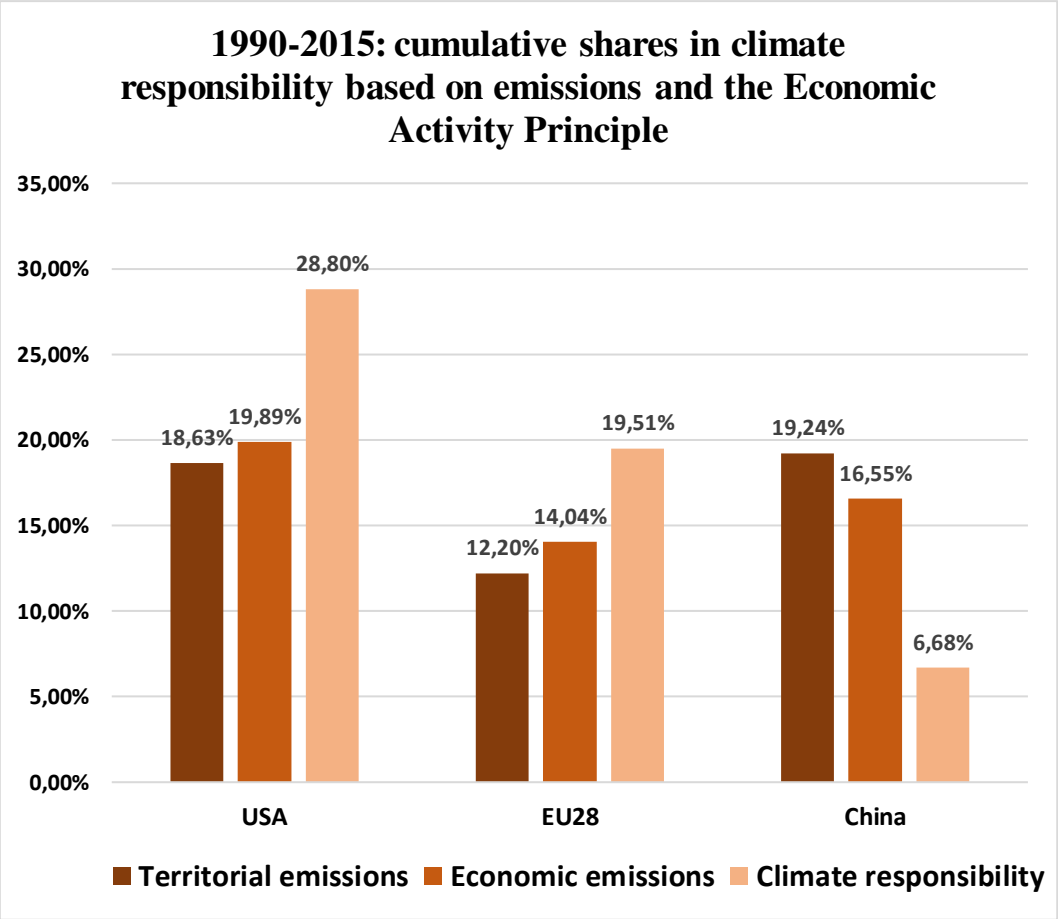

Figure 1-3: Cumulative shares in global territorial emissions, economic emissions (average of consumption- and income-based emissions), and climate responsibility for the USA, EU28, and China

Figure 1-3 draws together the main conclusions of this dissertation for the USA's, EU28's, and China's respective climate responsibility shares. We can see that switching from a territorial to an economic emissions accounting basis of climate responsibility would already have a significant effect on the distribution of respective climate responsibilities. But this effect would be dwarfed by that of switching from territorial emissions accounting to the *Economic Activity Principle* as basis of countries' climate responsibilities.[27]

1.6. Thesis outline

To address the research questions listed above, the thesis is structured as follows. In the following chapter 2 I discuss the relevant aspects of the international climate regime in greater depth, as well as providing the more thorough motivation for a new climate responsibility concept. Chapter two further continues the argument that climate responsibility is essentially contested and vaguely defined and

[27] Chapter 6 contains further results as well as their more detailed discussion.

that thoroughly and comprehensively reconceptualising and measuring climate responsibility could contribute to furthering the goals and goal characteristics of the Paris Agreement. On this basis, I identify a research gap and more thoroughly derive the research questions already mentioned above. Chapter 3 lays out the methodological framework I employ to fill the research gap and answer the research question. It argues that Robert Adcock and David Collier's measurement validity framework[28] provides a helpful outline for structuring the thesis and devising its individual research tasks.

Chapters 4 through 6 form the main part of the thesis. Here, I go through the individual research tasks associated with conceptualisation and measurement as outlined in Adcock and Collier's framework. Chapter 4 addresses the background concept level of my reconceptualisation of climate responsibility. This means identifying and establishing the normative building blocks and thresholds for a normatively defensible, empirically measurable, and practically useful concept of climate responsibility. Here, I argue that climate responsibility should generally arise out of economic choices that lead to emissions. However, not all emissions should count the same. It is instead important to simultaneously respect a sustainability threshold, a knowledge threshold, and an economic capability threshold. Emissions that can be viewed as sustainable should not count towards climate responsibility. And emissions before the knowledge and below the economic capability thresholds should also not count towards climate responsibility. In sum, the chapter provides the background for a systematised understanding of climate responsibility.

Chapter 5 develops this systematised concept of climate responsibility by building on prior principles of climate responsibility. It develops a new hybrid principle - the *Economic Activity Principle* already mentioned above - that combines essential characteristics of the *Polluter-Pays Principle*, *Beneficiary-Pays Principle*, and *Ability-to-Pay Principle*. According to the *Economic Activity Principle*, the systematised concept of climate responsibility holds agents responsible for the average of the emissions embodied in their consumption expenditures and enabled by their generation of income.

Chapter 6 takes the thresholds and building blocks developed in chapter 4 and the *Economic Activity Principle* developed in chapter 5 as starting point and sets

[28] Robert Adcock and David Collier, 'Measurement Validity: A Shared Standard for Qualitative and Quantitative Research', American Political Science Review, 95.3 (2001), 529–46.

out to measure climate responsibility. This involves measuring economic emissions, i.e., consumption-based and income-based emissions after the knowledge threshold. It also involves measuring what share of emissions was emitted above the economic capability threshold. Most importantly, it presents and discusses the results obtained from measuring climate responsibility according to the *Economic Activity Principle*.

Finally, the concluding chapter 7 discusses and reflects on the findings of the thesis and considers options for further research on and applications of the new climate responsibility concept. It argues that it is very unlikely for this concept to be broadly acceptable politically, especially in the diverse landscape of interests represented in international climate governance. However, the concept could nevertheless be useful as equity gauge from the outside with which to assess and evaluate countries' contributions to the climate regime as well as the regime as a whole. While climate responsibility as reconceptualised here may never be endorsed in policies, we may perhaps see a gradual and ever-greater approximation of it. Furthermore, rethinking climate responsibility in the way proposed here could also add new information and analytical order to the more general discourse on climate responsibility. It could add to how we think about climate responsibility in the media, non-governmental organisations, academia, as well as our personal lives. Equipped with this understanding of climate responsibility, we may find it easier to distinguish environmentally friendly from unsustainable behaviours and choices. This in turn may help us make our professional and private choices more consciously in order to behave as climate responsible as we consciously choose to.

Before diving into the further analysis, let me briefly demarcate the dissertation from other, related work. This book is not a thorough analysis of the injustices resulting from inaction on climate change. Finding out what injustices result from unmitigated climate change is a very important and too often neglected point. While many emphasise and discuss the costs of action on climate change, the costs of inaction and their inherent injustice are too often swept under the carpet. For example, the German left party – alongside others but currently quite visibly – has made a habit of underlining the social costs of action on climate change. This focus is very important, especially when discussing instruments such as price measures on products and technologies for which no viable alternatives exist especially for poorer people. The prime example are fossil fuels and the internal combustion

engine on which large parts of the rural, and often poorer, German population are still dependent. Making such technologies and resources more expensive by raising taxes or CO_2 prices, so the argument goes, would translate directly into a tax on poorer people as they have no viable alternatives and cannot decrease their respective consumption.

However, such arguments are at least one-sided, if not deliberately misleading. First, they tend to neglect the necessity to raise prices of unsustainable technologies to achieve desired environmental effects. Without noticeably increasing the prices of unsustainable products compared to sustainable alternatives (which would first have to be affordably established), people will most likely be continuing to opt for the former. Second, arguments that only focus on the costs of action tend to neglect the possibilities – and political willingness across the political spectrum – to cope with the unwanted social costs sometimes inherent in such policies. Often, it is possible to mitigate or even fully avoid adverse effects of such response measures, for example by directly redistributing the tax revenue raised.[29]

Third, and most importantly – especially from a global justice perspective, such arguments tend to neglect the global, social injustice inherent in inaction. If we respond to climate change by raising the price of unsustainable resources, products, and services, we may cause adverse effects which need to be addressed and managed. However, inaction on climate change will most likely lead to much higher overall costs and at the same time a distribution of these even higher costs that is as unjust or even more unjust than the distribution of the lower costs resulting from an ambitious response to climate change could be[30]. Furthermore, we have much more control over addressing and handling the potential injustices of response measures to climate change, than we have control over addressing and handling the injustices inherent in unmitigated climate change.

Designing burden-sharing in the response to climate change and distributing the resulting burdens equitably and with the interests of those most adversely affected in mind is the subject of this thesis and will be addressed in greater detail in

[29] Jouni Paavola and W. Neil Adger, 'Fair Adaptation to Climate Change', *Ecological Economics*, 56.4 (2006), 594–609 <https://doi.org/10.1016/j.ecolecon.2005.03.015>; D. Bazin, J. Ballet, and D. Touahri, 'Environmental Responsibility versus Taxation', *Ecological Economics*, 49.2 (2004), 129–34 <https://doi.org/10.1016/j.ecolecon.2004.03.015>; Svante Mandell, 'Optimal Mix of Emissions Taxes and Cap-and-Trade', *Journal of Environmental Economics and Management*, 56.2 (2008), 131–40 <https://doi.org/10.1016/j.jeem.2007.12.004>.

[30] CSO Equity Review, 'After Paris: Inequality, Fair Shares, and the Climate Emergency'; CSO Equity Review, 'Fair Shares: A Civil Society Equity Review of INDCs'; CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'; Simon Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change', *Leiden Journal of International Law*, 18.4 (2005), 747–75 <https://doi.org/10.1017/S0922156505002992>.

the following chapters. How the distribution of the burdens of not responding ambitiously to climate change is unjustly divided among the global population will not be the focus here.

2. Prior climate responsibility conceptualisation and measurement approaches

2.1. Introduction

Six years ago, the 2015 Paris Agreement broke the prior impasse in climate negotiations on a successor to the 1997 Kyoto Protocol. Its goal to "keep global temperature rises well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C"[31] reflects unprecedented overall ambition. The high number of signatory countries, most of which have since ratified the agreement, is another of its main accomplishments. A third major achievement is the renewed commitment to previously established but heavily contested equity norms, most importantly the principle of CBDR-RC. Many commentators, negotiators, and researchers credit the Paris Agreement's "bottom-up pledge and review" system with this success[32]. It allowed negotiators to set ambitious overall goals and reach widespread participation despite unresolved material and political differences as well as lingering disagreement over how to co-ordinate and institutionalise the response to climate change effectively and equitably. However, despite these overall successes of the Paris Agreement, the nationally determined contributions countries have since pledged are humbling when compared to what would be needed to not breach the temperature limits. According to assessments from outside the climate regime[33] such as Baer et al.'s CERF[34], for example, pledges under the Paris Agreement are neither sufficient and effective nor fair to poorer countries of the world[35].

This chapter provides the necessary background information against which to understand and appreciate the ensuing reconceptualisation and measurement of climate responsibility in this dissertation. This means first, describing in broad brushes why the principle of CBDR-RC can be regarded as most important

[31] United Nations, *Paris Agreement*.

[32] Keohane and Oppenheimer; Lavanya Rajamani, 'Differentiation in the Emerging Climate Regime', *Theoretical Inquiries in Law*, 14.1 (2013), 151–72; Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'; Lavanya Rajamani, 'The 2015 Paris Agreement: Interplay Between Hard, Soft, And Non-Obligations', *Journal of Environmental Law*, 28 (2016), 337–58 <https://doi.org/10.1093/jel/eqw015>.

[33] Climate Action Tracker; Ricarda Winkelmann and others, 'Trajectories of the Earth System in the Anthropocene', *Proceedings of the National Academy of Sciences*, 115.33 (2018), 8252–59 <https://doi.org/10.1073/pnas.1810141115>; Mercator Research Institute on Global Commons and Climate Change, 'That's How Fast the Carbon Clock Is Ticking', *Remaining Carbon Budget - Carbon Clock*, 2021 <https://www.mcc-berlin.net/en/research/co2-budget.html> [accessed 1 May 2021].

[34] Eric Kemp-Benedict and others, 'The Climate Equity Reference Calculator', *Climate Equity Reference Project* (EcoEquity & Stockholm Environment Institute, 2019) <https://calculator.climateequityreference.org>; Sivan Kartha and others, *The Greenhouse Development Rights Framework*, *Climate and Development*, 2009, 1 <https://doi.org/10.3763/cdev.2009.0010>.

[35] CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.

conceptualisation of climate responsibility and how it has evolved. It means second, describing what the most relevant existing ways of measuring climate responsibility are and how they have evolved. And it means third, arguing in what ways and why there is disagreement over conceptualisations and measurements of climate responsibility, as well as over how they should be matched. This chapter, however, is not a comprehensive literature review as the relevant literature will be discussed where most relevant throughout the arguments in the main chapters. Still, the present chapter will cover important segments of the previous literature as relevant to provide enough background information. It will then identify a research gap, the research questions already mentioned in the previous introductory chapter, and so motivate a research agenda for how to close it. On this last point, the following chapter 3 will then provide more depth by developing a corresponding methodological approach to structure the whole thesis.

Work in this thesis builds on previous contributions to climate science in the natural sciences, philosophy, politics, and economics. The respective histories of these different sub-fields of climate science have been told many times and in great depth before and need not be repeated here. Their early beginnings can be traced back to the works of Svante Arrhenius, Jean Baptiste Joseph Fourier, and John Tyndall, who throughout the 19th and early 20th centuries contributed substantially to the early scientific understandings of a changing atmosphere and climate[36]. The history of climate change as scientific and policy issue stretches up to Svante Arrhenius' recent remote descendant Greta Thunberg, who initiated a world-wide climate activist movement with her school strikes for climate[37]. Alongside millions of further activists, researchers, politicians, entrepreneurs, and many others engaging in some way or other with the issue of climate change, the relatively young *Fridays For Future* movement has renewed and redirected attention to climate change. In between the early beginnings of climate science and the most recent developments lies more than a century of convoluted ups and downs, euphoric and disappointing back and forth, of disagreements and discoveries reaching all walks of life.

Neither this chapter nor the thesis as a whole intends to be another comprehensive or thorough history of climate science, philosophy, politics, or economics. For

[36] Dale Jamieson, Reason In a Dark Time (New York: Oxford University Press, 2014), pp. 12–14.
[37] BBC, 'Greta Thunberg: Who Is She and What Does She Want?', 2020 <https://www.bbc.com/news/world-europe-49918719>.

one, to even try and squeeze such goals in here would inevitably go beyond the scope available. Furthermore, such historical contributions already exist at a level of depth and breadth that could not and need not be met here[38]. And third, retelling the history of climate responsibility is not the main goal of the present research. Rather, it is providing the relevant and necessary backward-looking information needed for a thorough and comprehensive, but fundamentally forward-looking, re-conceptualisation and measurement of climate responsibility. While this requires looking back and touching base with what is relevant, it would be counterproductive to get lost in the gaze and forget what the present focus is while retelling too much of what happened in the past.

So, this chapter aims for parsimoniously explaining first, why a concept of climate responsibility is even motivated and even needed, second, how and why existing conceptualisations and measurements have failed to properly fulfil this need, and third, why a reconceptualisation and measurement of climate responsibility along the lines proposed here could help address this failure.

On the first point, I argue that climate responsibility is needed as a concept with two essential aims. For one, it can answer the causal question who made climate change. I refer to *economic causality* here, meaning that economic motives and choices, arguably even more so than direct physical influence, should be regarded as underlying drivers of greenhouse gas emissions contributing to climate change. I will expand on and revisit this argument at several relevant points throughout the following chapters[39]. The corresponding first aim of a concept of climate responsibility is thus to tell us who to view as climate responsible in the sense of having economically brought about climate change. Second, climate responsibility can answer the related normative question who should do what in response to climate change. More specifically, this means answering who should bear which part of the burdens associated with a response to climate change. In this normative and forward-looking sense, being climate responsible thus means accepting a duty or

[38] To name but some of them: Hervé Le Treut, Richard Somerville, and et al., 'Historical Overview of Climate Change', in *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. by S. Solomon and et al. (Cambridge: Cambridge University Press, 2007) <https://www.ipcc.ch/site/assets/uploads/2018/03/ar4-wg1-chapter1.pdf>; Jamieson, *Reason In a Dark Time*, chap. 2; UNFCCC, 'A Brief History of the Negotiating Process', 2020; Joyeeta Gupta, *The History of Global Climate Governance* (Cambridge: Cambridge University Press, 2014); Lavanya Rajamani, *Differential Treatment in International Environmental Law* (Oxford: Oxford University Press, 2006) <https://doi.org/10.1016/B978-0-85709-454-4.50020-3>; Lavanya Rajamani, 'The Changing Fortunes of Differential Treatment in the Evolution Of', 3.October 2011 (2012), 605–23.

[39] For a condensed discussion, see subsection 4.2.1.

obligation to respond to climate change. By providing these two interrelated answers, the concept of climate responsibility can contribute to the two fundamental goals of the climate regime already briefly sketched in the previous chapter: effectiveness, and equity[40]. By giving good reasons for who should be viewed as being responsible for bringing about and for responding to climate change, i.e., reasons that take relevant circumstances of responsibility bearers into account, climate responsibility can raise equity. By raising equity, it can in turn broaden participation and raise ambition in the response to climate change, meaning it can contribute to the response being effective. This chapter as well as the following ones will further expand on this reasoning.

Regarding the second point, i.e., the shortcomings of existing conceptualisations and measurements of climate responsibility, I argue that climate responsibility currently appears in many different, often contradicting guises. The different real-life examples discussed in the preceding chapter illustrate that there is a lot of disagreement about what climate responsibility is, how its prescriptions are motivated and justified, and about how it should be shared. The international climate governance regime has institutionalised different forms of differential treatment to raise equity and in turn participation and effectiveness. But differential treatment and many of its norms – most prominently enshrined in the cornerstone principle of CBDR-RC – itself remains only vaguely defined. There are a whole range of different interpretations and possible implementations of equity as differential treatment as CBDR-RC in the climate regime, many of which are incompatible with each other. Just to briefly recap some, Lavanya Rajamani, for example, points to country groupings, auto-election, as well as objective criteria and graduation as potential and previously tried approaches to burden-sharing in the climate regime[41].

Under the perspective that it raises equity, participation, and effectiveness in the international climate governance regime, CBDR-RC can thus be regarded as dealmaker. Its vagueness and ambiguity contain a constructive element helping structurally different countries with differing interests and values to unite and agree

[40] Daniel Bodansky, 'The History of the Global Climate Change Regime', *International Relations and Global Climate Change*, 23 (2001); Philippe Cullet, 'Differential Treatment in Environmental Law: Addressing Critiques and Conceptualizing the Next Steps', *Transnational Environmental Law*, 5.2 (2016), 305–28 <https://doi.org/10.1017/S204710251600025X>; Sonja Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research', *Global Environmental Change*, 2016, 8–11 <https://doi.org/10.1016/j.gloenvcha.2016.08.002>; Rajamani, *Differential Treatment in International Environmental Law*.

[41] Rajamani, *Differential Treatment in International Environmental Law*, p. 165.

on ambitious goals. At the same time, its conceptual plurality and vagueness feed into destructive disagreements over practical implementation and burden-sharing. Under the perspective that it remains essentially contested and vaguely defined, CBDR-RC can thus also turn out to be a dealbreaker if it stands in the way of answering how best to respond to climate change and how to share the associated costs.

Rethinking, reconceptualising, and measuring climate responsibility in a way that respects prior agreement but derives further clarity from it can thus offer a promising way of responding to the issues of conceptual plurality and vagueness. It cannot, of course, solve problems unrelated to disagreements over conceptualisation and measurement. While the disagreement about burden-sharing is arguably at the heart of climate negotiations[42], there are of course many issues that go beyond and cannot be solved or even addressed by a new concept of or greater agreement on climate responsibility[43].

This chapter comes in three more parts to provide the background for understanding the ensuing main parts. The next section 2.2. more thoroughly introduces CBDR-RC as systematised conceptualisation[44] of climate responsibility, its sustained importance to the climate regime, and the major problems it poses. Section 2.3. then provides an overview over different ways to measure climate responsibility, their respective contradictions and shortcomings, as well as some existing approaches to addressing these issues. And the last section 2.4. argues that out of the drawbacks of existing ways of conceptualising and measuring climate responsibility arises a research gap for rethinking climate responsibility that offers a better match among the goals of the climate governance regime as well as the conceptualisation and measurement of climate responsibility. In this last section, I outline the argument that what is missing is a thoroughly and comprehensively conceptualised and measured understanding of climate responsibility. The rest of the dissertation then provides the methodological framework for and embarks on filling this gap.

[42] Douglas Bushey and Sikina Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC', *Berkeley Journal of International Law Publicist*, 6 (2010), 1–10; Jutta Brunnée and Charlotte Streck, 'The UNFCCC as a Negotiation Forum: Towards Common but More Differentiated Responsibilities', *Climate Policy*, 13.5 (2013), 589–607 <https://doi.org/10.1080/14693062.2013.822661>.

[43] Mike Hulme, *Why We Disagree About Climate Change* (Cambridge: Cambridge University Press, 2009); D. Bodansky and L. Rajamani, 'The Issues That Never Die', *Carbon & Climate Law Review*, 12.3 (2018), 184–90 <https://doi.org/10.21552/cclr/2018/3/4>.

[44] For more on what this means, please see subsections 3.2.2 and 3.3.2.

2.2. Conceptualising climate responsibility: CBDR-RC and its discontents

The necessity for states to negotiate climate governance has continuously arisen in essence because there remains disagreement in theory and practice about who should bear which portion of responsibility for climate change and consequently commit to which contribution to a response. To not breach the Paris Agreement's temperature limits, at least some countries will have to increase their respective ambitions substantially[45]. The concept of climate responsibility in its systematisation as CBDR-RC is so central to answering who should increase their policy ambition and by how much that climate negotiations can still justifiably be said to have their main purpose in finding agreement on the details of this concept[46]. What follows in this section is a brief collection of attempts at further specifying the principle of CBDR-RC. How these attempts turned into more specific operationalisation and measurement will then be addressed below in section 2.3.

To appreciate the undiminished importance of CBDR-RC and simultaneously recognise the need for its reconceptualisation, it is crucial to understand how it emerged and evolved over the three decades it has been around as systematisation of climate responsibility. CBDR-RC was crucial in the 1990s to initiate universal climate negotiations as it enabled states at very different stages of economic and human development to remain in broad agreement on initial climate policy. Its formulation was based on a proposal by India which suggested reformulating the IPCC's suggestion of "common responsibilities" into "common but differentiated responsibilities"[47].

However, the international community has developed unevenly since the emergence of the climate regime and CBDR-RC. Adapting the interpretation and implementation of the principle to new realities in the international landscape has proven tricky, and as a consequence, the principle has by now arguably begun to hinder rather than help agreement on climate policy. For example, its original institutionalisation continues to classify some of the largest greenhouse gas emitters bluntly as developing countries allowing them to escape any stringent mitigation

[45] IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; CSO Equity Review, 'After Paris: Inequality, Fair Shares, and the Climate Emergency'.

[46] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.

[47] Navroz K. Dubash and Lavanya Rajamani, 'Multilateral Diplomacy on Climate Change', in *The Oxford Handbook of Indian Foreign Policy*, ed. by David M. Malone, C. Raja Mohan, and Srinath Raghavan (Oxford University Press, 2015), p. 2 <https://doi.org/10.1093/oxfordhb/9780198743538.013.48>.

commitments[48]. Large emitters among developed countries, most notably the US, have used the absence of large developing country commitments as reason for their own lack of ambition[49].

Still, since its initial formulation, CBDR-RC has undergone significant changes regarding both its prominent interpretations and implementations[50]. The international community has time and again tried but only partially achieved to reflect objective changes in countries' differentiated contributions to climate change (i.e., greenhouse gas emissions) and responsive capabilities in the implementation of the principle. The current pledge and review system of the Paris Agreement has arguably softened the previous divide between industrialised and developing countries regarding central commitments. Now, every country is expected to deliver on "nationally determined contributions". But the Paris Agreement's new bottom-up approach has so far neither triggered the necessary overall ambition to remain within the agreed upon temperature limits, nor provided convincing, nuanced, and specific guidelines as to which distribution of contributions would be equitable.

Since emissions reductions are usually associated with immediate individual costs but often only offer collective future benefits, taking responsibility for them and agreeing to reductions is typically not something countries embrace voluntarily and unilaterally. At the same time, there is no organised authority with the capability of compelling countries to reduce emissions if they do not agree to do so first, which holds especially in the case of powerful emitters like the US. This fundamental difficulty has plagued climate conferences from their early beginnings. Successfully responding to tragedy of the commons scenarios typically requires co-ordination to ensure individual action is in line with the interests of the community. A successful internalisation of negative externalities cannot typically rely solely on the same private cost-benefit considerations which led to the tragic outcome in the

[48] Thomas Deleuil, 'The Common but Differentiated Responsibilities Principle: Changes in Continuity after the Durban Conference of the Parties', *Review of European Community and International Environmental Law*, 21.3 (2012), 271–81 <https://doi.org/10.1111/j.1467-9388.2012.00758.x>.

[49] Donald Trump, 'Statement by President Trump on the Paris Climate Accord', *White House Briefings and Statements*, 2017 <https://www.whitehouse.gov/briefings-statements/statement-president-trump-paris-climate-accord/>.

[50] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'; Rajamani, 'The Changing Fortunes of Differential Treatment in the Evolution Of'; Rajamani, 'The 2015 Paris Agreement: Interplay Between Hard, Soft, And Non-Obligations'; Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'.

first place. Instead, it requires larger than individual co-ordination and agreement on which costs should be identified, distributed, and internalised in which manner[51].

Reconceptualising and measuring climate responsibility is motivated in part by the standard response to the classic tragedy of the commons problem in economics[52]. Climate negotiation and policy platforms seek to offer at least two essential features to tackle the tragedy of the commons scenario. The first one is broad participation to maximise the potential for effective emissions reductions and the second one is equitable burden-sharing to ensure members are not asked to shoulder more than their fair shares[53]. So, climate talks need to strike a balance between goals regarded as too modest – which would make them redundant and ineffective which could quickly lead to disinterest in further talks – and overly ambitious – which would deter participants due to the expectation of excessively high or unfairly distributed costs.

Regarding effectiveness, the international climate governance regime has enshrined the prevention of "dangerous anthropogenic interference with the climate system" in its 1992 UN Framework Convention on Climate Change[54]. Since then, the regime has further narrowed down the meaning of dangerous climate change and the corresponding understanding of what is required to prevent it. Following the successive assessment reports of the Intergovernmental Panel on Climate Change[55], the international community has adopted the 2°C and 1.5°C temperature limits now anchored in the Paris Agreement as likely being effective in avoiding dangerous climate change. On this basis, one could regard the climate regime's goal characteristic of effectiveness to be met if the temperature limits remain unbreached. The "common" aspect of CBDR-RC can be understood as relating to this overarching goal of effectiveness in the response to climate change.

On equity, the international climate governance regime also relies on CBDR-RC to guide differential treatment in its 1992 UN Framework Convention on

[51] C. Kolstad and others, 'Social, Economic, and Ethical Concepts and Methods', in Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Edenhofer, (New York, 2014), pp. 207–82 (sec. 3.3) ff. Garrett Hardin, 'The Tragedy of the Commons', Science, 162 (1968), 1243–48; Garrett Hardin, 'The Tragedy of the Commons', Journal of Natural Resources Policy Research, 1.3 (2009), 243–53; David Feeny, 'The Tragedy of the Commons: Twenty-Two Years Later', Human Ecology, 18.1 (1990), 1–19.

[52] For more on this, see subsection 2.2.1. below.

[53] Tuula Honkonen, 'The Principle of Common But Differentiated Responsibility in Post-2012 Climate Negotiations', Reciel, 18.3 (2009), 257–68 (p. 259).

[54] United Nations, *United Nations Framework Convention on Climate Change*, 1992 <https://doi.org/10.1111/j.1467-9388.1992.tb00046.x>.

[55] e.g. IPCC, 'Climate Change 2014 Synthesis Report Summary Chapter for Policymakers'; IPCC, *Global Warming of 1.5 °C*, 2018 <http://www.ipcc.ch/report/sr15/>.

Climate Change and the subsequent major agreements under it[56]. Together, the prevention of dangerous climate change and the inclusion of differentiation thus establish *effectiveness* and *equity* as fundamental goal characteristics of the climate regime needed to raise the willingness of countries to opt in to international co-ordination on climate change[57]. Differential treatment in general and CBDR-RC as systematisation of climate responsibility in particular are included to further these goal characteristics. On the one hand, characterising climate responsibility as *common* aims at uniting as many states as possible in sharing the burdens of responding to climate change. On the other hand, *differentiation* among negotiating parties is meant to serve the ideal of equity. Equity in turn facilitates the inclusion of states that would or could not participate without differentiation in their favour and aims to ensure that no-one is asked to shoulder more than their fair share. Simultaneously, it is included to ensure that those with greater capabilities to respond take over greater respective shares of the responsive burden.

However, so long as CBDR-RC specifically and climate responsibility more generally remain only vaguely defined or even essentially contested concepts, they can end up hindering rather than helping to reach these goals.[58] Without knowing what the burdens to be distributed are and without agreement on an understanding of responsibility according to which they should be distributed, effective and equitable burden-sharing in the response to climate change likely remains mere aspiration.

2.2.1. CBDR-RC: an important but controversial enabling norm of effectiveness and equity

On the face of it, climate change poses a threat because it increases the likelihood and severity of extreme weather events (such as floods, droughts, or storms), corresponding crop failures, and species extinction among its many other negative consequences. In more abstract terms, climate change is a threat most fundamentally because it threatens current and future living standards as well as their further development. "Dangerous climate change" follows from temperature increases of

[56] United Nations, *United Nations Framework Convention on Climate Change*; United Nations, 'Kyoto Protocol To the United Nations Framework', 1998, 1–21 <https://doi.org/10.1111/1467-9388.00150>; United Nations, *Paris Agreement*.

[57] United Nations, United Nations Framework Convention on Climate Change.

[58] John Gerring, 'What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences', *Polity*, 31.3 (1999), 357–93; Sonja Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research', *Global Environmental Change*, November, 2016, 8–11 <https://doi.org/10.1016/j.gloenvcha.2016.08.002>; Gallie.

such proportions that some current and ever more future generations are forced into or only left with morally bad choices[59]. Examples include prolonging or creating poverty and unduly impairing development prospects.

Effectively responding to climate change will involve substantial costs. Assuming the unsustainable ways of production and consumption in contemporary market economies have evolved to their current form motivated by the goal of economic optimisation means that structural deviations typically involve costs. Such costs are currently invisible or externalised but would have to be quantified and internalised if the goal is to make simultaneously efficient and sustainable choices. Limiting the extent of climate change to manageable proportions, i.e., taking measures that are effectively mitigating climate change such that it does not become dangerous in the above sense, involves structural change and thus up-front costly deviations from business-as-usual pathways. If climate change is indeed the greatest market failure ever seen[60] and thus imposes external costs onto the international community, distant or future societies, and on the environment, any attempt to change the economic rationale of our modern market economies by internalising climate changing externalities, will impose substantial burdens on societies transitioning to sustainable lifestyles. It also involves goal conflicts such as the one potentially arising between development and sustainability. The UNFCCC's vision of sustainable development[61] is thus a corresponding attempt at reconciling the potentially conflicting goals of human development and environmental sustainability.

However, the costs of inaction would, for all we know, be even higher[62]. Continuing along business-as-usual pathways thus only appears rational and efficient if the external costs to the environment, some current, and ever more future generations are not yet made visible in cost-benefit analyses. To avoid these even higher costs resulting from unmitigated, dangerous climate change, large parts of the global economy will have to embark on a sustainability transition and in some way or other quantify, share, and distribute the associated burdens.

[59] Darrel Moellendorf; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*.
[60] 'What Is the Economics of Climate Change ?', *World Economics*, 7.2 (2006), 1–10; Nicholas Stern, *The Economics of Climate Change - The Stern Review* (Cambridge: Cambridge University Press, 2007) <https://doi.org/9780521700801>.
[61] UN, 'United Nations Framework Convention', *United Nations*, 1992, 1–33 <http://unfccc.int/resource/docs/convkp/conveng.pdf>.
[62] cf. IPCC, *Global Warming of 1.5 °C*; Stern, *The Economics of Climate Change - The Stern Review*; William D. Nordhaus, 'A Review of the Stern Review on the Economics of Climate Change', *Journal of Economic Literature*, 45.3 (2007), 686–702.

CBDR-RC is meant to serve as equity guide to and enabling norm of these tasks and in this sense, it remains immensely important. While predecessors of CBDR-RC had already been part of international agreements in the 1980s and can even be traced back to the 1972 "Stockholm Declaration", its first explicit formulation can be found in the Rio Declaration on Environment and Development and the UN Framework Convention on Climate Change[63]. Both were adopted at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, informally known as "Earth Summit"[64]. The conference resulted in the so called "Rio Declaration" which sets out principles attempting to strike a balance between potentially conflicting national interests of economic and human development on the one, and global interests of environmental protection on the other hand. For example, the Rio Declaration reaffirms major parts of the UN Charter in its first two principles, acknowledging present and future national interests of development. At the same time, it formulates new ways to make development more sustainable, i.e., enable sustainable development[65].

Besides such efforts at harmonising the interests of development and sustainability, the Rio Declaration articulates principles of equity, ascribing differing roles and responsibilities for action to different categories of states. It so initiated what Rajamani refers to as a list approach to differential treatment[66]. The most important – albeit basic – distinction is between developed and developing countries. With principles 6 and 7, the "Rio Declaration" points out explicitly that developing countries are in a "special situation" and "shall be given special priority", while

> *"developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command"*[67].

[63] United Nations, *United Nations Framework Convention on Climate Change*; United Nations, 'Declaration of the United Nations Conference on the Human Environment (UN Doc. A/CONF.48/14/Rev.1)' (Stockholm, 1972).
[64] Brunnée and Streck; Rajamani, *Differential Treatment in International Environmental Law*.
[65] United Nations, 'Rio Declaration on Environment and Development', 1992 <https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf>.
[66] Rajamani, *Differential Treatment in International Environmental Law*, p. 165.
[67] United Nations, 'Rio Declaration on Environment and Development'.

In light of these fundamental differences among states, Principle 7 of the Rio Declaration calls for global co-operation under the proviso that states have *common but differentiated responsibilities* with respect to their differing contributions to environmental degradation. The context distinguishes three groups of states – developed, developing and least developed – which according to the Rio Declaration have differentiated responsibilities with respect to environmental destruction and protection[68]. Along similar lines, the UN Framework Convention on Climate Change as well as its Kyoto Protocol and Paris Agreement incorporate states' *common but differentiated responsibilities and respective capabilities* to share the burdens resulting from agreements reached within the international climate regime. These cornerstone agreements also reaffirm countries' right to sustainable development[69].

By developing and implanting CBDR-RC in the practice of international climate governance, both the Rio Declaration and UN Framework Convention thus enshrine the fundamental idea that the burdens associated with a response to climate change should somehow reflect how much countries have contributed to the phenomenon of climate change as well as how much capability they command in doing something about it. Beyond that fundamental idea, however, there is little explicit guidance regarding its more detailed interpretation, measurement, and implementation.

In theory, CBDR-RC can be viewed as an international norm specifying how retrospective, i.e., contributory responsibility for a negative outcome (here: climate change) is divided among a group of heterogeneous agents (here: nation states) and how prospective responsibility, i.e., rectifying, remedial duties, should be divided respectively[70]. As already alluded to above, the first part of the principle carries the idea that in general, environmental degradation and pollution are problems concerning the international community *as a whole* and thus fall within their *common* responsibility[71]. Although it does not explicitly assign duties to individual members, the first part of CBDR-RC thus requires states to *justify inaction* on defensible and acceptable grounds. Being part of the overall community, countries share in the

[68] United Nations, 'Rio Declaration on Environment and Development'.
[69] United Nations, *United Nations Framework Convention on Climate Change*; United Nations, 'Kyoto Protocol To the United Nations Framework'; United Nations, *Paris Agreement*.
[70] For more on how I use and distinguish retrospective and prospective responsibility, see subsection 4.2.1.
[71] Rachel Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law', *New Zealand Journal of Environmental Law*, 14 (2010), 63–101.

common responsibility falling on all and may not be exempt without providing a reason that outweighs the drag of common responsibility. The idea that countries have to co-ordinate and bear a common responsibility is relatively uncontroversial and directly related to the climate regime's goal characteristic of effectiveness. The second part or CBDR-RC then relates to the goal characteristic of equity and differentiates among duty-bearers based on their differentiated responsibilities and respective capabilities. Beyond stating that differentiation should somehow relate to retrospective responsibility for bringing about climate change and current capability to respond, however, specific details regarding the grounds for differentiation are missing from the principle itself. The context arguably provides some further clarification in that specific groups of states were differentiated according to their respective contributions to the problem and their different capabilities to alleviate it.

Overall, CBDR-RC thus represents an institution that loosely regulates the sharing and differentiation of duties in correspondence to retrospective contributions to climate change and current responsive capabilities with the overarching purpose of increasing effectiveness and equity in the climate regime.

Beyond these fundamental components and definitions of the principle, the official outputs of the international climate regime are surprisingly silent regarding more explicit and detailed definitions, interpretations, and implementation guidelines of CBDR-RC. Over the years, different interpretations have been proposed within the regime[72] but the principle has not officially been specified further or operationalised in greater detail. Rather, the international climate governance regime has made a habit of repeatedly referring to the principle's original formulation without further specifying explicitly what it actually means or how its official meaning

[72] One of the most prominent examples is the so called 'Brazilian Proposal' according to which burden-sharing should be informed by historical contributions to climate change: Brazil, 'Proposed Elements of a Protocol to the UNFCCC', in *AD HOC GROUP ON THE BERLIN MANDATE - SEVENTH SESSION - IMPLEMENTATION OF THE BERLIN MANDATE - Additional Proposals from Parties - Addendum*, FCCC/AGBM/ (Bonn: United Nations, 1997) <http://unfccc.int/cop3/resource/docs/1997/agbm/misc01a3.htm>; Michel G.J. Den Elzen, Michiel Schaeffer, and Paul L. Lucas, 'Differentiating Future Commitments on the Basis of Countries' Relative Historical Responsibility for Climate Change: Uncertainties in the "Brazilian Proposal" in the Context of a Policy Implementation.', *Climatic Change*, 71.3 (2005), 277–301 <https://d1wqtxts1xzle7.cloudfront.net/44108945/den_Elzen_Schaeffer_Lucas_Climatic_Change_2005_Climate_attribution.pdf?1458949815=&response-content-disposition=inline%3B+filename%3DDIFFERENTIATING_FUTURE_COMMITMENTS_ON_TH.pdf&Expires=1627703439&Signature=E>; Benito Müller, Niklas Höhne, and Christian Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', *Climate Policy*, 9.6 (2009), 593–611 <https://doi.org/10.3763/cpol.2008.0570>.

has changed[73]. Implementation and actual burden-sharing are thus often regulated by more specific operational agreements which do not directly or explicitly claim to be official reinterpretations of CBDR-RC. This way, the differential treatment provisions contained in the UNFCCC, Kyoto Protocol, and Paris Agreement as well as COP decisions made and institutional structures erected in between can claim being in line with CBDR-RC although their practical consequences for burden-sharing differ greatly.

Despite this absence of official change to the principle, in between the Kyoto Protocol and Paris Agreement, there has been what Bushey and Jinnah[74] call "important, albeit measured progress toward agreeing on a new instantiation of CBDR". For example, the *Bali Action Plan* managed to get developing countries' agreement on "nationally appropriate mitigation actions" while keeping quantified emissions limitation and reduction targets exclusive to developed countries – a clear deviation from the former complete exemption of developing countries[75]. The 2009 conference in Copenhagen, although widely regarded as disappointing, meant the next substantial development of CBDR-RC. Prior to this conference, the US and other developed nations spoke out for the creation of a new category of states comprising "advanced developing countries". Eventually, there was too much opposition to officially form this category. Still, the Copenhagen Accord established an approximation of a three-tiered system of differentiation. According to the Accord, developed countries[76] "commit" to action in the form of emission targets, developing countries "will" take specific mitigation action and least developed countries as well as small island developing states "may undertake actions voluntarily and on the basis of support"[77]. While it would be wrong to regard this distinction as breakthrough – especially considering that the conference eventually merely "took note" of the Copenhagen Accord instead of formally adopting it[78] – it nonetheless

[73] Brunnée and Streck; Lasse Ringius, Asbjørn Torvanger, and Arild Underdal, 'Burden Sharing and Fairness Principles in International Climate Policy', *International Environmental Agreements*, 2.1 (2002), 1–22 <https://doi.org/10.1023/A:1015041613785>; Lavanya Rajamani, 'The Durban Platform for Enhanced Action and the Future of the Climate Regime', *International & Comparative Law Quarterly*, 61.2 (2012), 501–18 <https://doi.org/10.1017/S0020589312000085>; Lavanya Rajamani, 'Differentiation In the Post-2012 Climate Regime', *Policy Quarterly*, 4.4 (2008); Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'; United Nations, *Paris Agreement*.

[74] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.

[75] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.

[76] Listed in Annex I to the UN Framework Convention.

[77] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'; Lavanya Rajamani, 'The Making and Unmaking of the Copenhagen Accord', *International & Comparative Law Quarterly*, 59.3 (2010), 824–43 <https://doi.org/10.1017/S0020589310000400>.

[78] Brunnée and Streck, p. 594.

signalled a notable advance because it split up the group of "developing countries" who were previously united in their exemption from any form of prospective climate responsibility. The demands for a third differentiation category in the run-up to Copenhagen and the resulting Copenhagen Accord demonstrate only some of the continued debates surrounding CBDR-RC. They also clearly show that the two-tiered differentiation system of the Kyoto Protocol lost its initially broad support especially among developed countries. In the run-up to the 2015 climate conference in Paris, the Bali Action Plan's nationally appropriate mitigation actions eventually played a crucial role as they provided the blueprint for all countries to voluntarily develop and propose their NDCs[79]. Arguably, the Paris Agreement's switch to a bottom-up "pledge and review" system was key to enabling a new agreement although CBDR-RC was not explicitly reconceptualised again.

Unconstrained by the need to find political consensus within the climate regime, the corresponding theoretical literature, by contrast, contains more detailed interpretations and specifications of the principle. One of the most encompassing is Rajamani's "summary equation" which offers a quick and intuitive grasp of the main elements contained in CBDR-RC and of how the climate regime has commonly put it into practice[80]:

$$CBDRRC = Capacity + Contribution\ (Historical + Current + Future)$$
$$= Differential\ Treatment\ in\ Favour\ of\ Developing\ Countries$$
$$+ Leadership\ by\ Industrial\ Countries$$

Although Rajamani's summary equation of CBDR-RC comes as equation containing mathematical operators, its individual components and their interrelation remain vague and should not be taken as implying unambiguity. They must not be read as mathematical but rather as a theoretical shorthand representation. What is to be understood by $Capacity$ and $Contribution\ (Historical + Current + Future)$, or by $in\ Favour\ of$ and $Leadership$, or by the groups of countries named is unclear. Correspondingly unclear is also how they should be measured or

[79] Lavanya Rajamani, 'From Berlin to Bali and beyond: Killing Kyoto Softly?', *International & Comparative Law Quarterly*, 57.4 (2008), 909–39 <https://doi.org/10.1017/S002058930800064X>; Bård Lahn, 'In the Light of Equity and Science: Scientific Expertise and Climate Justice after Paris', *International Environmental Agreements: Politics, Law and Economics*, 18.1 (2018), 29–43 <https://doi.org/10.1007/s10784-017-9375-8>.

[80] Rajamani, *Differential Treatment in International Environmental Law*; Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.

practically operationalised respectively. So far, CBDR-RC is thus immensely important but remains at the same time notoriously vague.

Unmitigated and dangerous climate change not only involves higher costs than strong and ambitious mitigation, the distribution of these higher costs is also most likely more unjust than the distribution of costs of a controlled response can be. Climate change is affecting different parts of the world and their respective populations very differently. If it goes unchecked, its effects will likely hit those hardest who contributed least to it and who have least adaptive capacities[81]. Brought about predominantly by richer countries' historical emissions, but affecting poorer countries most adversely, unmitigated climate change is thus an inherently unjust phenomenon[82].

The response to climate change does not have to be equally unjust. First, we have greater control over costs associated with a response to climate change than over the costs we face if we do not co-ordinate and let climate change go unchecked. And second, the response can be structured such that its own as well as the adverse effects of climate change are minimised especially to those least capable of coping with them. Since the response to climate change is typically understood to imply substantive costs, even though they are most likely lower than those associated with uncontrolled climate change, their distribution matters from the perspective of *equity*. To reiterate, dangerous climate change is to be averted most fundamentally because it lowers living standards and dampens development prospects. However, if the response to climate change is formulated in a way that itself threatens living standards and development prospects by placing high burdens on those least able to shoulder them, the response could end up hurting rather than helping its own purpose. A great deal of disagreement about climate policies results because policy proposals are perceived as most severely hurting, i.e., costing, the most vulnerable. Fairness principles incorporated into the international climate governance regime but also smaller scale climate policies thus aim to avoid undue burdens to living standards and development prospects, especially of the currently poor[83]. CBDR-RC

[81] e.g. Henry Shue, Climate Justice - Vulnerability and Protection, 1st edn (Oxford: Oxford University Press, 2014).
[82] Jamieson, Reason In a Dark Time, chaps 1–2.
[83] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Darrell Moellendorf, 'Climate Change and Global Justice', *Wiley Interdisciplinary Reviews: Climate Change*, 3.2 (2012), 131–43 <https://doi.org/10.1002/wcc.158>; Edward A. Page, 'Distributing the Burdens of Climate Change', *Environmental Politics*, 17.4 (2008), 556–75 <https://doi.org/10.1080/09644010802193419>.

incorporates *equity* in that it differentiates burden shares in response to relevant differences in countries' respective responsibilities and capabilities[84].

With this in mind, we can now revisit how the international climate regime attempts to solve the tragedy of the commons scenario already touched upon above that aptly captures relevant aspects of the current problems in the climate regime. Following individual optimal choices which are visually impaired with respect to environmental externalities, everyone is contributing to creating an outcome that no-one wants. Greenhouse gas emissions are associated typically with immediate private gains but lead to distant collective costs. Incorporating attempts to avoid such costs would also be costly but relatively cheaper overall than starting no such or only unambitious attempts. Since emissions reductions are in turn usually associated with immediate individual costs but often only offer collective future benefits, taking responsibility for them by agreeing to reductions is typically not something states have an interest to do voluntarily and unilaterally. Internally optimal policies of individual countries thus continue leading to immediate private gains but also to external effects and the eventual depletion of common resources. This happens at a scale that eventually endangers or at least changes vital if not all ways and parts of life on earth[85]. On the flipside, based on internal cost-benefit analyses alone, individual countries lack adequate incentives to behave sustainably and engage in ambitious mitigation as this would often imply immediate private losses and only future and common gains.

Such tragedy of the commons scenarios can thus not typically be overcome by leaving decisions about climate policies solely in the hands of individual countries who base their decisions on individual cost-benefit analyses. They lack the incentives and oftentimes the capacity to internalise distant and future externalities. At the same time, there is no organised and effective authority in place that could compel states to take mitigation action if they do not agree to do so first. This holds especially in the case of those states most needed for an effective response to climate change, i.e., powerful emitters like the US or China. This fundamental difficulty has plagued climate conferences from their early beginnings. To tackle it, coordination is needed that effectively and equitably internalises common future costs

[84] Philippe Cullet, *Differential Treatment in International Environmental Law* (Burlington: Ashgate Publishing Company, 2003); e.g. Rajamani, *Differential Treatment in International Environmental Law*, p. 150.
[85] Darrel Moellendorf; Jamieson, *Reason In a Dark Time*.

into private current cost-benefit considerations. For individual countries to opt in to the globally concerted attempt at co-ordination, the system must on the one hand have the power to believably internalise future common costs into current private cost-benefit analyses. On the other hand, to attract wide participation and ambition it must also be perceived as equitable[86]. Without the perception of equity, countries would more likely only enter co-ordination if this is in their individual national interests. If countries can rely on reciprocal and perhaps even equitably shared ambition in other countries, however, their willingness to chip in their fair share most likely rises all else equal.

Besides co-ordination, however, the regime also needs climate responsibility. Co-ordination can pave the way to and enable climate responsibility. But without an external authority to compel countries into adopting effective and equitable climate policies and the corresponding obligations and costs, countries must still muster the necessary willingness to accept climate responsibility. Responsibility is not something that can be fully imposed from the outside. If it was externally imposed, it would collapse into a blind duty, an external obligation requiring obedience in agents rather than responsibility[87].

The German Federal Constitutional Court's April 2021 decision is relevant in this regard. It has revived the debate on the inclusion of future costs into current legislation. It ruled that the previous German environmental draft legislation was violating future generations' basic right to freedom as it was not ambitious enough to reach the Paris Agreement's temperature goals[88]. However, even in this case in which we have seen an authority compelling an agent into more ambitious climate policy, it remains crucial that the government answers this call of duty responsibly. The court ruled that the previous draft law was not ambitious enough. In this sense, it drew some responsibility from the government and formulated a general prescription. It did not, however, prescribe how exactly to respond to this ruling. The subsequently resulting more stringent draft law reflects to a larger extent internalised costs previously externalised to future generations. But debates are ongoing about whether the new legislation can now be called responsible or not. Since the negative

[86] Honkonen, 'The Principle of Common But Differentiated Responsibility in Post-2012 Climate Negotiations', p. 259.
[87] For more on this point, see section 4.1.
[88] Frank Dohman and others, 'Germany's Stricter New Emissions Goals Present Huge Challenge', *SPIEGEL International*, 2021 <https://www.spiegel.de/international/business/quiet-energy-revolution-germany-s-stricter-new-emissions-goals-present-huge-challenge-a-2acf3de0-66a0-433e-8d40-1338e9cc209b>; BBC, 'German Climate Change Law Violates Rights, Court Rules', 29 April 2021 <https://www.bbc.com/news/world-europe-56927010>.

effects of climate change are already and will increasingly be felt globally, the corresponding attempt to co-ordinate a response to this threat should optimally be global too – again to further the goals of *effectiveness* and *equity*. A similarly powerful equivalent to the German Federal Constitutional Court is, however, blatantly absent from the international political system. Responsibility thus remains with the climate governance regime and its members. A realistic image of the damage to be felt by the commons in the future must still be drawn and effective and equitable ways must still be found to avoid or at least mitigate these damages.

Crucially, however, even if we have such a realistic image of the challenges and corresponding global effort before us, this unfortunately does not automatically or uncontroversially translate into specific action for individual countries, let alone subnational actors, trying to co-ordinate their response. For example, it appears appealing at first sight to quickly the Paris Agreement's temperature limits into individual countries' remaining emissions budgets[89]. This, however, risks neglecting the political and ethical complexities involved in translating an overall goal of sustainability into individual burden-shares to be distributed in the overall attempt to reach said goal[90]. On its own, a clear image of the overall, i.e., common, burden merely creates an urgent sense of the overall task that must be accomplished, a global call of duty if you will, that all levels of agency must respond to responsibly. But without further input, it still remains unclear what "responsibly" means in this regard. So far, rulings like the one by the German Federal Constitutional Court that draw responsibility from the legislative and executive levels remain the exception rather than the rule at any level of agency.

To draw the previous arguments together, effectiveness and equity thus enable climate responsibility in the sense that they co-determine what climate responsibility is and motivate climate responsible action. They can furthermore be regarded as supporting each other in the opposite direction too. Climate responsibility can further equity, and equity in turn forms an important support beam of effectiveness. Without equity principles guiding its institutionalisation and implementation, the international climate regime could likely not spark enough participation to avoid dangerous climate change. Even if participation is high, the quality and ambition of its goals would depend on the shared belief in their *equity*. And finally, even if the

[89] On how much of the global budget is left, see Mercator Research Institute on Global Commons and Climate Change.
[90] This point will be more thoroughly addressed in the main chapters 4-6.

international climate regime accomplishes to formulate widely accepted and highly ambitious goals, their actual translation into individual countries' ambitious climate policies will once more depend on a shared belief in the *equity* of the system as a whole.

The performance of the international response to climate change can therefore be evaluated in terms of effectiveness and equity and with respect to how well the principle of CBDR-RC as systematisation of climate responsibility works to enable them. Although CBDR-RC is certainly not a sufficient requirement for an effective climate governance regime, its emphasis on equity, responsibility, and capability has proven to be essential to broad participation and fair cost allocation[91]. The existing major climate agreements would arguably not have been possible in their universality without the principle of CBDR-RC[92]. After the Kyoto Protocol, climate negotiations have struggled to make further significant progress on a more specific common interpretation and implementation, i.e., a thorough reconceptualisation of CBDR-RC[93].

Evaluated against its dual goals of effectiveness and equity, the international climate governance regime can theoretically and logically assume several outcome characters (s. *Table 2-1*). For example, if the global response to climate change is effective, the temperature limits will likely not be breached, and climate change will likely pose manageable threats to future living standards and development prospects. If the response to climate change is ineffective, climate change will likely take on dangerous proportions and pose potentially unmanageable threats to living standards, human development, and human rights[94]. If the response to climate change is effective but itself threatens human development and living standards (for example by raising energy costs without compensating or at least somehow exempting the global poor), it undercuts the very reason for limiting climate change and becomes self-defeating. In this case, it fails to meet the goal characteristic of equity because it unduly trades off current living standards and development prospects for those in the future. Finally, if the response to climate change is neither effective nor equitable, it runs counter to the most fundamental reasons for action against climate change and fails to prevent it from taking on dangerous proportions. Lastly, only an

[91] Brunnée and Streck.
[92] Deleuil, p. 272.
[93] Brunnée and Streck, p. 594.
[94] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Darrel Moellendorf.

effective and simultaneously equitable response to climate change should be viewed as climate responsible.[95]

Effective, equitable, and responsible	Effective but inequitable
Ineffective but equitable	Ineffective and inequitable

Figure 2-1: Effectiveness, equity, and responsibility in the response to climate change

The international climate regime has now for a long time been in a situation in which science urges action on climate change, the international community has agreed to respond and developed corresponding principles for action. But these principles are yet to be operationalised in greater detail in order to more successfully support effective, equitable, and responsible policy. CBDR-RC as systematisation of climate responsibility has proven remarkably resilient and remained essential to the international climate governance regime. Its sustained importance relates directly to its ability to enable broad participation and effectiveness, equity, and coordination in response to the tragedy of the commons issues outlined above. Although CBDR-RC is not a sufficient requirement for an effective climate change regime, it has thus proven to be essential[96]. Arguably, none of the major climate agreements would have been possible in their universality without the principle of CBDR-RC[97]. Recognising their historical responsibility for climate change and their greater capacity to act, CBDR-RC in its early and most important manifestations assigns mitigation commitments solely to developed countries while essentially exempting developing countries[98]. After the Kyoto Protocol and until the Paris Agreement, climate negotiations have struggled to make further significant progress and were often regarded as "failure", because states could not settle on a new and more specific, shared interpretation of CBDR-RC[99].

2.2.2. Major problems with CBDR-RC

While the legally binding overall temperature limits included in the Paris Agreement make it one of the greatest achievements in the history of climate

[95] Chapters 4 and 5 will elaborate on this.
[96] Brunnée and Streck.
[97] Deleuil.
[98] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.
[99] Brunnée and Streck.

negotiations, it also exhibits serious shortcomings with respect to the two goal characteristics introduced in the previous subsection. The first and perhaps most humbling is that the Nationally Determined Contributions submitted by member countries to the agreement are incompatible with the temperature limits agreed upon by a long shot[100]. Even if every country which pledged climate action under the Paris Agreement were to fully fulfil its pledge, the resulting reduction in greenhouse gas emissions would most likely not suffice to keep within the temperature limits. Furthermore, while the Paris Agreement determines that Nationally Determined Contributions may only be adjusted upward, meaning that countries which have ratified the agreement may not weaken their ambitions once they formally submitted a pledge, there is no authority in place to effectively enforce compliance with this rule. While there is certainly hope that countries will tighten their commitments to bring them in line with the ambitious temperature limits, this hope will not be fulfilled automatically.

The second serious shortcoming of the Paris Agreement is that the current pledges must be regarded as inequitable, especially so long as industrialised countries do not ramp up their efforts and more substantively support developing countries in sustainable development[101]. While the Paris Agreement garnered support for highly ambitious temperature goals and reaffirmed the principle of CBDR-RC, the actual pledges submitted by countries as well as their actual implementation are neither in line with the ambitious goals nor with rigorous readings of the reaffirmed equity principles. Until the remaining gap between the current pledges and those necessary to achieve the temperature goals is closed equitably, the distribution of efforts among rich and poor countries cannot be described as fair[102].

So, while the first, common part of CBDR-RC has proven – relatively – uncontroversial, major problems arise from its conceptual vagueness and the still unsettled disagreements about the specifics of its second part: differentiation. Conceptual vagueness can help participation when it enables countries that disagree about climate responsibility not to make their disagreements explicit and proceed as if such differences did not exist or at least without focussing too much attention on them. However, satisfying both effectiveness in the response to climate change and

[100] Rogelj and et al.; Climate Action Tracker.
[101] Holz, Kartha, and Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5°C-Compliant Global Mitigation Effort'; CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.
[102] Holz, Kartha, and Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5 C-Compliant Global Mitigation Effort'.

equity, i.e., fairly reflecting relevant national differences while distributing burdens, requires directing explicit focus on such uncomfortable disagreement about climate responsibility and its systematisation as CBDR-RC.

To date, however, all components of CBDR-RC remain remarkably vague concepts and the principle thus fails to provide this much needed clarity[103]. Negotiators' continuing failure to establish clear criteria on which to base justifiable differentiation prevents CBDR-RC from functioning properly and obstructs ambitious climate policy. Prior to the Paris Agreement, this arguably contributed as a major driver to the negotiations deadlock for finding a new agreement. Since the Paris Agreement, it arguably remains a major driver for the discrepancy between what countries are willing to pledge in their NDCs and what would objectively be required to not breach the agreed-upon temperature limits. So far, the main basis for differentiation beyond voluntary commitments in the climate regime is whether or not a country is classified as "developed" or "developing", which are both remarkably vague[104]. Negotiators' continuing struggles to establish clear criteria on which to base justifiable differentiation prevents the systematisation of climate responsibility as CBDR-RC from functioning properly and obstructs greater effectiveness and equity in the international climate regime.

Effectively implementing the current climate regime means developing ways to overcome such persistent structural flaws. For example, some of the now greatest emitting countries (such as China and even members of the Organisation of the Petroleum-Exporting Countries) were not required to reduce any emissions under the UN Framework Convention and Kyoto Protocol because they were classified as "developing countries" in the 1990s and the climate regime has shied away from touching this categorisation since[105]. China continues to be grouped together with other "developing countries" despite their enormous differences because there is no clear definition of the criteria required to fit the term and it has so far proven impossible for developed countries to separate it from the group[106]. With developing countries now also pledging NDCs under the Paris Agreement, this first structural

[103] Rachel Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing"/Developed" Dichotomy in International Environmental Law', *New Zealand Journal of Environmental Law*, 14.14 (2010), 63–101 <https://doi.org/10.2307/3176729>.
[104] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.
[105] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.
[106] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.

problem of the Kyoto Protocol has lost some of its severity. From an equity perspective, one could even argue that many developing countries now overfulfil what could fairly be asked of them[107].

A related and simultaneous issue continues to be the effective inclusion of the largest emitters among developed countries. Some of them, who would have been required to reduce emissions under the Kyoto Protocol already (e.g., the United States) never ratified the Kyoto Protocol or dropped out of it (e.g., Canada). Both of these shortcomings of the Kyoto Protocol can be understood in light of the opposing views on CBDR-RC[108]. The former Bush administration used the differentiated treatment of countries like China as justification for the US's refusal to fully partake in environmental agreements arguing that the US would not agree to emissions reductions if "80% of the world are exempt"[109]. The recently succeeded US President again used the essentially same narrative of unfairness as main reason for withdrawing the US from the Paris Agreement[110].

CBDR-RC is so central to climate negotiations that lack of agreement on the principle often translates into lack of progress in tackling the issues of the climate regime. Since it is both vital to achieving the fundamental goals of climate agreements and still not conceptualised concretely and defined in detail, the climate regime must currently be evaluated as remaining in the upper-left cell of Figure 2-1, i.e., as being ineffective and inequitable.

2.3. Measuring climate responsibility: territorial versus economic emissions

Besides prior conceptualisations of climate responsibility in- and outside the international climate governance regime, there are also multiple prior attempts at measuring it. Reviewing the different ways of measuring climate responsibility quickly turns into the examination of a rather controversial, disorderly, and far from settled debate that comprises numerous opposing views, policy developments, and changing scientific trends. In this section, I introduce measuring climate responsibility. I focus on the most prominent advances in climate responsibility measurement research to establish some relevant history as well as where we are currently at.

[107] CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.
[108] Brunnée and Streck.
[109] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.
[110] Trump.

In relation to the design and measurement of a quantifiable indicator for climate responsibility, the most relevant literature can be divided into three main strands. The first two argue for different versions of "production-based responsibility" on the one and "consumption-based responsibility" on the other hand. The third and more encompassing strand is concerned with different indicators of "shared responsibility" that combine elements of both "production-based" and "consumption-based responsibility". Note that until this point, the terms used in quotation marks here will have to be more thoroughly introduced and discussed and each of them comprises a great number of indicators.

2.3.1. Greenhouse gas emissions as major factor in measuring climate responsibility

The principle of CBDR-RC as systematisation of climate responsibility identifies countries' "responsibilities" and "respective capabilities" as major inputs into differentiated climate responsibility shares. In this respect, "responsibilities" are typically read as referring to countries' prior contributions to climate change, while "respective capabilities" are understood as referring to their economic abilities to contribute to response measures. As Rajamani's summary equation (s. above) further distinguishes, however, responsibilities can be regarded as either historical, current, or prospective contributions, or some combination of the three[111]. For capabilities, although forecasts are important, this temporal distinction in measuring climate responsibilities is untypical since current capabilities to contribute to response measures less controversially count as most significant. Past capabilities only count inasmuch as they have been preserved and future capabilities mostly matter in relation to future actions, i.e., once they materialise.

Beyond Rajamani's distinctions, the literature has made further relevant ones that help structure the controversy around climate responsibility. They further specify how to measure countries responsibilities (i.e., emissions) and respective capabilities (i.e., wealth). There are, for example, many different ways in which greenhouse gas emissions and countries capabilities can be measured and attributed to agents. These result in or are based on largely differing understandings of climate responsibility.

[111] Rajamani, *Differential Treatment in International Environmental Law*, p. 150.

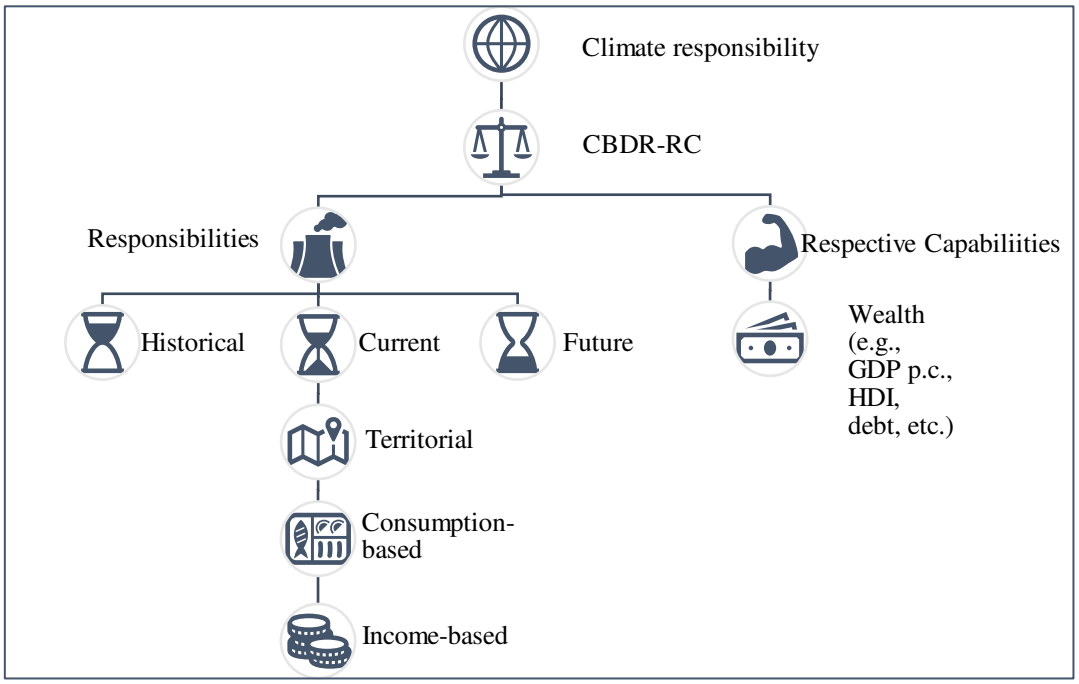

Figure 2-2: Schematic overview over ways of measuring climate responsibility.

As the contributing factors of climate change are ever better understood in the natural and social sciences, climate responsibility is typically not based on capability alone but leans more heavily on the respectively differentiated contributions to climate change. The most prominent ways to measure climate responsibility are thus forms of emissions-based accounting. These in turn come most prominently as production-based emissions accounting, consumption-based emissions accounting, and shared approaches[112]. The general idea underlying all of them is that climate responsibility should be operationalised by measuring greenhouse gas emissions (in CO_2 equivalents) since such emissions form the major anthropogenic driver of climate change[113]. Most basically, emissions are first estimated based on resource flows and resource consumption and then assigned to specific agents (typically countries, though not necessarily). This step identifies agents as "responsible" for the respective emissions. Things in turn become even more complicated as there are not only different ways of measuring emissions, but also different types of agents, different ways of assigning emissions to agents, and different ways of

[112] Thomas Wiedmann and others, 'Quo Vadis MRIO? Methodological, Data and Institutional Requirements for Multi-Region Input-Output Analysis', *Ecological Economics*, 70.11 (2011), 1937–45 <https://doi.org/10.1016/j.ecolecon.2011.06.014>; J. C. Minx and others, *Input-Output Analysis and Carbon Footprinting: An Overview of Applications*, 2009 <https://doi.org/10.1080/09535310903541298>.

[113] Besides greenhouse gas emissions, a major anthropogenic influence on climate change is exerted by how emissions sinks are treated, i.e., through land-use.

translating assigned emissions of agents into these same agents' climate responsibilities, for example, by also considering respective capabilities.

Fundamentally, one can distinguish two broad kinds of emissions accounting: physical and economic. Physical emissions accounting asks who directly emitted greenhouse gases and where. If it is used as basis of climate responsibility, direct emitters and the countries they emit in are viewed as responsible for emissions. Economic emissions accounting, by contrast, is mostly concerned with the economic interactions and underlying drivers of greenhouse gas emissions. If an economic accounting approach is chosen as basis of climate responsibility, those who are identified as economically bringing about greenhouse gas emissions are also viewed as climate responsible. There are significant overlaps and differences among the respective accounting systems as will be more thoroughly addressed below and in the following chapters.

2.3.2. Territorial emissions accounting

The most widely known physical emissions accounting approach, territorial emissions accounting, assigns emissions to those countries in which they occur. It is the official emissions accounting system developed by the IPCC and has become the most prominent way to calculate emissions and assign respective responsibility since the Kyoto Protocol. Importantly, it uses the location of emissions as basis of assigning responsibility for them rather than potentially indirect or economic causes for emissions that could be attributed to only indirectly involved economic agents. For example, under a territorial emissions accounting basis, Germany is regarded as responsible for all greenhouse gas emissions occurring on its territory, whether they are emitted by passenger cars (which could count as personal consumption- or professional production-based emissions, depending on the circumstances), lorries (typically production-based emissions), or even methane "emitting" cows being transported on lorries. What matters is that the emissions occur on German soil, not who emits them or why. In this regard, the territorial accounting basis does not so much rest on an economic justification but rather on a political and physical one. Being politically responsible for their territories, countries are thus regarded as climate responsible for the emissions occurring on their territories. And being directly, i.e., physically, involved in emitting greenhouse gases, direct emitters are held climate responsible. Territorial emissions accounting can still be regarded as one

approximation of production-based emissions accounting when most direct emissions occur during the production of goods and services.

Territorial emissions accounting as basis for climate responsibility is reliably established, enjoys broad acceptance by Annex I countries[114], and has been applied as international standard to estimate national emissions inventories[115]. In 1996, the IPCC developed the original guidelines for measuring national greenhouse gas inventories on a territorial basis and has since updated its guidelines in 2006 and most recently in 2019[116]. The advantages of this emissions accounting approach are straightforward: both the measurement of emissions and the agents to assign them to are relatively easy to identify. Emissions in this system are calculated using energy consumption data within a country's territory[117]. The data requirements are comparably manageable and historical emissions records of this system range very far back and are most reliable among different emissions accounting indicators[118]. Almost all countries now keep emissions records according to the territorial inventory guidelines, and there are numerous national and international institutions and organisations estimating territorial emissions of the few countries which do not. Furthermore, most countries have a political system in place that can accept the corresponding climate responsibility and can make decisions based on it. The territorial emissions accounting system is also widely used in the media and civil society organisations.

Despite its broad acceptance among industrialised countries and despite its high sophistication in measurement, however, territorial emissions accounting also draws a lot of criticism[119]. The effectiveness of any climate agreement crucially depends on the successful inclusion of large emitters like China and the USA without which wide-ranging climate change mitigation is much more likely to fail[120].

[114] Manfred Lenzen, Joy Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice', *Ecological Economics*, 61.1 (2007), 27–42 <https://doi.org/10.1016/j.ecolecon.2006.05.018>.
[115] IPCC, 'IPCC Guidelines for National Greenhouse Gas Inventories', 2.OVERVIEW (2006), 12 <https://doi.org/http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf>.
[116] IPCC, 'IPCC Guidelines for National Greenhouse Gas Inventories'; Simone Bastianoni, Federico Maria Pulselli, and Enzo Tiezzi, 'The Problem of Assigning Responsibility for Greenhouse Gas Emissions', *Ecological Economics*, 49.3 (2004), 253–57 <https://doi.org/10.1016/j.ecolecon.2004.01.018>; IPCC, '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories', 2019 <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>.
[117] Minx and others; Hannah Ritchie and Max Roser, 'CO2 Emissions' (Our World in Data, 2021) <https://ourworldindata.org/co2-emissions>.
[118] United Nations, *Handbook of Input-Output Table Compilation and Analysis*, *United Nations Publication* (New York, 1999); Wiedmann and others.
[119] Glen P. Peters, 'From Production-Based to Consumption-Based National Emission Inventories', *Ecological Economics*, 65.1 (2008), 13–23 <https://doi.org/10.1016/j.ecolecon.2007.10.014>.
[120] Paul G. Harris, Alice S Y Chow, and Rasmus Karlsson, 'China and Climate Justice: Moving beyond Statism', *International Environmental Agreements: Politics, Law and Economics*, 13.3 (2013), 291–305 <https://doi.org/10.1007/s10784-012-9189-7>.

Typical findings under this approach are, however, that Chinese and other export-oriented economies' emissions are substantially higher relative to, e.g., consumption-based accounts. At the same time, emissions of many developed countries with import-oriented economies are relatively lower when using a territorial approach[121]. China, and other export-focused economies have thus continuously expressed their discontentment with territorial emissions accounting[122]. To "break the climate impasse" with China[123] prior to the Paris Agreement, observers regarded it as necessary to move away from the perspective of territorial responsibility. Since it neglects the responsibility of consumers, it is unlikely to ever be accepted as basis of ambitious action by export-oriented economies like China[124].

But – crucially – this way of measuring and assigning greenhouse gas emissions is not the only or the "right" one. It is one among many options and was chosen at a time when other options were less readily available. I discuss three prominent alternatives – consumption-based accounting, income-based accounting, and shared approaches – in the next subsections.

2.3.3. Consumption-based emissions accounting

Since territorial emissions accounting as discussed in the previous section neglects indirect and economic causes of emissions, equating direct emissions of, say, a country or region with its climate responsibility for them is arguably one-sided[125]. While it is true that countries exert extensive influence over emissions on their territories, it is also true that those who are buying exports from a country are also

[121] Edgar G. Hertwich and others, 'China's Balance of Emissions Embodied in Trade: Approaches to Measurement and Allocating International Responsibility', *Oxford Review of Economic Policy*, 24.2 (2008), 354–76 <https://doi.org/10.1093/oxrep/grn016>; João Rodrigues and others, 'Designing an Indicator of Environmental Responsibility', *Ecological Economics*, 59.3 (2006), 256–66 <https://doi.org/10.1016/j.ecolecon.2005.10.002>; João Rodrigues and Tiago Domingos, 'Consumer and Producer Environmental Responsibility: Comparing Two Approaches', *Ecological Economics*, 66.2–3 (2008), 533–46 <https://doi.org/10.1016/j.ecolecon.2007.12.010>; Sai Liang and others, 'Income-Based Greenhouse Gas Emissions of Nations', *Environmental Science and Technology*, 51 (2017), 346–55 <https://doi.org/10.1021/acs.est.6b02510>; Ritchie and Roser.

[122] Bin Su and B. W. Ang, 'Input–Output Analysis of CO2 Emissions Embodied in Trade: The Effects of Spatial Aggregation', *Ecological Economics*, 70.1 (2010), 10–18 <https://doi.org/10.1016/j.ecolecon.2010.08.016>; Hertwich and others; Harris, Chow, and Karlsson; Jiahua Pan, Jonathan Phillips, and Ying Chen, 'China's Balance of Emissions Embodied in Trade: Approaches to Measurement and Allocating International Responsibility', *Oxford Review of Economic Policy*, 24.2 (2008), 354–76 <https://doi.org/10.1093/oxrep/grn016>; Youguo Zhang, 'The Responsibility for Carbon Emissions and Carbon Efficiency at the Sectoral Level: Evidence from China', *Energy Economics*, 40 (2013), 967–75 <https://doi.org/10.1016/j.eneco.2013.05.025>; Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'; Manfred Lenzen and Joy Murray, 'Conceptualising Environmental Responsibility', *Ecological Economics*, 70.2 (2010), 261–70 <https://doi.org/10.1016/j.ecolecon.2010.04.005>.

[123] Kelly Sims Gallagher, *Breaking the Climate Impasse with China: A Global Solution*, *Harvard Project on International Climate Agreements* (John F. Kennedy School of Government, 2009) <http://belfercenter.ksg.harvard.edu/files/Gallagher_Final_5.pdf>; Marco Grasso and Timmons Roberts, 'A Compromise to Break the Climate Impasse', *Nature Climate Change*, 4.7 (2014), 543–49 <https://doi.org/10.1038/nclimate2259>.

[124] João Rodrigues and others; Pan, Phillips, and Chen.

[125] Bastianoni, Pulselli, and Tiezzi.

profiting from and creating demand for the emissions on said country's territory. Furthermore, while the total climate responsibility of the world might be equal to the total amount of greenhouse gases emitted, the same is not always the case for sub-global agents under some versions of territorial emissions accounting. If, for example, only emissions on countries' territories count towards their responsibilities, adding up all countries' territorial emissions and responsibilities associated with them does not equal total global emissions, since some emissions occur on international territory and are thus not assigned to countries under some territorial operationalisations of climate responsibility. A further well-known and widely discussed problem with territorial emissions accounting is that of "carbon leakage" which occurs when one country moves emissions-intensive industry from its own to another country's territory to avoid the resulting emissions responsibility under a territorial emissions accounting standard. If, for example, a German car-manufacturer moves a production facility to China the climate responsibility resulting from emissions of that facility now falls to China, even though the facility still belongs to the German company (and its capital owners) and may still produce cars mostly for markets in developed countries. Many researchers, observers, and practitioners thus regard it as promising to move away from the perspective of territorial emissions accounting since it unfairly neglects the role of consumers and thus will hardly ever be accepted by exporting nations like China[126]. In the reconceptualisation and measurement of climate responsibility I develop in the main chapters 4-6, I therefore decided against the inclusion of the territorial standard.

The most established candidate for replacing the territorial emissions accounting system is that of consumption-based emissions accounting. Proponents of consumption-based emissions accounting maintain that climate responsibility should lie with consumers as they are the agents who demand products which in turn economically causes emissions higher up supply chains. There are, again, different versions of consumption-based emissions accounting which disagree, for example, about whether intermediate and or final demand should end up bearing responsibility and whether indirect economic influences should be considered[127].

The widely known "carbon footprints" and their respective online calculators typically employ direct and indirect consumption-based emissions accounting

[126] e.g. Pan, Phillips, and Chen; João Rodrigues and others.
[127] Rodrigues and Domingos.

approaches. Under such approaches, all emissions emitted during production, transport, and consumption of goods and services are assigned to the final consumers of these goods and services, and to the countries they reside in. Conversely, indirect production-based emissions accounting[128] assigns emissions emitted during consumption, transport, and production of goods and services to the producers and suppliers of these goods and services and to the countries they in turn reside in[129].

There are many ways in which production-based responsibility can be conceptualised and measured. They differ, for example, in whether they take indirect or only direct emissions into account and in whether they exclude emissions not associated with production[130]. As explained above, export-oriented economies' climate responsibility is typically much higher under a production-based accounting scheme than it would be under consumption-based accounting[131].

Compared to the direct territorial emissions accounting system discussed in the previous subsection, indirect emissions accounting systems are somewhat more complicated as they involve measuring emissions associated with products moving along supply chains and assigning emissions to potentially distant agents engaging in transactions with one another. All of these steps imply greater empirical data requirements and greater conceptual and analytical complexity. Also, the total amount of emissions assigned to agents is greater than under some territorial systems since indirect accounting systems include emissions on international territory.

2.3.4. Income-based emissions accounting

Besides the more prominent territorial and consumption-based approaches, income-based emissions accounting is a third, rather neglected way to account for agents' emissions. While the territorial approach holds countries responsible for emissions occurring within their borders, and the consumption-based approach attributes emissions to those who consume goods and services, income-based emissions accounting takes the economic flipside view of consumption-based accounting. In this sense, it also falls under the broad category of economic accounting approaches and differs from territorial emissions accounting in that it includes indirect emissions and excludes consumption-based emissions. Consumption-based

[128] As opposed to direct production-based or territorial emissions accounting – see section 2.3.2.
[129] See section 2.3.3. and 2.3.4.
[130] See section 2.3.4.
[131] Pan, Phillips, and Chen, p. 354.

accounting is motivated by the argument that consumers create demand for goods and services and thus also for the emissions embodied in goods and services, albeit only indirectly and unintentionally. Without consumers creating the economic demand, emissions would arguably not occur, so consumers should be viewed as responsible. Income-based emissions accounting turns this logic upside down and argues that the suppliers of primary inputs – i.e., capital and labour – should be viewed as climate responsible.

Just as one can argue that without final consumers and consumption there would be no supply of goods and services and consequently no embodied emissions, one can argue that suppliers of primary inputs *enable* emissions by providing their capital and/or labour[132]. Consumption-based climate responsibility is thus based on how agents spend income while income-based climate responsibility is based on how agents earn income. While consumers spending their income create the demand for goods and services the supply of which embodies emissions, suppliers enable and often directly emit these emissions and earn income in the process[133]. Going back to Ghosh's influential input output model, the income-based emissions accounting approach can thus be viewed as economic counterpart of the consumption-based approach which goes back to Leontief's original input-output formulation[134].

2.3.5. Shared emissions accounting

While territorial emissions accounting is still the international standard emissions accounting scheme and while there are some demands for consumption- or income-based accounting to replace it, there has been a further important development in more recent research on measuring climate responsibility that focuses on combining versions of the different views into a shared approach. Replacing full territorial or other direct emissions accounting systems with consumption-based

[132] Manfred Lenzen, Joy Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice', 1 (2007) <https://doi.org/10.1016/j.ecolecon.2006.05.018>.

[133] Sections 5.5.3., 6.3., and 6.4. contain a more thorough discussion on these points.

[134] A. Ghosh, 'Input-Output Approach in an Allocation System', *Economica*, 25.97 (1958), 58–64 <http://www.jstor.org/stable/2550694>; Erik Dietzenbacher, 'In Vindication of the Ghosh Model: A Reinterpretation as a Price Model', *Journal of Regional Science*, 37.4 (1997), 629–51; Ana-Isabel Guerra and Ferran Sancho, 'Revisiting the Original Ghosh Model: Can It Be Made More Plausible?', *Economic Systems Research*, 23.3 (2011), 319–28; Wassily W. Leontief, 'Quantitative Input and Output Relations in the Economic Systems of the United States', *The Review of Economics and Statistics*, 18.3 (1936), 105–25 <http://www.jstor.org/stable/1927837>; Wassily Leontief, 'Structure of the World Economy: Outline of a Simple Input-Output Formulation', *The American Economic Review*, 64.6 (1974), 823–34 <http://www.jstor.org/stable/1815236>; João F D Rodrigues and others, 'An Input-Output Model of Extended Producer Responsibility', *Journal of Industrial Ecology*, 00.0 (2016) <https://doi.org/10.1111/jiec.12401>; Ronald E. Miller and Peter D. Blair, *Input-Output Analysis - Foundations and Extensions*, 2nd edn (Cambridge: Cambridge University Press, 2009), chaps 10 & 12.

emissions accounting would arguably be similarly one-sided in that now the contribution of producers to climate change would be unjustifiably ignored and producers would lose much of the incentive to avoid emissions-intensive production[135].

The underlying broad idea of shared emissions accounting is thus that responsibility for greenhouse gas emissions should be divided in some meaningful way between producers and consumers[136]. The main question then is what portions to assign to which kinds of producers and consumers respectively and why.

Attempts at conceptualising shared responsibility appear to offer the greatest chance of finding an indicator that covers all significant aspects of climate responsibility while at the same time being acceptable to the greatest number of different actors[137]. Most important shared responsibility indicators first conceptualise versions of producer and consumer responsibility respectively, before sharing responsibility between these bases[138]. Related to the empirical part of this thesis in which I estimate the climate responsibilities of selected countries, the literature shows broad support for the use of multi-regional input-output analysis to estimate a country's climate responsibility using economic emissions accounting[139].

One of the earlier attempts to conceptualise climate responsibility with an indicator that lies between consumer and producer responsibility is Jiun-Jiun Ferng's 2003 contribution[140]. The author argues that neither production- nor consumption-based accounting schemes are appropriate and that instead a "benefit principle" should be applied to measure producers' and consumers' share in overall climate responsibility[141]. She suggests to first calculate responsibility under specific forms of both, production-based and consumption-based accounting schemes and to

[135] Bastianoni, Pulselli, and Tiezzi.
[136] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'; María Ángeles Cadarso and others, 'International Trade and Shared Environmental Responsibility by Sector. An Application to the Spanish Economy', *Ecological Economics*, 83 (2012), 221–35 <https://doi.org/10.1016/j.ecolecon.2012.05.009>; João Rodrigues and others.
[137] Lenzen and Murray; João Rodrigues and others.
[138] Alexandra Marques and others, 'Income-Based Environmental Responsibility', *Ecological Economics*, 84 (2012), 57–65 <https://doi.org/10.1016/j.ecolecon.2012.09.010>.
[139] Joao Rodrigues, Alexandra Marques, and Tiago Domingos, *Carbon Responsibility and Embodied Emissions - Theory and Measurement* (New York: Routledge, 2010); Wiedmann and others; Minx and others; Thomas Wiedmann, 'A Review of Recent Multi-Region Input-Output Models Used for Consumption-Based Emission and Resource Accounting', *Ecological Economics*, 69.2 (2009), 211–22 <https://doi.org/10.1016/j.ecolecon.2009.08.026>; Bin Su, B. W. Ang, and Melissa Low, 'Input-Output Analysis of CO2 Emissions Embodied in Trade and the Driving Forces: Processing and Normal Exports', *Ecological Economics*, 88 (2013), 119–25 <https://doi.org/10.1016/j.ecolecon.2013.01.017>; Edgar G. Hertwich and Glen P. Peters, 'Carbon Footprint of Nations: A Global, Trade-Linked Analysis', *Environmental Science and Technology*, 43.16 (2009), 6414–20 <https://doi.org/10.1021/es803496a>; Glen P. Peters; Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'; Lenzen and Murray.
[140] Jiun-Jiun Ferng, 'Allocating the Responsibility of CO2 Over-Emissions from the Perspectives of Benefit Principle and Ecological Deficit', *Ecological Economics*, 46.1 (2003), 121–41 <https://doi.org/10.1016/S0921-8009(03)00104-6>.
[141] Jiun-Jiun Ferng.

subsequently apply a weighting system that attributes responsibility to producers and consumers according to their respective "benefits" from partaking in the environmentally damaging activity. The author suggests letting the weighting system vary between producer and consumer responsibility depending on living standards and export shares of a given country[142]. However, Ferng does not develop a unique or normatively justified method of finding the appropriate weight in any particular case, so her proposed indicator leaves much room for disagreement.

Simone Bastianoni et al.[143] suggest a different indicator called the "Carbon Emissions Added" approach. This approach implies breaking up supply chains of products into individual pairs of directly interacting producers and consumers, measuring their respective emissions in relation to the traded product and then holding the consumer "co-responsible" for the emissions of the supplier(s) upstream[144]. This approach would imply that the greatest share of responsibility would be assigned to final consumers as they are held "co-responsible" for emissions of all previous suppliers and producers upstream, while at the same time conserving each producer's incentive to reduce direct emissions. Bastianoni et al.'s approach, however, does not normatively justify why consumers should be held "co-responsible" for suppliers' emissions and not vice versa.

Under more sophisticated shared responsibility approaches in the literature, agents are simultaneously environmentally responsible because of two economic roles assumed[145]. *Upstream responsibility* arises when, in their role as consumers, agents directly cause emissions during consumption and indirectly create the demand for goods and services which *embody* emissions from production upstream. *Downstream responsibility* arises when, in their role as producers, agents directly cause emissions in production and indirectly *enable* emissions in production and consumption downstream. Ultimately, *upstream responsibility* lies with final demand and *downstream responsibility* lies with primary inputs into production (i.e., capital and labour)[146]. Since final demand and primary inputs are ultimately responsible for *upstream* and *downstream* emissions respectively but often do not coincide in person, organisation or nationality, adopting just one of the two perspectives

[142] Jiun-Jiun Ferng.
[143] Bastianoni, Pulselli, and Tiezzi.
[144] Bastianoni, Pulselli, and Tiezzi.
[145] Lenzen and Murray.
[146] João Rodrigues and others.

represents an agent's responsibility incompletely. To adequately report an agent's share of responsibility for GHG emissions, economic flows among agents must be analysed under both perspectives.

Manfred Lenzen and Joy Murray[147] thus point out that while it is true that demand economically "causes" producers to emit, so too does supply "enable" the emissions in consumption. Lenzen et al.[148] further criticise Bastianoni et al.'s approach on the more technical ground that it fails to be invariant with respect to sector aggregation. Lenzen et al. have contributed to the development of their own indicator of shared responsibility in various of their research outputs[149]. They discuss the development of several indicators in the related literature, offer assessments of advances in multi-regional input-output methodologies, develop their own indicators to quantify upstream, downstream and shared responsibility, and provide various examples of how to apply them empirically. In Lenzen et al.[150], the authors discuss some of the problems that arise from double-counting responsibility when production-based and consumption-based accounting schemes are uncritically applied alongside each other instead of being incorporated in a shared responsibility approach. If individual emissions accounting approaches are applied consecutively or shared approaches applied inconsistently, for example, emissions responsibility can be counted once on the first and then again on the second basis. Such responsibility double counting thus misrepresents relative responsibility shares. They argue that neither exclusive producer responsibility nor exclusive consumer responsibility are sufficient by themselves, since both, consumers and producers are aware that they cause part of the problem and have an interest in quantifying their respective share. However, if the separate calculation of both approaches is done arbitrarily and simultaneously, double counting causes the sum of consumer and producer responsibilities of a given supply chain to be considerably larger than the chain's overall responsibility[151]. Lenzen et al.[152] argue normatively that shared responsibility should reflect an individual agent's contribution to the supply chain. They argue for a *value-added approach* that reflects how much economic influence an

[147] Lenzen and Murray.
[148] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'.
[149] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'; Wiedmann and others; Lenzen and Murray; Marques and others; Karen Turner and others, 'Examining the Global Environmental Impact of Regional Consumption Activities - Part 1: A Technical Note on Combining Input-Output and Ecological Footprint Analysis', *Ecological Economics*, 62.1 (2007), 37–44 <https://doi.org/10.1016/j.ecolecon.2006.12.002>.
[150] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'.
[151] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'.
[152] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'.

individual agent has over a product by adding value to the supply chain. But in contrast to Bastianoni et al.'s approach discussed above, Lenzen et al. argue that co-responsibility goes both ways, upstream as well as downstream. They further develop this point in Lenzen & Murray[153], conceptualising and measuring downstream responsibility as arising from "enabling" consumers downstream to emit. Here, upstream responsibility is calculated from the fraction of consumers' purchases in the output of suppliers and their emissions while downstream responsibility is calculated as the fraction of suppliers' sales in the output of customers. Ultimate upstream responsibility lies with buyers of final outputs while ultimate downstream responsibility lies with sellers of primary inputs[154]. But in between, intermediary suppliers and buyers retain some share of responsibility. By comparing payments for primary inputs and associated emissions, it is possible to quantify downstream environmental responsibility. By comparing expenditures on final outputs and associated emissions, on the other hand, one can quantify upstream responsibility[155]. Shared responsibility then arises by combining the upstream and downstream responsibility of any given agent.

Joao Rodrigues et al.[156], are also concerned with the question what properties a "fair" indicator of climate responsibility should have in order to be most acceptable to the greatest variety of different countries. They make the normative argument that a fair indicator should appropriately reflect an agent's contribution to the environmental problem. Fundamentally deliberating which attributes are necessary for an indicator to be fair, the authors develop six properties they regard as crucial. For example, they argue that an indicator must be additive so that a region's responsibility can be subdivided into the responsibility shares of its parts, must reflect economic causality to properly reflect why emissions occur, must be monotonous with respect to environmental pressure and symmetrical regarding consumption and production so that there is no incentive for carbon leakage[157]. Another important feature of their indicator is that they transfer all downstream emissions responsibility along supply chains to primary inputs and all upstream emissions responsibility to final demand so that there remains no responsibility with intermediate

[153] Lenzen and Murray.
[154] Lenzen and Murray.
[155] Lenzen and Murray.
[156] João Rodrigues and others; Rodrigues, Marques, and Domingos; Marques and others.
[157] João Rodrigues and others, pp. 259–61.

producers/consumers. This is a major difference between their and Lenzen et al.'s shared responsibility approach. Rodrigues et al. derive that the environmental responsibility of any given country should then be calculated as the arithmetic average of the upstream environmental pressure of final demand and the downstream environmental pressure of primary inputs[158].[159]

2.3.6. Climate responsibility as based on both emissions *and* respective capabilities

The climate responsibility indicators discussed in the previous section have in common that they do not explicitly or directly take agents' capability into account when assigning climate responsibility. This is not an all too severe omission so long as they are merely trying to find out who holds *causal* responsibility for bringing about the phenomenon of climate change. Even if trying to find the "economic causality" for climate change, i.e., indirect economic influences that contribute to emissions, absence of capability from the equation need not be too problematic so long as this is not used to argue for specific distributions of costs.

However, leaving out explicit accounts of agents' capabilities arguably wreaks havoc if we use such merely backward-looking indicators in order to quantify and distribute forward-looking burden-shares associated with a response to climate change. In other words, once we cross the line from merely backward-looking, factual descriptions of who contributed how much to climate change[160] to forward-looking, normative arguments about who should take on which duties in response to climate change, capabilities become crucial. It is important to remember that the indicators discussed above are all measurements of backward-looking contributions to climate change but have been at least implicitly developed and applied to also quantify and distribute appropriate shares of forward-looking duties. Despite this at least implicit design and usage for burden-sharing, none of the emissions accounting approaches mentioned here explicitly includes capabilities, defends their exclusion, or ensures that the resulting responsibilities are interpreted solely in the backward-looking sense.

[158] João Rodrigues and others, p. 264.

[159] All of the approaches mentioned here shall inform the development and discussion of empirical indicators in chapter 6 of this thesis but emphasis will lie on the ones developed by Rodrigues et al. (2006) and Lenzen et al. (2010) as they are normatively most convincing and economically most rigorous.

[160] As I will discuss further in subsection 5.2.1., not even these backward-looking understandings are value-neutral. The choice conceptual choices, indicators, and selection of measurement methods are all inherently value laden. The interesting dual meaning of responsibility as causal contribution in a backward-looking sense on the one hand and forward-looking duty to respond on the other will be addressed in greater detail in the reconceptualisation chapters 4 and 5.

The inclusion of "respective capabilities" in the CBDR-RC principle, however, shows that capabilities are widely viewed as an important factor for burden-sharing in the international climate governance regime. Climate responsibility in a forward-looking sense of a duty to contribute to a response to climate change should not only be responsive to past contributions to the problem but also to the abilities and resources countries respectively command[161]. The territorial, consumption-based, income-based, and shared emissions accounting approaches considered so far, thus all fall short of reflecting this crucial element of CBDR-RC as systematisation of climate responsibility.

To avoid getting lost in the details of the many competing indicators of climate responsibility at the measurement level, it helps to take a step back and remember the original aim behind their design. It is to make visible, i.e., operationalise and measure, normatively convincing conceptualisations of climate responsibility. Looking at and comparing the different indicators put forward in the literature, it appears that they typically are not too concerned with a comprehensive and simultaneous inclusion of all relevant aspects contained in CBDR-RC. Instead, they are typically concerned with problems pertaining to the level of measurement such as data availability, computational challenges, or whether the proposed indicator is unique, i.e. unambiguous and original. This focus on questions of measurement risks losing sight of the overarching question what it is that *should* be measured. While most of the works reviewed here include a discussion of why their indicator is favourable to others, none of them does so in appropriate depth or normatively explicitly. Rodrigues et al.[162], for example, base their indicator on different *fairness properties*, each of which they discuss and motivate. However, even in this discussion of the underlying normative arguments, a thorough normative reflection is missing. Unfortunately, most of the existing indicators of climate responsibility merely show that there are many potentially interesting and useful ways of measuring climate responsibility. A more thorough and comprehensive reconceptualisation and measurement of climate responsibility would need to develop a sturdy normative basis and then examine which existing or new indicator serves as appropriate measure of it.

[161] United Nations, 'Rio Declaration on Environment and Development'.
[162] João Rodrigues and others, pp. 159–261.

The Climate Equity Reference Framework[163]

There is, however, one important prior contribution that provides both a normatively thorough conceptualisation as well as a sophisticated empirical measurement of countries climate responsibilities and includes both emissions accounting and capabilities. The CERF is an attempt to quantify fair burden shares for countries in line with given temperature goals agreed upon in climate negotiations. It attempts to reconcile the potentially conflicting goals between global justice and rights to development on the one side, and sustainability in the sense of avoiding dangerous climate change on the other. Its goals are similar to those of the principle of CBDR-RC but its approach is entirely different. While the principle of CBDR-RC on its own lacks an explicit connection to how climate responsibility should be measured exactly, the CERF is much more focused on measurement and can be used to calculate responsibility and obligation shares of countries[164].

The authors of the CERF, which was originally named greenhouse development rights framework, set out to estimate fair development rights under a greenhouse gas emissions budget in line with a "good" (i.e. >66%) chance of avoiding dangerous climate change. The framework radically altered the understanding of climate responsibility as well as the view of nations' capability to partake in climate mitigation and adaptation. The framework offers interesting insights into what starting date for measuring emissions responsibility should be regarded as reasonable (1850, 1950, 1980, and 1990 are among the candidates of the corresponding calculator). It also allows assigning different weights to responsibility and capacity respectively in a "responsibility capacity indicator" based on which countries' contribution to the overall costs of avoiding dangerous climate change are calculated. The authors argue that there should be a "trust building period" during which rich nations should lead the way and show that they were willing to shoulder the lions' share of the burden[165]. This in turn, the authors argued, would help poorer nations to partake as well, believing that their efforts would be supported, guided, and largely paid for by richer countries. After this trust building period, countries should

[163] See also subsection 5.3.4.
[164] Kemp-Benedict and others.
[165] Paul Baer and others, 'Greenhouse Development Rights: A Proposal for a Fair Global Climate Treaty', *Ethics, Place & Environment*, 12.3 (2009), 267–81 <https://doi.org/10.1080/13668790903195495>; Kartha and others, I; Paul Baer, Tom Athanasiou, and Sivan Kartha, 'The Right to Development in a Climate Constrained World: The Greenhouse Development Rights Framework', in *Der Klimawandel* (VS Verlag für Sozialwissenschafter, 2010), pp. 205–26 <https://doi.org/10.1007/978-3-531-92258-4_12>.

start to contribute their "fair shares" to the overall endeavour of preventing dangerous climate change.

"Fair contribution shares" of countries, i.e., forward-looking climate responsibilities, according to the CERF, are calculated based on a combination of a country's capability and backward-looking emissions responsibility. A country's capability directly follows the number of people within a nation with incomes above a specified and normatively defended subsistence level[166]. Under this framework, even poor countries have some capability to contribute to climate mitigation and adaptation costs since there is no country without citizens above the income threshold. Instead of following the crude "developing/developed" divide that contributed to countless controversies in climate negotiations and policies, the CERF assigns some portion of the burden to every country but takes each country's individual circumstances into serious consideration. At the same time, however, rich countries typically have such large proportions of their populations above the income threshold specified as counting towards capacity that the CERF argues they have a duty to transfer knowledge, technology, and funds to poorer countries to help them cope with their burden shares. In other words, through their financing of emissions reductions in poorer countries, richer countries should end up with net negative emissions under the aspired burden-sharing framework of the CERF. This is justified because richer countries have a high historical responsibility for climate change, not enough room to rectify this backward-looking responsibility on their own territories, and because the CERF takes countries' right to development seriously[167].

Backward-looking emissions responsibility, on the other hand, is specified in the CERF as a country's emissions starting from a specific point in time after which there can be no more "excusable ignorance" exempting countries from translating emissions into duties. However, the CERF does not specify a "right" way to calculate countries' climate responsibility. Instead, it offers data and numbers for both territorial and consumption-based emissions accounting, so that decision makers can choose which understanding of emissions responsibility to favour. This is a

[166] Paul Baer, 'The Greenhouse Development Rights Framework for Global Burden Sharing: Reflection on Principles and Prospects', *Wiley Interdisciplinary Reviews: Climate Change*, 4.1 (2013), 61–71 <https://doi.org/10.1002/wcc.201>.

[167] Arjun Sengupta, 'On the Theory and Practice of the Right to Development', in *Challenges in International Human Rights Law*, 2014, p. 54; Darrell Moellendorf, 'Climate Change and Global Justice'; Baer and others; United Nations, 'Declaration on the Right to Development' (United Nations Human Rights Office of the High Commissioner, 1986) <https://www.ohchr.org/en/professionalinterest/pages/righttodevelopment.aspx>; Darrel Moellendorf, Dominic Roser, and Jennifer Heyward, 'Taking UNFCCC-Norms Seriously', in *Climate Change and Non-Ideal Theory*, ed. by Dominic Roser and Jennifer Heyward (Oxford: Oxford University Press); Callies and Moellendorf.

strength of the CERF because it allows for different understandings of emissions responsibility to be expressed within the same overall framework. At the same time, it is also a shortcoming since there are opposing arguments for the different understandings of responsibility underlying different emissions accounting systems (s. discussion in the preceding subsections). While decision-makers from around the globe with different constraints and from different political systems are thus given the chance to negotiate which understanding of responsibility they could converge on, they are offered little normative or scientific guidance by the CERF in their negotiations. While this might strengthen the value-neutrality and perceived objectivity of the CERF, it could also ultimately weaken agreement when decision-makers fail to figure out their own normative guidelines for how to employ the CERF. The emissions responsibility side of the CERF is thus much fuzzier and remains much more unclear compared to the capability side for which the authors offer concrete guidelines. Furthermore, even in its most recent update, the CERF calculator does not yet include income-based emissions accounts, meaning it can be criticised for being one-sided both on the territorial as well as fully consumption-based emissions approaches currently offered.

The calculator developed under the CERF then combines the above-described understandings of capability and responsibility into a single number that can be directly translated into a country's obligation towards the overall tasks associated with climate change mitigation and adaptation. This "responsibility capability indicator" is a weighted average of a country's capability and emissions responsibility. It allows for different understandings of emissions responsibility (territorial or consumption-based), different emissions accounting starting dates, different weights assigned to capability and emissions responsibility respectively, different capability thresholds and progressivity. The CERF calculator is thus responsive to decision-makers' or negotiators' preferences and the resulting burden shares can vary greatly[168]. However, no matter which specific settings are chosen in the calculator, some characteristic findings in resulting numbers remain fundamentally unchanged and will remain so even when reconceptualising climate responsibility.

First, emissions must fall sharply to not breach the temperature limits established to avoid dangerous climate change. Second, richer countries typically carry

[168] Kemp-Benedict and others.

contribution obligations that are larger than their own emissions shares because they have such relatively high capabilities. So not only to they have to reduce emissions domestically, they must also enable emissions reductions elsewhere (through transfer of knowledge, technology, or funds) in order to satisfy their fair share of the burden. Third, poorer countries, on the other hand, typically have to shoulder some of their domestic emissions reductions themselves (depending to how many rich citizens are among their populations) and can leave the rest of their domestic emissions reductions contingent on support from richer countries. This, however, requires that they offer the willingness and build capacities to receive measurable, reportable, and verifiable international climate finance. These three characteristics must be fulfilled in any response to climate change in order for it to be equitable in the sense proposed by the CERF.

In their more recent contributions[169], the architects of the CERF evaluate nationally determined contributions pledged towards the Paris Agreement. Considering the three main requirements of the CERF outlined above, they find the following: 1) overall emissions reduction pledged fall far short of the reductions necessary to avoid dangerous climate change. 2) richer countries' pledges remain significantly below their fair shares. 3) poorer countries' emissions reduction pledges typically meet and, in several cases, even over-fulfil their fair shares according to the CERF.

Considering these findings regarding the fair distribution of the costs connected to the Paris Agreement's temperature limits, the international community must, according to the CERF, find ways to increase ambition, particularly among richer countries. But considering the rather sluggishly developing pledges across rich countries, it remains uncertain whether this can still be achieved with the limited time left. Former US President Trump even argued for the US withdrawal from the Paris Agreement on grounds of the Paris Agreement's alleged unfairness towards the US. According to his withdrawal statement, the Paris Agreement demands too little of developing countries and too much of the US. Under the CERF, this view cannot find support. For one, the Paris Agreement does not demand anything specific of any individual country. It merely cements the overall goal of the international community to remain below temperature increases of no more than 2°, preferably no more than 1.5° Celsius compared to pre-industrial levels. So, arguing

[169] CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.

from an individual country's perspective that the new agreement asks too much of any country appears twisted. Furthermore, given the rather fuzzy and vague language surrounding the principle of CBDR-RC in the Paris Agreement, not even groups of countries, such as developed countries or other potential groupings of richer countries, have defensible ground for perceived unfairness in favour of other countries. While CBDR-RC in the Paris Agreement reinforces the equity requirement that developed countries should take the lead in climate mitigation and that they should support climate mitigation and adaptation not only domestically but globally, it does not ask for any specific action by any individual country, nor for a specific burden sharing system for any group of countries. This includes climate finance which remains an individually voluntary matter of negotiations. Former US President Trump's statement is thus at least misleading because the Paris Agreement does not specify demands for individual countries and the CERF shows that even if the Paris Agreement was able to actually enforce the current pledges, it would still not be an unfair demand to industrialised countries. On the contrary, as Holz et al.[170] argue, pledges by industrialised countries stay typically and significantly far below the levels that could be considered "fair" according to CERF. So, while the overall pledges submitted may be defensibly argued to be unfair, this unfairness would not wrong industrialised countries but, on the contrary, developing and poorer countries. All of these arguments based on the CERF support the case that the current response to the phenomenon of climate change falls into the upper-left cell of Figure 2-1, meaning that it is neither effective, nor equitable, and in turn does not reflect climate responsibility.

The CERF aims to offer a morally convincing and broadly acceptable burden-sharing approach for climate change mitigation and adaptation costs. Its normative persuasiveness follows from its taking the right to development as well as the differential treatment principles enshrined in the international climate governance regime seriously. By placing the right to development at the centre and arranging understandings of capability and emissions responsibility in relation to a persuasive income-level required for human development, the CERF gains moral ground. At the same time, its acceptability is strengthened by its flexibility to accommodate different views on how exactly capability and emissions responsibility are to be

[170] Holz, Kartha, and Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5°C-Compliant Global Mitigation Effort'.

conceptualised. The CERF does not dictate a specific conceptualisation of capability but argues for a certain threshold and progressivity that effectively accommodates different views on what should count as "poor", "marginally capable", and "wealthy" when it comes to burden-sharing of climate mitigation and adaptation related costs. Similarly, it does not dictate a certain understanding of emissions responsibility, although it does not include income-based accounting. On the one hand, this flexibility allows for setting different starting dates for emissions responsibility, after which no more excusable ignorance can be defended. On the other hand, it includes the possibility to calculate a country's emissions on different bases. Overall, the different options to set the CERF calculator according to one's own preferences allow for the CERF to be acceptable to a greater number of negotiating parties. At the same time, the clear focus on the (sustainable) protection of human development raises the normative persuasiveness of the CERF.

The CERF does, however, not come without its own set of drawbacks. An important shortcoming of the CERF is that it develops the normative structure of its "responsibility capability indicator" which determines the equitable kind and extent of countries' contributions broadly convincing but not in great depth. While it is convincing to generally argue that goal conflicts between sustainability and development must be overcome and that both the emissions responsibility and capability of states should inform how much they should do, the CERF does not thoroughly root its positions in broader normative theories and arguments of justice. In its current form, it is missing a thorough background conceptualisation underlying both its systematisation of emissions responsibility and capability[171]. While the CERF calculator's results empirically sophisticated, their normative basis could be strengthened.

Another issue with the CERF is that it does not take into thorough consideration *why* emissions occur, i.e., what causes them economically, beyond the distinction between luxury and subsistence emissions. Its conceptualisation of climate responsibility is, on the one hand, rather broad because the CERF does not offer detailed guidance on which of the options of its calculator are chosen. But at the same time, it is rather narrow because it does not include further important options for calculating emissions responsibilities – such as income-based accounting. Out of the

[171] See also sections 3.2. and 3.3. as well as chapter 4.

many available indicators that can be used to measure climate responsibility, it picks territorial emissions accounting and as an economic alternative consumption-based emissions accounting. While these two are certainly prominent ways to measure emissions, they are neither the only ones nor uncontroversial (s. discussion in the previous subsections). By offering only these two ways of measuring climate responsibility as options in the calculator, the CERF makes implicit but wide-reaching value-judgments without simultaneously justifying them. To overcome this problem, the calculator could either reduce the number of different conceptualisations of emissions responsibility and argue convincingly for the remaining one(s) or could give a fairer representation to all significant indicators of measuring climate responsibility in the literature by including further prominent indicators.

2.4. Thoroughly and comprehensively reconceptualising and measuring climate responsibility

Against this brief excurse through the practice and literature of conceptualising and measuring climate responsibility, climate policy researchers ask which research focus to set themselves. On the one hand, there may be a risk that more explicit research into normative questions related to climate responsibility and policy paralyse ambitious implementation following the Paris Agreement[172]. The underlying argument, in a nutshell, is that the ambitious goals set out are best served by designing policy without diving into renewed debates over their normative underpinnings, because thoroughly reopening questions into normative concepts such as CBDR-RC would lead to unnecessary conflicts that the "pledge and review"[173] system of COP21 successfully managed to avoid.

The opposite argument – which motivates this thesis – is that the Paris Agreement achieved its inclusive and ambitious goals by suppressing, rather than easing the normative disagreements surrounding the systematisation of climate responsibility as CBDR-RC. By not openly addressing and lessening these pressures, they were kept alive and continue smouldering below the surface of the current, superficially ambitious regime. Without resolving them and reaching more explicit agreement on climate responsibility, however, ambitious goals are unlikely to be translated into ambitious implementation and policy.

[172] Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'.
[173] Keohane and Oppenheimer.

If this argument holds, questions about how to interpret climate responsibility, will inevitably resurface whenever countries negotiate how current nationally determined contributions can be brought in line with the temperature limits of the Paris Agreement. If pledges and their implementation turn out to remain ineffective and inequitable without a more detailed understanding of CBDR-RC, states must either abandon the main goals of the Paris Agreement or find other ways of increasing ambition without a normatively guided burden-sharing principle. Since it is arguably not a viable option to give up the temperature limits if high risks of dangerous climate change are still to be avoided, thoroughly and explicitly readdressing the latent disagreements over climate responsibility specifically and climate justice more broadly seems warranted[174].

To enable informed climate policy at this point, it is therefore vital to further investigate how climate responsibility should be conceptualised equitably. As Sonja Klinsky et al.[175] have argued, research into climate policy equity is needed because 1) climate policy cannot be set in isolation from questions of human well-being and development, 2) political analysis does not present the whole picture without addressing underlying questions of justice, 3) equity is not necessarily an obstacle to but a driver of ambitious climate policy, and 4) many of the unavoidable trade-offs we face through climate change, are impossible to comprehend without agreement on questions of equity. Following this argumentation, it appears sensible that principled pragmatism trumps pragmatically progressing without principles.

The literature and practice on reconceptualising climate responsibility suggests several ways to address problems surrounding its systematisation as CBDR-RC. A rather prominent idea, for example, is the creation of a new category of states, called "Annex C", for rapidly growing emerging economies[176]. The climate regime under the Kyoto Protocol only distinguished between Annex I (countries with reduction targets) and non-Annex I parties (countries without reduction targets). Proponents of "Annex C" argue that it would recognise the rapid development of emerging economies and would allow for this new category of states to be assigned their own quality and share of differentiated responsibility. Rachel Boyte[177] suggests a similar

[174] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change.
[175] Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'.
[176] Anita M. Halvorssen, 'Common, but Differentiated Commitments in the Future Climate Change Regime - Amending the Kyoto Protocol to Include Annex C, and the Annex C Mitigation Fund', *Colorado Journal of International Environmental Law and Policy*, 18.2 (2007), 247–66 <https://doi.org/10.1016/j.infsof.2008.09.005>.
[177] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing" / "Developed" Dichotomy in International Environmental Law'.

adjustment of CBDR-RC, arguing that the old "developing/developed" dichotomy should be replaced with four categories of states – least developed, developing, rapidly developing, developed – which would categorise countries according to previously negotiated, objective criteria.

However, while appealing in its intuition and relative simplicity, the creation of a three- or even four-tiered categorisation system has or will at some point most likely have the same principal flaw of the current two-tiered system distinguishing developed from developing countries: no fixed categorisation of countries could ever fairly and appropriately represent the heterogeneously changing landscape of different countries over longer time horizons. It might approximate it at a given point in time, just as the distinction between developed and developing countries seemed to do in the 1990s, but sooner or later it would again be inappropriate to reflect existing capability and emissions structures of the international community, and countries would in all likelihood once more be inclined to start using their categorisation as excuse to avoid inconvenient commitments. The creation of ever more country categories as basis of differential treatment is therefore not a long-term solution to the structural difficulties of finding a convincing conceptualisation of climate responsibility. It would at best postpone the more difficult but necessary fundamental discussion about a sustainable redesign of CBDR-RC.

A more daunting although politically and practically very difficult approach would be to directly and unilaterally associate a country's climate responsibility with carefully developed empirical indicators such as income and emissions per capita or forms of economic activity[178]. Such a formula approach involving a more nuanced reconceptualisation of climate responsibility could avoid the long-term problems associated with state categorisation and offer distinct and potentially fair differentiation for each country. If appropriate indicators are chosen and convincingly defended, this method would have the best chance of fulfilling the CERF's requirement that differentiation be based on states' individual *capability* and *responsibility*. It would also still be in line with the Paris Agreement's call for "nationally appropriate" contributions.

The history of conceptualising CBDR-RC has shown that its current usage leads to serious complications for the successful implementation of the Paris

[178] Honkonen, 'The Principle of Common But Differentiated Responsibility in Post-2012 Climate Negotiations', p. 262; Baer.

Agreement. Since its abolition is, however, not an option, climate responsibility remains at the heart of "practically all modern environmental treaties"[179] and should be reconceptualised to overcome its weaknesses.

There also have been many promising developments in the literature on measuring climate responsibility on which this thesis can build. It appears there is ever more structure to and growing consensus on the need for alternatives to the territorial approach applied by the IPCC. While the empirical application of existing shared responsibility indicators is still limited by relatively poor data availability and conceptual disagreements, these problems have been recognised and triggered a growing discourse on their solution. If this trend continues and draws more attention by policy-makers, it could soon be possible to estimate emissions on multiple bases just as reliably as currently under territorial responsibility.

Measuring climate responsibility in this thesis thus follows and contributes to recent developments in the empirical estimation of climate responsibility for large emitting countries. On measuring climate responsibility, I combine existing approaches into a new hybrid including both emissions and capability rather than developing a whole new method for estimating its individual parts. Input-output analysis in general and MRIOA models in particular are widely regarded as the most appropriate and useful way to disentangle complex webs of intersectoral and international supply chains[180]. Complementing statistical input-output tables for industrial sectors with data on emissions intensity allows to estimate emissions associated with any given actor along a supply chain[181]. So, once a responsibility indicator is chosen, input-output analysis can be used to empirically estimate the climate responsibility arising from this indicator – given that sufficient data of appropriate quality is available. There are many studies which have applied different responsibility indicators to different economic agents in different parts of the world. All of these rely on the original development of input-output analysis by Leontief[182]. Most relevant and useful as blueprints for my analysis are the works of Rodrigues et al.[183], Hertwich and Peters[184], and Pan et al.[185]. Pan et al. use statistical input-output tables from the National Bureau of Statistics China to calculate China's climate

[179] Honkonen, 'The Principle of Common But Differentiated Responsibility in Post-2012 Climate Negotiations', p. 258.
[180] Lenzen and Murray, p. 4; Hertwich and Peters, p. 2; Wiedmann and others.
[181] Pan, Phillips, and Chen.
[182] "Quantitative Input and Output Relations in the Economic Systems of the United States."
[183] Rodrigues, Marques, and Domingos.
[184] Hertwich and Peters.
[185] Marques and others.

responsibility on a consumption basis to contrast them with calculations on the IPCC's production based accounting scheme. Their most important finding is that China's emissions in 2006 were almost one third lower if calculated on a consumption basis compared to calculation on a production basis [186]. Hertwich and Peters quantify greenhouse gas emissions associated with the final consumption of goods and services for 73 nations and 14 aggregate world regions. Their paper discusses various advantages and weaknesses of MRIOA to the GTAP database which encompasses input-output tables from many regions and countries worldwide. Rodrigues et al.[187] develop a MRIOA model and apply it to the GTAP 6 database, comprising data from 2001 for 87 regions and 57 industrial sectors to compare emissions on different production- and consumption-based approaches. Similarly, Marques et al. [188] use the GTAP 7.1 database to estimate and compare country emissions under income- and consumption-based approaches. The dataset used covers 113 world regions and 57 industrial sectors for the year 2004[189]. They find that the choice of a specific emissions accounting basis can substantially alter a country's greenhouse gas emissions, especially in the case of small, open economies. Switzerland's emissions, for example are about 170% higher on an income basis than they are under producer-responsibility[190]. And finally, Liang et al.[191] have recently used the World Input-Output Database to estimate countries territorial, consumption-based, and income-based emissions responsibility.

What is still missing despite these prior contributions, however, is a thorough and comprehensive reconceptualisation and measurement of climate responsibility derived from the goals of the international climate regime and its cornerstone principle of CBDR-RC. This thesis sets out to close this gap. It must take the principles and goal characteristics enshrined in the international climate regime seriously and develop a corresponding normatively defensible, empirically measurable, and practically useful concept of climate responsibility. The corresponding research questions addressed in this thesis are therefore:

A) What is a normatively convincing background concept of climate responsibility?

[186] Pan, Phillips, and Chen.
[187] Rodrigues, Marques, and Domingos.
[188] Marques and others.
[189] Marques and others.
[190] Marques and others.
[191] Liang and others.

B) How can and should this concept of climate responsibility be systematised to be practically useful and measurable?

C) How can and should this conceptualisation of climate responsibility be operationalised and measured?

The following chapter lays out the methodological framework employed to structure this thesis and close the research gap.

3. Methodological framework

3.1. Introduction

Against the discrepancies between the overall goals and actual implementation of the Paris Agreement outlined in the previous chapter, this thesis reconceptualises and measures climate responsibility. It derives its underlying motivation from the argument that in order to close the gap between the insufficient ambition in actual individual pledges and overarching ambitious goals, the international community will have to adopt measures to as fast and far as possible increase the effectiveness and equity of the international climate regime. Rethinking, reconceptualising, and measuring climate responsibility can clarify, structure, and evaluate debates about the ongoing discrepancies between actual and desirable burden-sharing arrangements. While I argue that this is a necessary step towards greater ambition, effectiveness, and equity, I must not be misunderstood as thinking it would be sufficient. The conceptual work involved in reconceptualising and measuring climate responsibility can help make progress on political disagreements but it cannot of course solve them on its own[192]. It is not as if the problems plaguing the climate regime could be solved by finding the right words to describe them. However, appropriately naming and conceptualising them helps to clarify which disagreements are superficial and which reach deeper. It helps illuminate what problems negotiation and implementation efforts should lay their focus on. With this preliminary thought in mind, let us turn to what rethinking climate responsibility could and should entail and how a corresponding research agenda could and should be structured methodologically.

The previous chapter identified the history of climate negotiations as a history of attempts to find agreement on how climate responsibility should be conceptualised, measured, and distributed in order to achieve effectiveness and equity in the response to climate change[193]. This relates both to its backward-looking dimension as responsibility for creating the problem as well as the corresponding forward-looking dimension as responsibility in the sense of a duty for contributing to a response[194]. In broad terms, costs associated with responsibility for bringing about as

[192] Bodansky and Rajamani.
[193] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.
[194] A distinction made, for example, in Hans Jonas, Das Prinzip Verantwortung - Versuch Einer Ethik Für Die Technologische Zivilisation, 7th edn (Frankfurt am Main: Insel Verlag, 1987), chaps 4.II.1.-2.

well as responding to the phenomenon of climate change are unavoidable. But their magnitude as well as the ensuing heft of their distributional impacts can be influenced which is what the international climate governance regime has set out to do since the early 1990s.

Closing the research gap identified in the previous chapter by reconceptualising and measuring climate responsibility is a fundamentally interdisciplinary endeavour that involves multiple theoretical and methodological approaches. In order to overcome the shortcomings of prior work which opened up the research gap, such an interdisciplinary reconceptualisation and measurement of climate responsibility should strive to be comprehensive and thorough, meaning that it covers the relevant conceptual breadth at an adequate level of depth. A comprehensive and thorough reconceptualisation and measurement of climate responsibility must appreciate the relevant prior contributions and take their different relevant methodological approaches seriously. I further argue that a comprehensive and thorough reconceptualisation and measurement of climate responsibility is one that is normatively defensible, empirically measurable, and practically useful. In order to have these qualities, it must engage with the relevant philosophical underpinnings, measurement methods, and prior debates around the goal characteristics of the international climate regime.

But what exactly does this entail? I find, first, that the methodological approach and research design must be motivated against and in turn work towards the overall research goal of the thesis, i.e., towards a comprehensive and thorough reconceptualisation and measurement of climate responsibility. Second, it must not work against the overall goals of the international climate regime, i.e., effectiveness and equity in the response to climate change as developed in the previous chapter. This involves engaging with the most relevant underlying building blocks of and related debates about CBDR-RC as well as the most important contenders for a more concrete operationalisation[195]. And third, it must employ the relevant and recent methods of empirically estimating countries' respective climate responsibilities.

Drawing these methodological goals arising from the previous chapter together, I now correspondingly argue in section 3.2. of the present chapter why Adcock and Collier's measurement validity framework[196] offers a comprehensive

[195] These two issues will be addressed thoroughly in chapters 4 and 5 respectively.
[196] Adcock and Collier, p. 531.

methodological structure for the remainder of the whole dissertation that meets these different demands if all of its levels are thoroughly addressed. In the same, I also briefly sketch (s. Figure 3-1) how I employ this framework to structure the remainder of the thesis and how I devise the research tasks pertaining to the upcoming main chapters. The same section further discusses prior contributions that are similar in their approaches to the individual research tasks involved in the present dissertation. Section 3.3. then addresses how I intend to build on and go beyond them and what research levels and tasks the following main chapters focus on.

Overall and drawing from Adcock and Collier's terminology, I argue that a thorough and comprehensive reconceptualisation and measurement of climate responsibility involves work at three levels of conceptual analysis. First, at the level of the *background concept*, the broad meanings and values associated with climate responsibility must be identified and established. This involves engaging with the relevant philosophical literature and providing defensible reasons for the inclusion and exclusion of individual ideas and values as building blocks of climate responsibility. It also means taking the goals of the climate governance regime into account. Chapter 4 is devoted to this task. At the second level of the *systematised concept*, these building blocks should then be systematically related to one another to develop guiding principles underlying a more systematised and context-specific understanding of climate responsibility. Chapter 5 addresses this level and examines CBDR-RC, prominent alternative principles in the literature, as well as my proposed hybrid *Economic Activity Principle* as underlying basis of climate responsibility. And lastly, at the third level of *measurement*, the background and systematised concepts as well as the *Economic Activity Principle* of climate responsibility should then inform the search for empirical indicators that measure climate responsibility with greatest possible precision and measurement validity.

This dissertation thus draws on and owes to a multitude of prior work that developed and already tested and tried the approaches chosen and employed here. The main contribution lies in how the methodological framework is filled with content and in the fact that all of the framework's levels are addressed. Previous work typically suffers from pertaining to only one or two of the three analytical levels discussed here, i.e., from a lack of breadth and depth with respect to the levels that are left out. Contributions to the conceptual work on climate responsibility typically either focus on the level of the background and / or systematised concept levels but

neglect or only fleetingly touch upon measurement[197]. As a result, such contributions offer normatively appealing and at this level invaluable conceptualisations of climate responsibility. But on their own, it remains unclear whether and how they can be measured and so translated into practically useful and implementable distributions of climate responsibility. Contributions at the other end of Adcock and Collier's analytical spectrum, by contrast, too often focus on how exactly to measure given understandings of climate responsibility without thoroughly engaging with the normative underpinnings of their work[198]. Such contributions typically result in very precise measurements of very specific understandings of climate responsibility without at the same time offering a thorough enough discussion for why a specific understanding is chosen or normatively preferable to others[199]. Again, these contributions have been very important to pushing the boundaries of how climate responsibility can be measured. But they too cannot on their own provide a thorough and comprehensive reconceptualisation and measurement of climate responsibility as envisaged here. Typically, they either neglect the importance of measurability or normative defensibility or practical usefulness of climate responsibility.

By contrast, this dissertation addresses all three analytical levels identified here at an adequate level of depth. It so aims at a thorough and comprehensive reconceptualisation and measurement of climate responsibility that speaks to each individual one of the levels and combines them such that they build upon, correspond to, and co-qualify each other. This means that the normative underpinnings pertaining to the background concept level are explicitly and openly discussed and

[197] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Simon Caney, 'Climate Change and the Duties of the Advantaged', *Critical Review of International Social and Political Philosophy*, 13.1 (2010), 203–28 <https://doi.org/10.1080/13698230903326331>; Simon Caney, 'Justice and the Distribution of Greenhouse Gas Emissions', *Journal of Global Ethics*, 5.2 (2009), 125–46 <https://doi.org/10.1080/17449620903110300>; Darrel Moellendorf; Darrell Moellendorf, 'Climate Change and Global Justice'; Simon Caney, 'Just Emissions', *Philosophy and Public Affairs*, 40.4 (2012), 255–300 <https://doi.org/10.1111/papa.12005>; Shue, *Climate Justice - Vulnerability and Protection*; Henry Shue, 'Global Environment and International Inequality', *International Affairs (Royal Institute of International Affairs)*, 75.3 (2017), 531–45; Dale Jamieson, 'Climate Change, Responsibility, and Justice', *Science and Engineering Ethics*, 16.3 (2010), 431–45 <https://doi.org/10.1007/s11948-009-9174-x>; Jamieson, *Reason In a Dark Time*; Lukas Meyer and Dominic Roser, 'Distributive Justice and Climate Change: The Allocation of Emission Rights', *Analyse Und Kritik-Zeitschrift Für Sozialwissenschaften*, 22.2 (2006), 223–49; Roser and Seidel.

[198] Bastianoni, Pulselli, and Tiezzi; Jiun Jiun Ferng, 'Allocating the Responsibility of CO2 Over-Emissions from the Perspectives of Benefit Principle and Ecological Deficit', *Ecological Economics*, 46.1 (2003), 121–41 <https://doi.org/10.1016/S0921-8009(03)00104-6>; Rodrigues and Domingos; Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'; Blanca Gallego and Manfred Lenzen, 'A Consistent Input–Output Formulation of Shared Producer and Consumer Responsibility', *Economic Systems Research*, 17.4 (2005), 365–91 <https://doi.org/10.1080/09535310500283492>; Marques and others; João F D Rodrigues and others; Hertwich and Peters; Glen P. Peters; Manfred Lenzen, Daniel Moran, and others, 'Building Eora: A Global Multi-Regional Input-Output Database at High Country and Sector Resolution', *Economic Systems Research*, 25.1 (2013), 20–49 <https://doi.org/10.1080/09535314.2013.769938>; Manfred Lenzen, K. Kanemoto, and others, 'Mapping the Structure of the World Economy', *Environmental Science and Technology*, 46.15 (2012), 8374–81 <https://doi.org/10.1021/es300171x>.

[199] This has most recently been criticised, for example, in Kate Dooley and others, 'Ethical Choices behind Quantifications of Fair Contributions under the Paris Agreement', Nature Climate Change, 11 (2021), 300–305.

defended. It further means that the systematised concept level develops a principled systematisation in line with the background concept and the goals of the climate regime that simultaneously can be measured empirically. And it means that the measurement level aims for precision and internal validity in measuring what understanding of climate responsibility has before been identified as relevant by the background and systematised concept levels. In this comprehensive and thorough approach, the work developed here shares greatest similarity to such prior contributions as the "climate equity reference framework"[200] which also addresses all research levels of Adcock and Collier's measurement validity framework. However, the present contribution still differs substantially in its normative choices at the systematised concept level and corresponding results at the measurement level.

On the one hand, the present dissertation is thus an attempt at overcoming the weaknesses associated with a lack of breadth and depth in prior contributions which result from their exclusive focus on only one or two of the analytical levels outlined. On the other hand, this also brings with it the potential for a greater variety of criticism directed at any of the levels addressed, some of which will be discussed below in the concluding remarks. Such criticism is fair enough and explicitly welcome. What this dissertation can do in response is follow Dooley et al.'s recent advice and be open and transparent in its normative choices and arguments as well as its corresponding measurement methods and the derivation of its results[201].

3.2. A thorough and comprehensive methodological framework to structure this thesis

3.2.1. Responding to the issues of conceptual vagueness and plurality

So, which research agenda should be adopted in light of the issues discussed and research gap identified? Alongside other scholars[202], Chukwumerije Okereke argues that

> *"one of the greatest challenges facing commentators and policy makers relates to how best to provide conceptual clarity to equity concepts in regimes terms and how to translate the*

[200] Kartha and others, i; Baer; Baer and others.
[201] Dooley and others.
[202] e.g. Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'.

concepts into practical policies that bridge the gap between moral ideals and political realities". [203]

If the motivating argument laid out in the previous section holds, and if a more concrete understanding of climate responsibility in the international climate regime could raise ambition and effectiveness because it would foster equity, what would and should be entailed in rethinking climate responsibility? In this section, I argue that a thorough and comprehensive reconceptualisation and measurement of climate responsibility should involve an engagement with its philosophical bases, its potential political systematisation, as well as its empirical measurement. These levels should respectively receive due attention and correspond to each other in meaningfully defensible ways.

While different understandings of climate responsibility have been disputed over decades[204], I am not aware of any contribution to the literature that sets out to comprehensively reconceptualise and measure climate responsibility from its philosophical bases through its political systematisation down to its empirical measurement. But all these levels need adequate attention if the result is intended to be a normatively grounded, practically useful, and empirically measurable concept of climate responsibility.

While the natural sciences are predominantly interested in causal connections of natural phenomena, the social sciences concern themselves first and foremost with the discovery of causal connections between social phenomena. But to establish such causal links in either science, phenomena must be measured. In order to be measured, they must be operationalised along measurable dimensions. In order to be operationalised, they must be systematised. And in order to be systematised they must first be conceptualised. Working on all these levels of reconceptualising and measuring climate responsibility hence requires a number of different instruments from different scientific toolboxes.

Concepts can be regarded as containers of meaning preferably with edges as sharp as possible and content that is defined as clear and tangible as possible. John Gerring identifies familiarity, resonance, parsimony, coherence, differentiation,

[203] Chukwumerije Okereke, 'Climate Justice and the International Regime', *Wiley Interdisciplinary Reviews: Climate Change*, 1.3 (2010), 462–74 (p. 469) <https://doi.org/10.1002/wcc.52>.
[204] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.

depth, theoretical utility, and field utility as crucial characteristics along which concepts' performance in capturing meaning can be assessed[205]. To analyse a statement like "poverty raises the likelihood of violent crimes", the different concepts used in this statement must first be defined. Gerring's goal characteristics of good concepts apply whether we think of measuring temperature, atmospheric composition, and more complex phenomena such as climate in the natural sciences, or whether we try and measure happiness, democracy, or freedom in the social sciences. Crucial to all these scientific endeavours is a thorough conceptualisation of what it is we set out to measure.

Concepts not only shape our perception, interpretation and understanding of phenomena, but – by labelling these phenomena never quite perfectly and fairly – can shape the phenomena themselves. (Re-)conceptualisation in the social sciences thus also involves research tasks pertaining to improving the match between the containers and the phenomena to be captured. But by working on this match never quite neutrally the research endeavour itself can have an impact on the phenomena, especially if they are viewed differently as a result[206]. Reconceptualisation and measurement of climate responsibility requires connecting the literature on different existing climate responsibility concepts (s. previous chapter) with respective methodologies involved in conceptualisation research in the social sciences.

A shared and precise understanding of climate responsibility supports the essential goal characteristics of effectiveness and equity in the international climate regime by clarifying what is at stake and enabling conscious trade-offs among conflicting goals. But without a well-defined concept of climate responsibility, it is unclear what choices can count as "responsible" in light of conflicting goals.

Reconceptualising climate responsibility is thus a subtopic of climate justice which in turn is about ideals versus reality, about fairness in processes, distribution, and outcomes. Dominic Roser and Christian Seidel[207] offer a comprehensive introductory overview over the ethical questions surrounding climate change. They divide the research field of climate justice into three main questions and ask: 1) do we have a duty to do anything at all about climate change?, 2) assuming we are obliged to do something, how much should we do?, and 3) how should the resulting

[205] 'What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences'.
[206] I briefly turn to the issue of value neutrality in the concluding remarks of this chapter.
[207] Roser and Seidel.

overall duty to act be divided and distributed among actors?[208] Most research on normative questions of climate change can be classified in terms of these fundamental questions.

As I briefly laid out in the introduction chapter, the present dissertation takes the first two of Roser and Seidel's questions as by now – at least relatively – uncontroversial and focuses on contributing to answering the third. Although "climate scepticism" is still wide-spread and has found a powerful obstructive companion in systematic and organised denial[209], there is a large and still growing consensus among scientists and policymakers that climate change is anthropogenic and should be prevented from taking on dangerous proportions[210]. Furthermore, whether we should do anything about climate change is arguably not a typical case of a "Humean guillotine", i.e., a situation in which no normative guidelines directly follow from a natural state of the world. First, thinkers like Hans Jonas convincingly argue that in matters concerning the entirety and essence of human existence, the normative follows the natural since human existence, especially its continued reproduction into the future, is intrinsically moral and in itself formulates a moral demand for its preservation[211]. In such cases, and climate change clearly falls among them, *ought* can thus follow from *is*. And second, climate change is not simply a natural phenomenon independent of human behaviour but brought about by ever-more conscious and increasingly deliberate[212] behavioural choices. Once there is agreement that these choices are morally undesirable or lead to morally undesirable outcomes, the question whether climate change raises fundamental ethical demands loses its practical relevance[213].

The second question "how much should be done?", has also overcome much of its previous controversy. While the early years of understanding and addressing climate change were characterised by much more substantial disagreements as to how much should be done about it globally, there is much more consensus or at least compromise now. As elaborated in the previous chapter and above, preventing

[208] Roser and Seidel, p. 4.
[209] e.g. Jamieson, Reason In a Dark Time, chap. 3.5.
[210] Jamieson, *Reason In a Dark Time*; IPCC, *Summary for Policymakers - Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 2014 <https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_summary-for-policymakers.pdf>; United Nations, *Paris Agreement*.
[211] Jonas, chap. 4.
[212] Both of these play an important role in the design of a convincing responsibility concept and will be further discussed in chapter 4.
[213] More on this in chapter 4.

temperature increases of more than 2°C above pre-industrial times has been agreed upon worldwide as the compromise between too little and too much action. While it remains unclear in detail how deep the changes to our ways of life will have to cut to remain within this limit, the main measures and direction of the goal to be reached have been identified.

By contrast, the third of Roser and Seidel's main questions of climate justice, "who should do what?", remains largely unsettled despite at least three decades of climate negotiations, a large and growing body of literature devoted to it, and even though most countries have pledged contributions under the Paris Agreement. Among the many still open questions related to climate justice, this thesis therefore focuses on how climate responsibility should be conceptualised, measured, and distributed – a sub-question of Roser and Seidel's third main question of climate justice. Specifically, my motivating argument is that a reconceptualisation and measurement of climate responsibility is needed to help overcome some of the main challenges in international climate negotiations and to raise individual countries' as well as global ambitions in the response to climate change because without a clear and measurable concept of climate responsibility, burden-sharing as well as distinguishing responsible from irresponsible behaviour remain essentially contested if not to say impossible.

3.2.2. Robert Adcock and David Collier's measurement validity framework

Adcock and Collier's[214] measurement validity framework – see Figure 3-1 – offers a useful structure for and guide to the tasks involved in reconceptualising and measuring climate responsibility as envisaged in this dissertation.

Measurement validity, as seminally discussed and developed by Adcock and Collier, refers to the applicable correspondence between the conceptual and empirical levels, i.e., the correspondence between concepts and the phenomena they intend to capture. The better a concept fits a phenomenon (and the better a measurement of a phenomenon matches a concept in turn), the higher is its measurement validity.

The concept of "poverty", for example, exhibits greater measurement validity if it appropriately reflects all of the identifying characteristics that should be contained in it. Since poverty is a relative concept, it matters, for instance, whether it

[214] Adcock and Collier.

is measured along all relevant dimensions (e.g., inflows, outflows, stocks must be considered in light of social contexts such as living costs). If it is not, the real-world phenomenon to be described might not correspond well to the concept used to describe it, weakening its measurement validity in the process. Other concepts, such as that of democracy, are characterised by their own challenges regarding measurement validity. While most people living in democracies have some idea of what the concept "democracy" describes, there is disagreement about what exactly is meant by it, which necessary components should be included, and how they should be measured[215]. The examples illustrate how significantly concepts vary regarding their performance along Gerring's[216] and Adcock and Collier's[217] requirements. In the natural sciences, concepts often exhibit strong empirical measurability (think, for example, of distances, temperatures, or mass), while the social sciences often deal with fuzzier concepts which not only evoke disagreement regarding their core meaning, but also the specific contexts in which they can be applied, as well as their concrete measurability (e.g., love, happiness, freedom).

In agreement with prominent previous contributions such as King, Keohane, and Verba[218], Adcock and Collier thus argue that "valid measurement is achieved when scores […] meaningfully capture the ideas contained in the corresponding concept."[219]. In other words, measurement validity changes with the degree to which the conceptual higher levels capture what is measured at the lower levels and the lower measurement levels measure what is conceptualised higher up. Measurement validity thus concerns the match between conceptualisation, description, and reality, from the most abstract down to the most concrete empirical levels.

[215] Gerardo L. Munck and Jay Verkuilen, 'Conceptualizing and Measuring Democracy: Evaluating Alternative Indices', *Comparative Political Studies*, 35.1 (2002), 5–34 <https://doi.org/10.1177/001041400203500101>.
[216] 'What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences'.
[217] "Measurement Validity: A Shared Standard for Qualitative and Quantitative Research."
[218] Gary King, Robert Owen Keohane, and Sidney Verba, Designing Social Inquiry: Sccientific Inference in Qualitative Research. (Princeton: Princeton University Press, 1994), p. 25.
[219] Adcock and Collier, p. 530.

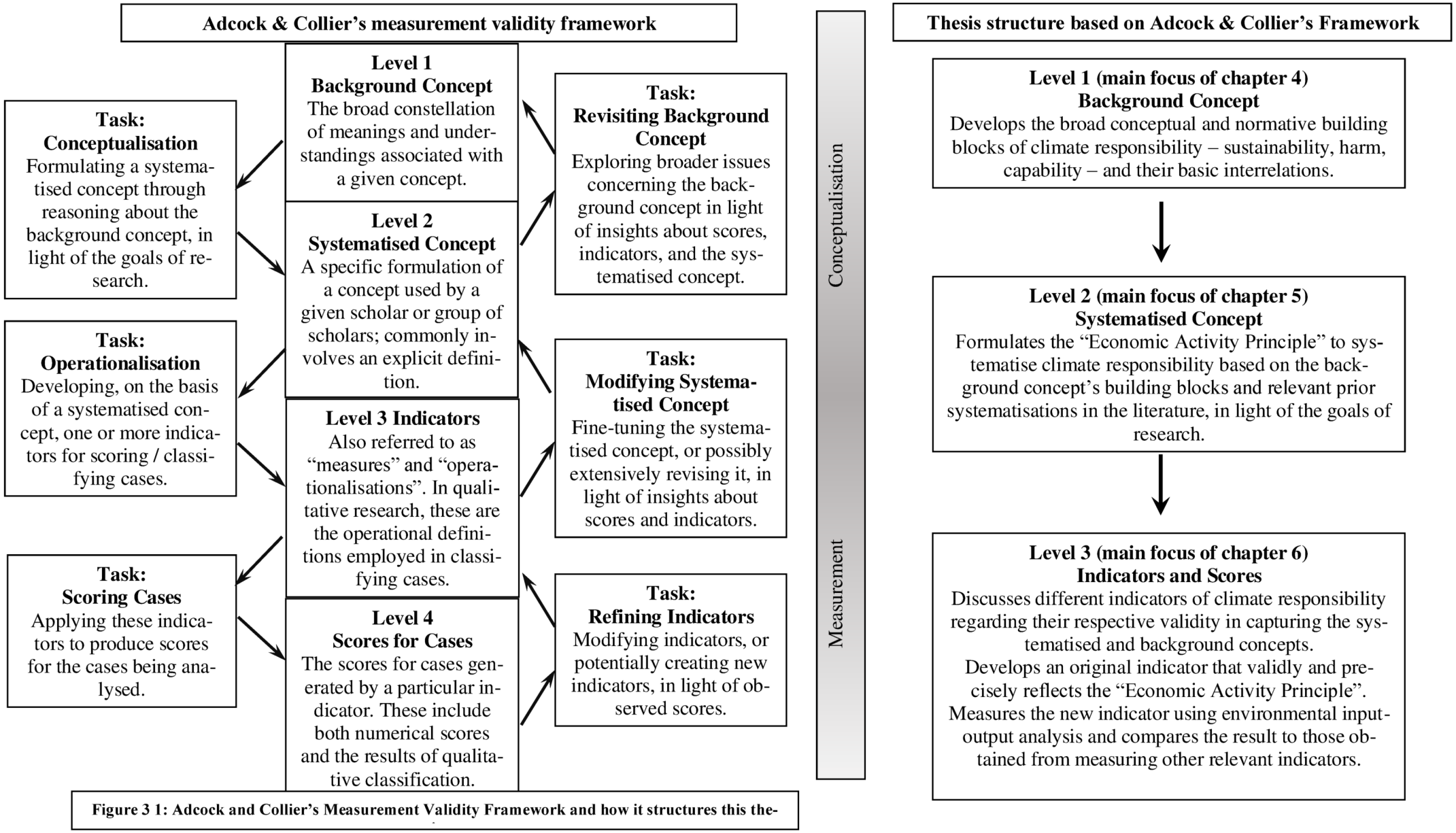

Figure 3 1: Adcock and Collier's Measurement Validity Framework and how it structures this the-

Figure 3-1 depicts Adcock and Collier's framework on the left as well as the corresponding research foci of this thesis' main chapters 4 through 6 on the right. While the present dissertation addresses all four of Adcock and Collier's conceptualisation and measurement levels[220], the third and fourth levels are both simultaneously addressed in chapter 6. The framework also structures the thesis as a whole as each chapter engages with at least one of the research tasks described in Figure 3-1. Adcock and Collier's framework divides conceptualisation and measurement into four levels, from the most abstract first level of the "Background Concept" down to the most specific fourth level of "Scores for Cases". The individual research tasks depicted show how research can move from level to level to either progress from conceptualisation to measurement or revise the conceptual levels in light of measurement.

Adcock and Collier developed their framework of measurement validity in the social sciences with several goals in mind. They intended, for example, to provide a unified framework for quantitative and qualitative approaches. Second, they wanted to illustrate which research tasks are respectively involved in reconceptualisation and measurement. Third, they aimed to keep disputes over conceptualisation and measurement at their respective levels such that these disputes do not feed into disagreement at levels they do not respectively pertain to. And fourth, their framework aims to enable research projects engaging with more than one of the levels.[221] This requires on the one hand that the concepts are sufficiently clearly defined to be measurable, and on the other hand that indicators and the corresponding scores of cases validly reflect what the conceptual levels are meant to capture.

Moving from background concept to systematised concept down to scores of cases contains the risk of losing or trivialising important bits of meaning that are still contained in a given background concept. It is thus crucial to assess whether chosen measurements are indeed comprehensive revelations of the concept under study. Conversely, revising indicators, the systematised concept, and possibly the background concept in light of scores contains the risk of altering the meaning of concepts just because results may only fit uncomfortably (this is discussed further

[220] See section 3.3. below
[221] Adcock and Collier, p. 529.

below in the concluding remarks). Research moving up or down the framework must thus always divide attention between both the present level under main consideration and the other levels that feed into the present work or depend upon its outcome.

Adcock and Collier's framework helps classify research into the different tasks depicted. It can raise awareness for common pitfalls when engaging in any of the research tasks outlined. Also, it can bring order to conceptual contestation and disagreements by separating disputes over measurement from disputes over conceptualisation.

3.2.3. Prior conceptualisations of climate responsibility and their restricted coverage of Adcock and Collier's framework

Adcock and Collier's measurement validity framework has influenced a range of subsequent contributions. Among the most prominent ones is, for example, Munck and Verkuilen's "Conceptualising and Measuring Democracy: Evaluating Alternative Indices"[222]. More directly relevant to the topic of reconceptualisation climate responsibility is, for example, John Mikler's contribution on framing environmental responsibility[223]. However, its focus on multinational corporations instead of nation states as responsibility bearers as well as its focus on measuring corporations' own views of environmental responsibility makes it a whole different endeavour than the one pursued here. To my knowledge, prior work on climate responsibility has not explicitly, systematically, or comprehensively employed Adcock and Collier's measurement validity framework as research design. However, prior contributions can still be assessed in light of the framework even if they do not explicitly employ it.

Previous work on conceptualising and measuring climate responsibility is united with regard to the methodological framework discussed here in that it typically predominantly pertains to only one, sometimes two of the levels and corresponding research tasks depicted in Figure 3-1. Seminal theoretical and

[222] Munck and Verkuilen.
[223] John Mikler, 'Framing Environmental Responsibility: National Variations in Corporations' Motivations', Policy and Society, 26.4 (2007), 67–104.

philosophical contributions by Henry Shue[224], Darrel Moellendorf[225], Simon Caney[226], or Dale Jamieson[227], for example, remain restricted to the levels of the background concept or systematised concept and do not typically or extensively concern measurement of climate responsibility. Influential work on interpreting the principle of CBDR-RC[228] is often restricted to the level of the systematised concept with occasional excursions to either the background concept or measurement levels. And cornerstone contributions to the measurement of climate responsibility typically lack the space, time, or even interest in the upper levels of the framework. This finding is not at all meant to criticise these respective contributions for the input they provide because, as I said, they did not set out to comprehensively address all levels contained in Adcock and Collier's framework. It just means that their scope is restricted to the levels addressed respectively and so excludes from consideration problems potentially lurking at the respective other levels.

In order to comprehensively develop a normatively convincing, empirically measurable, and practically useful concept of climate responsibility, however, all levels are required. Consequently, existing conceptualisations and measurements of climate responsibility which are restricted to either of the levels may be open to potential mismatches between the ideals contained in their respective background concepts and / or the empirical realities of their respective measurement levels. Such a mismatch between the conceptual and empirical levels, I argue, results in some of the main problems with current conceptualisations and measurements of climate responsibility. It stands in the way of both finding more ambitious agreement on burden-sharing and international climate policies as well as greater measurement validity.

[224] Shue, *Climate Justice - Vulnerability and Protection*; Shue, 'Global Environment and International Inequality'; Ravi Kanbur and Henry Shue, *Climate Justice: Integrating Economics and Philosophy.*, ed. by Ravi Kanbur and Henry Shue (Oxford University Press, 2018); Henry Shue, 'Subsistence Protection and Mitigation Ambition: Necessities, Economic and Climatic', *The British Journal of Politics and International Relations*, 21.2 (2019), 251–62.

[225] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Darrel Moellendorf; Moellendorf, Roser, and Heyward; Callies and Moellendorf; Darrell Moellendorf, 'Responsibility for Increasing Mitigation Ambition in Light of the Right to Sustainable Development'.

[226] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Caney, 'Just Emissions'; Caney, 'Justice and the Distribution of Greenhouse Gas Emissions'.

[227] Jamieson, Reason In a Dark Time; Jamieson, 'Climate Change, Responsibility, and Justice'.

[228] Rajamani, *Differential Treatment in International Environmental Law*; Lavanya Rajamani, 'Differentiation in the Post-2012 Climate Regime', *Policy Quarterly*, 4.4 (2008), 48–51 <http://ips.ac.nz/publications/files/8509e4c9e66.pdf accessed 3 October 2011>; Harald Winkler and Lavanya Rajamani, 'CBDR&RC in a Regime Applicable to All', *Climate Policy*, 14.1 (2014), 102–21 <https://doi.org/10.1080/14693062.2013.791184>; Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'.

Baer et al.'s CERF, by contrast, arguably comes closest to employing and addressing the full range of Adcock and Collier's framework. The CERF sets out to derive countries' fair shares in the overall effort of avoiding dangerous climate change[229]. It contains a thorough engagement with normative arguments underlying its conceptual choices. For example, its authors argue both why and how exactly distributions of efforts should take countries' capabilities and historical as well as current emissions into account, why a right to development should be protected, and why poverty should be measured on an individual rather than national level of agency[230]. Their "responsibility capability index"[231] can in turn be regarded as pertaining to the systematised concept level of climate responsibility and their "Climate equity reference calculator" allows for numerous ways to empirically measure numerical scores for countries' respective duties[232].

The CERF thus has a much stronger simultaneous connection to all levels of Adcock and Collier's framework than other previous contributions. What it still misses, however, are robust links in between its conceptual and measurement levels as well as a more concrete normative stance on which of the many settings of the calculator are defensible. While the overall endeavour of raising ambition and effectiveness through concretising our understanding of equity holds promise, the CERF's specific answer to what would be equitable is relatively vulnerable. The CERF's major shortcoming, and I develop this argument more thoroughly in the three following main chapters, is its conceptualisation of emissions responsibility which is very controversial and may even work against the overall goal of greater agreement on equity in the international climate regime. The CERF identifies the major building blocks of climate responsibility[233], systematically relates them to one-another[234], and measures most of them convincingly[235]. Yet, the conceptual choices for emissions accounting in the calculator are between a conceptualisation of responsibility based on territorial or on consumption-based emissions, both of

[229] Baer and others; Kartha and others, i; Baer.
[230] Baer, Athanasiou, and Kartha; Baer and others.
[231] Climate Equity Reference Project, 'Glossary' (EcoEquity & Stockholm Environment Institute, 2021) <https://calculator.climateequityreference.org/glossary.php>.
[232] Kemp-Benedict and others.
[233] More on this in chapter 4.
[234] More on this in chapter 5.
[235] More on this in chapter 6.

which are economically one-sided and do not properly reflect how and why emissions occur[236]. Furthermore, after establishing emissions responsibility as either based on territorial or consumption-based accounting, the calculator proposes taking a weighted average of countries' so found responsibility- and capacity-shares to arrive at their respective fair shares in the overall effort of responding to climate change. As I argue more thoroughly in chapter 5, the operationalisations involved in this process lead to conceptual overlap, lead to inconsistent "responsibility double-counting", and so misrepresent countries' fair shares. Generally, however, and although I deviate from it in several choices regarding both the conceptual and measurement levels, the CERF serves as informative and useful methodological template for the present dissertation.

A more nuanced overall argument motivating this thesis and its methodological approach is therefore that a reconceptualised concept of climate responsibility that thoroughly and comprehensively addresses Adcock and Collier's levels would strengthen approaches like the one represented by the CERF. Our shared understanding of an equitable international climate governance regime could be improved this way. This in turn could help raise ambition in national and international climate policies and thereby ultimately the effectiveness of the global response to climate change. It is crucial, however, that such a reconceptualisation of climate responsibility is at the same time normatively defensible, empirically measurable, and practically useful. Giving due consideration to all of Adcock and Collier's levels and strengthening their interrelations, i.e., the overall measurement validity of the system to be developed is a promising way towards this end.

3.3. How Adcock and Collier's framework serves to structure this thesis

This thesis is structured by Adcock and Collier's methodological framework (see Figure 3-1) as well as related work on conceptualisation and measurement[237]. The dissertation develops a background concept of climate responsibility in chapter

[236] More on this in 2.3., as well as chapters 4-6.

[237] Adcock and Collier; David Collier, 'Understanding Process Tracing', *American Political Science Review*, 44.4 (2015), 823–30; John Gerring, *Social Science Methodology - A Unified Framework*, 2nd edn (Cambridge: Cambridge University Press, 2012); John Gerring, 'What Is a Case Study and What Is It Good For?', *American Political Science Review*, 98.2 (2004), 341–54; Gerring, 'What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences'; Giovanni Sartori, 'Concept Misformation in Comparative Politics', *The American Political Science Review*, 64.4 (1970), 1033–53 <http://www.jstor.org/stable/1958356?seq=1#page_scan_tab_contents>.

4, derives a systematised concept from it in chapter 5, and discusses, designs, and measures an empirical indicator of it in chapter 6. But its most important contribution will lie in between these different levels and in their co-constituting correspondence. By reconceptualising and measuring climate responsibility thoroughly and comprehensively, the thesis aims to develop a simultaneously normatively defensible, empirically measurable, and practically useful concept of climate responsibility. Thorough here means that all three goal characteristics of normative defensibility, empirical measurability, and practical usefulness serve as goals at each level. Comprehensive here means that it engages with all of Adcock and Collier's levels of conceptualisation and measurement.

A thorough and comprehensive reconceptualisation of climate responsibility in the international climate regime holds potential to be a relevant contribution. It could help 1) address the current conceptual vagueness and plurality surrounding climate responsibility[238], 2) increase equity and ambition in responses to climate change, and so 3) provide an unassuming aid to the ultimate goals of the international climate regime. To recap, working towards these goals, the thesis thus addresses the following research questions:

A) What is a normatively convincing background concept of climate responsibility?
B) How can and should this concept of climate responsibility be systematised to be practically useful and measurable?
C) How can and should this conceptualisation of climate responsibility be operationalised and measured?

Addressing these questions in turn means addressing the methodological framework's levels in turn and helps order the various disputes over climate responsibility. The following subsections further elaborate how the rest of the dissertation will proceed.

[238] Chukwumerije Okereke and Philip Coventry, 'Climate Justice and the International Regime: Before, during, and after Paris', *Wiley Interdisciplinary Reviews: Climate Change*, 7.6 (2016), 834–51 (p. 466) <https://doi.org/10.1002/wcc.419>.

3.3.1. Level 1: background concept

Chapter 4 addresses the broadest and most abstract meanings associated with climate responsibility at the level of the background concept where inputs from philosophy and political theory but also from existing climate agreements come to play a role. The background concept establishes the conceptual climate responsibility building blocks from notions of sustainability, capability, moral duty, as well as harm and guilt. Most fundamentally, this level must address the question how to derive "ought" from "is" with respect to what climate responsibility can reasonably demand[239].

Questions regarding the background concept of climate responsibility concern scholars from many different disciplines most commonly rooted in philosophy and political theory. There is disagreement over whether environmental responsibility should be connected to other issues of justice such as poverty and human development, i.e., whether it should be addressed separately or in conjunction with other global equity issues. There also is disagreement over the temporal dimension of responsibility. Backward-looking, this relates to disputed questions and understandings of historical responsibility and the causal role different agents played in bringing about the phenomenon of climate change. Forward-looking the temporal dimension opens up questions of intergenerational responsibility and justice and asks which duties should be distributed to whom considering the consequences of as well as contributions to climate change.

Some of the most influential and comprehensive recent work that could be regarded as reshaping the background concept of climate responsibility is that by political theorists and philosophers Henry Shue, Darrel Moellendorf, Dale Jamieson, and Simon Caney among others. Henry Shue's major contributions help order the debates around questions of climate justice and responsibility and offer some of the most influential reasons why equity concerns are central to global climate policy. Shue divides the topic of climate justice into four kinds of overarching questions which he argues must be addressed to pave the way for successful global climate policy: "1) What is a fair allocation of the costs of *preventing* the global warming that is still avoidable? 2) What is a fair allocation of the costs of *coping* with the

[239] Roser and Seidel, p. 17ff.

social consequences of the global warming that will not in fact be avoided? 3) What background allocation of wealth would allow international bargaining (about issues such as 1) and 2)) to be a fair *process*? And 4) what is a *fair allocation of emissions of greenhouse gases* (over the long term and during the transition to the long-term allocation)?"[240]. These questions of fair mitigation, adaptation, procedures, and distribution respectively classify and structure much of the literature on climate justice. They cover most of the important disputes, such as those about trade-offs between mitigation and development, intergenerational and intragenerational distribution of costs and benefits, as well as questions of historical responsibility and fair distributions of power.

Darrel Moellendorf too addresses the overarching normative questions posed by what he terms "dangerous" climate change in several of his most important works[241]. "Dangerous" in his work refers to those climatic changes that are "too risky" to take chances with, because they would involve not only trading off preferences over measurable material goods but trading off rights and moral values in uncertain and fundamentally unmeasurable ways[242]. Furthermore, since not only the rights of decision-makers are at stake but those of billions of other people too, not just prudential but moral categories are involved. In this regard, Moellendorf follows in the footsteps of Hans Jonas who established that taking risky chances with the totality of other peoples' interests and rights can never be morally defensible and that the existence of humanity may not be gambled with[243]. Moellendorf's work further clarifies the conceptual link between responsibility and justice and stresses the importance of not confusing methodological with substantive disagreements, as well as disagreements over facts with disagreements over values. In this regard he describes justice as concerning "which people are owed what" in the sense of being moral creditors and responsibility as concerning "which people owe what" as moral debtors[244].

[240] Shue, Climate Justice - Vulnerability and Protection, pp. 47–48 my italics.
[241] For a comprehensive overview over his work, his 2014 "The Moral Challenge of Dangerous Climate Change" is still a good start.
[242] Darrel Moellendorf.
[243] Jonas, chap. 2.
[244] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*, pp. 153–54.

Simon Caney's work also contributes significantly to shaping the background concept of climate responsibility in this dissertation. Most important to his argument is that the conceptualisation of climate justice should be an integrated as opposed to an isolationist endeavour, meaning that the overarching questions of climate justice should be tackled in conjunction[245]. In several of his contributions he offers a detailed account of how we could determine a fair distribution of greenhouse gas emissions rights, without, however, going into the details of measurement[246].

In a comparably disenchanted manner, Dale Jamieson asks why the struggle against climate change has failed[247]. His perhaps most prominent argument is that the complex phenomenon of climate change overwhelms our scientific, political, economic, and moral capacities to varying degrees. According to him we have not found adequate ways to conceptualise and then institutionalise the complicated interrelations among facts, values, science, and policy that arise out of the challenge of climate change[248]. Jamieson's arguments find support in such contributions as Mike Hulme's "Why we disagree about climate change"[249].

Chapter 4 of this dissertation engages with similar questions as the prior contributions briefly discussed here in a similar way. However, it already aims to keep an eye on the lower levels of the methodological framework to develop a background concept that can be systematised in a practically useful way and eventually be measured empirically. This step could help prevent frictions further down the road by settling debates at the appropriate level.

3.3.2. Level 2: systematised concept

Chapter 5 then turns to the systematised concept level to examine narrower meanings of practically applicable, context-specific aspects of the background concept. For climate responsibility as developed in this thesis, this includes different potentially applicable systematisations of CBDR-RC and a principled approach to

[245] Caney, 'Just Emissions'.
[246] Caney, 'Just Emissions'; Caney, 'Justice and the Distribution of Greenhouse Gas Emissions'; Simon Caney, 'The Struggle for Climate Justice in a Non-Ideal World', *Midwest Studies in Philosophy*, 40 (2016), 9–26; Simon Caney, 'Two Kinds of Climate Justice: Avoiding Harm and Sharing Burdens', *Journal of Political Philosophy*, 22.2 (2014), 125–49 <https://doi.org/10.1111/jopp.12030>.
[247] Jamieson, Reason In a Dark Time.
[248] Jamieson, Reason In a Dark Time, p. 107.
[249] Hulme.

how the conceptual climate responsibility building blocks from chapter 4 could and should be interrelated.

In practice, the conceptualisation of the systematised concept of climate responsibility takes place predominantly within international climate negotiations. Disagreements on this level typically arise over which of the various aspects of competing background concepts should inform the conceptualisation and implementation of CBDR-RC and over how its second part should be operationalised in detail.

The corresponding fifth chapter follows and builds, for example, on previous work by Lavanja Rajamani[250], Simon Caney[251], Dominic Roser and Christian Seidel[252], as well as the authors behind the CERF[253] and several others[254]. These contributors have developed different systematised interpretations and implementation proposals of climate responsibility that could serve as complements of or alternatives to current ways of interpreting and implementing the principle of CBDR-RC in the climate regime. Building on but going beyond these proposals, chapter 5 develops an *Economic Activity Principle* of climate responsibility on the basis of the background concept from chapter 4 to be measured in chapter 6.

The systematised concept thus represents a narrower and more detailed concept of climate responsibility on the basis of a systematically ordered set of meanings contained in the background concept. This involves not just the fundamental

[250] Rajamani, Differential Treatment in International Environmental Law.
[251] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[252] Roser and Seidel.
[253] Kemp-Benedict and others.
[254] Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'; Robert O Keohane, 'The Regime Complex for Climate Change', *Perspectives on Politics*, 9.January (2011), 7–23 <https://doi.org/10.1017/S1537592710004068>; Julia Morse and Robert Owen Keohane, 'Contested Multilateralism', *The Review of International Organizations*, 9.4 (2014), 385–412; Robert O Keohane and Robert Keohane, 'Reciprocity in International Relations Reciprocity in International Relations', *International Relations*, 40.1 (2008), 1–27; Keohane and Oppenheimer; Deleuil; Sebastian Oberthür and Thomas Gehring, 'Reforming International Environmental Governance: An Institutionalist Critique of the Proposal for a World Environment Organisation', *International Environmental Agreements: Politics, Law and Economics*, 4.4 (2004), 359–81 <https://doi.org/10.1007/s10784-004-3095-6>; Stern, *The Economics of Climate Change - The Stern Review*; Rachel Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing'/'developed" Dichotomy in International Environmental Law', *New Zealand Journal of Environmental Law*, 14 (2010), 63–101 <https://doi.org/10.2307/3176729>; Halvorssen; Donald W. Kaniaru, 'The Development of the Concept of Sustainable Development and the Birth of UNEP', in *International Environmental Law-Making and Diplomacy*, ed. by Tuomas Kuokkanen and others (New York: Routledge, 2016), pp. 127–43; Tuula Honkonen, 'The Principle of "common but Differentiated Responsibility" and the UNFCCC', I.June 1992 (2012), 257–68 <http://www.climaticoanalysis.org/wp-content/uploads/2009/12/kmcmanus_common-responsibilities.pdf>; Kenneth W. Abbott, 'The Transnational Regime Complex for Climate Change', *Transnational Environmental Law*, 30.4 (2012), 571–90 <https://doi.org/10.1017/S2047102513000502>; Karen J. Alter and Sophie Meunier, 'The Politics of International Regime Complexity', *Perspectives on Politics*, 7.1 (2009), 13–24 <https://doi.org/10.1017/S1537592709090033>; Alexander Thompson, 'Rational Design in Motion: Uncertainty and Flexibility in the Global Climate Regime', *European Journal of International Relations*, 16.2 (2010), 269–96 <https://doi.org/10.1177/1354066109342918>; S. Yearley, 'Sociology and Climate Change after Kyoto: What Roles for Social Science in Understanding Climate Change?', *Current Sociology*, 57.3 (2009), 389–405 <https://doi.org/10.1177/0011392108101589>.

questions of why action is required but ask in more detail how responsibility should be assigned and distributed[255]. The chapter so departs from mere goal setting related to ideals and starts asking how well the goals fit together in practice and what their implementation should look like. In order to ensure the systematised concept's measurability, choices have to be made over which properties of the background concept remain justifiable parts of the systematised concept and which should be set aside. Crucially, however, the core meaning of the background concept must be conserved so as to safeguard measurement validity at the lower levels.

3.3.3. Level 3: measurement

The third level, to be tackled in the corresponding chapter 6, is concerned with selecting and measuring indicators of the systematised concept of climate responsibility. This relates on the one hand to the different indicators currently used to measure and assign greenhouse gas emissions (territorial, production-based, income-based, shared[256]). On the other hand, it also relates to different indicators for the other building blocks of climate responsibility identified at the higher levels of the methodological framework, such as capability, sustainability, and knowledge.

The design of measurable climate responsibility indicators can be found primarily in prior contributions to economic research. Scholars committed to this level of the conceptualisation and measurement framework typically take differing background concepts of climate responsibility as given and design indicators that reflect them as best as possible. In their contributions, most disagreements arise over the chosen aspects of the underlying concepts and over how exactly to measure them empirically. Among many prominent approaches there appears to be agreement that the appropriate way to measure climate responsibility is by measuring greenhouse gas emissions. However, opinions diverge substantially over which economic agents – consumers, producers, firms, states, regions – should be assigned which proportions of responsibility leading to different views of how exactly to measure emissions. As methodological blueprints among the many contributions to this field, the work of Joao Rodrigues et al.[257], Manfred Lenzen[258], and Thomas

[255] Roser and Seidel, pts III & IV.
[256] Lenzen, Murray, and others, 'Shared Producer and Consumer Responsibility — Theory and Practice'.
[257] João Rodrigues and others.
[258] 'Shared Producer and Consumer Responsibility — Theory and Practice'.

Wiedmann[259] stand out as interesting examples of how to measure differing concepts of environmental responsibility. More recently, Liang et al.[260] have continued this work. The previous chapter as well as the corresponding measurement chapter 6 go into more detail comparing these approaches. What matters here is that chapter 6 on measuring climate responsibility follows their contributions in employing environmental input-output analysis to measure countries' territorial, consumption-based, as well as income-based emissions which feed into the *Economic Activity Principle*.

Overall, the methodological approach and research agenda discussed here outline and structure different research contributions to a reconceptualisation of climate responsibility which the following chapters set out to deliver. In their conjunction, these contributions offer a first thorough and comprehensive reconceptualisation and measurement of climate responsibility from the theoretical and philosophical underpinnings to their empirical measurement and practical implementation in the climate regime.

3.4. Concluding remarks

The current chapter set out to develop a research agenda and corresponding methodological framework explaining how the research in this thesis could and should be structured. I argued in the previous chapter that ambition in the international climate regime currently suffers inter alia because the concept of climate responsibility remains essentially contested which in part results from its conceptual vagueness and plurality. Thoroughly and comprehensively reconceptualising and measuring climate responsibility were thus identified as important contribution to fill the research gap identified. The remainder of the chapter argued how Adcock and Collier's measurement validity framework and other relevant prior contributions could be employed as methodological framework and prior contributions to structure this dissertation.

In summary, the research tasks of the present dissertation project could be defined as follows: reconceptualising and measuring climate responsibility involves in a first step establishing what a background concept of climate responsibility is,

[259] Input-Output Analysis and Carbon Footprinting: An Overview of Applications.
[260] Liang and others.

how it arises, and who can and should bear it to what broad extent. A second step then involves specifically deriving a systematised concept of climate responsibility. This involves showing how it arises out of climate damaging economic choices and explaining why which kinds of agents should end up bearing which proportions of the corresponding duties of a concerted response to climate change. And a third step then comprises measuring countries' corresponding individual responsibility shares in terms of this narrowly systematised conceptualisation of climate responsibility.

Unfortunately, this broad and blue-eyed description of the research tasks lying ahead is insensitive to numerous problems lurking along the way. Here, I shall only point to three of the most serious ones which must be kept in mind when thinking about or employing the reconceptualisation of climate responsibility in this work or when interpreting the results of the empirical estimation. All three drawbacks relate to widely discussed problems of value-neutrality in the social sciences as well as potential circularity issues with Adcock and Collier's methodological framework.

First, the whole endeavour of setting out to reconceptualise and measure a normative concept like climate responsibility poses immediate and widely known problems related to measurement in the social sciences. The responsibility of an agent is an elusive, constantly changing, and easily influenced concept. Chasing it with a ruler risks changing its character or petrifying a merely fleeting glance of it. Measurement in the social sciences is the search for empirical occurrences of previously conceptualised social phenomena, and – once found – dimensioning, classifying, and counting them along established scales.

But what if a phenomenon under study is not or cannot be conceptualised precisely enough to be found, classified, and counted along established scales in the way just described because it depends on value judgments of those examining it? While it is nowadays relatively straightforward to answer what "the average temperature in Europe" is, measuring becomes more controversial once we try to speak in a similar fashion of concepts like poverty, democracy, or freedom. It is nowadays possible to get high quality data on greenhouse gases being emitted on almost any country's territory. But conceptualising and measuring who is economically or otherwise indirectly responsible for bringing about these emissions is much more

involved and depends on databases that remain under construction and are still courting for attention and more funding[261].

Things get even more complicated when we not only set out to measure and ascribe responsibility for bringing about emissions but to then find out what should be done and by whom in light of emissions. Besides its positive aspects, such research always and necessarily contains a normative side, which shapes and co-creates the facts under study by making conceptual and measurement choices. How these complications ought best to be addressed is an old and unsettled question[262]. To an extent, it may be unanswerable, at least if we expect the answer to be an objective, value-neutral, and undisputable fact. Consequently, if there is mention of "measuring countries' climate responsibility" in this work, such language must be enjoyed with a pinch of salt containing this first caveat discussed here.

A second and related issue is that of data availability and quality. As I elaborate at different points throughout this thesis, climate responsibility should be related to the anthropogenic emission of greenhouse gases. Such gases (and other influences expressed as their equivalents) have after all been identified beyond a reasonable doubt as the main anthropogenic drivers underlying climate change. However, measuring not just any understanding of climate responsibility but the one developed and defended in this thesis requires relating relevant emissions back to different types of economic behaviours and interactions on a global scale[263]. Databases on global energy and trade flows have been growing rapidly and provide an ever-clearer image of the economic interactions to be studied to characterise climate responsibility. But high quality and high resolution historical data remains relatively scarce – especially for other than territorial emissions – and their reliability is still evolving which is problematic since the effects of emissions on the climate will be felt for a long time to come[264]. While it may be possible to depict countries' climate

[261] Lenzen, Moran, and others; Lenzen, Kanemoto, and others; Glen P Peters, 'Opportunities and Challenges for Environmental MRIO Modelling : Illustrations with the GTAP Database', 16th International Input-Output Conference of the International Input-Output Association (IIOA), 2007, 1–26.

[262] e.g. Mark Blaug, 'The Distinction between Positive and Normative Economics', in The Methology of Economics: Or How Economists Explain, ed. by Mark Perlman and Roy E. Weintraub, 2nd edn (Cambridge: Cambridge University Press, 1992), pp. 112–34; Martin Hollis, 'A Value-Neutral Social Science?', in The Philosophy of Social Science (Cambridge: Cambridge University Press, 1994), pp. 202–23.

[263] Specifically, to consumption expenditures and income generation above a capability threshold and after a knowledge threshold – see chapters 5 and 6.

[264] For a sophisticated account using territorial emissions, see Marcia Rocha and others, *Historical Responsibility for Climate Change - from Countries' Emissions to Contribution to Temperature Increase*, *Clmiate Analytics Report*, 2015.

responsibilities quite precisely for recent and present times, it may not be possible to draw a complete picture, which again must be kept in mind throughout this work.

The third problem to be briefly mentioned here which is also related to the issue of value-neutrality could be levelled directly at Adcock and Collier's framework which is used as methodological approach structuring this thesis. Keen observers of *Figure 3-1* will have noticed that the arrows in Adcock and Collier's original measurement validity framework go down from conceptualisation to measurement on the left side and up from measurement to conceptualisation on the right. Comprehensive research such as that conducted here which addresses all levels of the framework thus ends up with a strong case of circularity: the concepts chosen and shaped at the upper levels determine the results obtained at the lower levels. And the results in turn can and should be used to revise and revisit conceptualisation in the upper levels. Connected to such circularity are thus serious issues of subjectivity and value commitments in the conceptual choices made as well as potentially lacking scientific objectivity and confirmation biases in the empirical results obtained.

However, unless the research focus is narrowed down again to any single one or a subset of the framework's levels and then takes the other levels as respectively given, this problem cannot be avoided. Furthermore, even if the focus were thus narrowed to counter the problem of circularity, this would just mean that the conceptual design choices which are here explicitly and openly included, would then be left outside of the analysis and thus not scrutinised but uncritically accepted as given. This in turn would entail the same problems of measurement validity and conceptual plurality I mentioned with regard to most previous conceptualisations of climate responsibility.

Instead of restricting its focus on only one or some of Adcock and Collier's levels, this thesis therefore follows Dooley et al.'s recent advice on how best to engage in value laden research: by trying to be explicit and open in the arguments made for and against certain normative and conceptual choices and accepting the ensuing empirical results in light of the underlying assumptions made instead of as objectively uncontroversial[265].

[265] Dooley and others.

The study of climate change, especially its social dimensions, perhaps more than other fields, is characterised by a great multitude of possible approaches open to researchers. One important spectrum along which approaches can be differentiated is that between positive and normative enquiry. On the one hand, a true and objective depiction of the facts of climate change is crucial to any hope of understanding this phenomenon. On the other hand, no facts of climate change can on their own prescribe what should be done about them. Their likely implications for action or inaction may sometimes be representable in a "value-neutral" way, but their normative interpretation and the evaluation of choices which ought to be made in light of them necessarily elude purely positive investigation.

Furthermore, while establishing the facts of climate change, as well as their wider implications and consequences for society, researchers often have to employ value laden concepts, even if "just" to name their research object. Researchers and theorists cannot avoid making value judgements which ultimately colour results when observing and classifying scores, or when developing indicators for and conceptualising concepts[266]. Debates over scientific results can thus be driven by disagreement over measurement, conceptualisation, or ultimately the values that inform the underlying background concepts. Confusing disputes over values with disputes over facts can create avoidable disagreement and hinders progress on substantive issues[267]. Separating the necessarily value laden tasks of conceptualisation and the potentially value-neutral tasks of measurement in the way suggested by the methodological framework structuring this thesis can help avoid such disagreements or keep them in their place.

For my thesis, these problems mean that I intend to work my way down Adcock and Collier's framework once and in this way aim to contribute to greater precision and measurement validity in the concept of climate responsibility. Can this be done in a value-free way? The short answer is: no. But I hope to be able to demonstrate that the question may be misplaced, because it fails to capture the subtleties involved in the different research tasks discussed above and could be used to criticise any comprehensive conceptualisation and measurement research endeavour. A

[266] Adcock and Collier, p. 531.
[267] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change, p. 153.

deeper look reveals that it would be an utterly meaningless and by definition impossible task to "value-neutrally conceptualise climate responsibility".

So, instead of evaluating this kind of research against an inapplicable standard, it is more helpful to understand it in terms of Max Weber's three phases of scientific enquiry[268]. Work at the levels of conceptualisation is necessarily value laden as it involves the selection and evaluation of values, which best fits Weber's first phase of research. Work at the levels of measurement can and should in Weber's view be uncommitted, although it is important to keep in mind that the values contained in the concepts carry over into these levels too. And finally, evaluating, interpreting, and practically implementing eventual results is again, and for good reason, value laden. Scholars and policymakers both do well to carefully study and think about the concepts underlying the scientific results they are presented with as policy-advice. This is especially so when making decisions on wicked phenomena like climate change or essentially contested concepts like climate responsibility.

Despite these fundamental drawbacks discussed, the research agenda outlined above holds promise. While it may be problematic to measure climate responsibility and express it quantitatively, it is interesting and may even be enlightening to see how far we can come with defensible conceptualisations, methods, and data. While the results may not contain truth in the form of a single and correct number, they may be able to approximate this goal by narrowing down its corridors. While limited data and ongoing conceptual disagreements may only allow drawing a partial image of climate responsibility, there may be value in the parts we can see, and they may allow inferences about those parts that for now remain hidden. And while the motivating argument underlying this work is empirically untested, so is its counter-argument. To discuss their respective ability to explain facts to which they are exposed is interesting, whether or not one of them turns out to be false.

This thesis is an odd one. It sets out with an empirically untested motivating argument, reconceptualises a concept of climate responsibility that is currently still challenging to measure reliably, and attempts to measure it nonetheless. Problems of value-neutrality and the creative rather than merely descriptive power of concepts are more pronounced in this than in many other dissertation projects.

[268] cf. Hollis, p. 208.

Throughout the following work, the caveats mentioned here must thus be kept in mind to understand and soberly appreciate what insights it may hold.

4. A working background concept of climate responsibility

4.1. Introduction – responsibility and climate responsibility

In this chapter, I focus on the conceptualisation of a background concept of climate responsibility, i.e., the first research question developed in the previous chapters. In accordance with the methodological framework[269], this involves engaging with the "broad constellation of meanings and understandings associated with a given concept"[270]. Based on the background concept developed here, the subsequent chapters can then build on the ground already covered and engage in the conceptualisation of a systematised concept, as well as the corresponding research tasks associated with the operationalisation and measurement of climate responsibility.

Before delving into the main argument, some preliminary remarks are important. For one, as I discussed more thoroughly in section 3.4., this chapter shows that the present dissertation is not, and I think cannot be, value neutral. What it at least can do, however, is follow the tentatively emerging guidelines for value laden endeavours as the recent one developed in Dooley et al.[271]. It requires being explicit about the normative foundations built here and about those underlying the later systematisation and measurement as well as giving reasons for the normative choices made. What this chapter further cannot address in great depth but still touches upon briefly are the questions of a) whether and how denial impacts upon climate responsibility, b) how much should be done overall in light of climate change, i.e., what the climate regime's temperature limits should be and c) how, i.e., by what concerted efforts exactly, the temperature limits should be reached. Instead, the focus here lies on the conceptualisation and distribution of climate responsibility among nation-states as responsibility bearers trusting that at least sufficiently adequate answers to these questions have already been found.

So, what is climate responsibility and who can and should bear it for which reasons? To introduce the topic, let us first briefly turn to its superordinate concept of responsibility. According to the recent comprehensive investigation into the power of responsibility by contemporary philosopher Ina Schmidt, responsibility

[269] See Figure 3-1.
[270] Adcock and Collier, p. 531.
[271] Dooley and others.

should be regarded as venture we choose to dare embark on because we can give good reasons for thinking that this is the right thing to do and even though there are potential costs, risks, or uncertainties involved. What it requires is the courage to take action for what is right despite the potentially unknown risks of failure[272]. Schmidt's work builds heavily on that of many previous thinkers, most notably on Hans Jonas' ethics of responsibility. According to Jonas, responsibility should be viewed as a non-reciprocal duty to care about other beings which has its origins in the relationship between a parent and their child and is nurtured by and rests on feelings of solidarity and love[273].

Taking these broad definitions as starting point, the search for a concept of climate responsibility then begins by recognising that it involves trying to distinguish "right" from "wrong" or "good" from "bad" in the context of climate change. Once this distinction is made, it further involves uncovering the relevant characteristics – such as virtues, emotions, as well as cognitive, economic, or also physical abilities – required of agents as bearers of responsibility. Such characteristics enable agents to responsibly and courageously choose to accept duties in light of what they have reason to believe is right and despite imperfect knowledge or potential dangers lurking along the way. Schmidt argues that responsibility cannot be imposed upon us as punishment or obligation from the outside but must be taken up by choice and accepted willingly even if perhaps grudgingly and painfully. If such an eventually accepting attitude and willing disposition towards a duty were lacking, one would not choose it responsibly but perhaps out of guilt, fear of being sanctioned, or obedience to given rules. Responsible behaviour, by contrast, is qualified by constantly searching for and questioning what should be viewed as right and wrong. This search and its results in turn enable and guide a responsible choice to shoulder those kinds of duties one can give the best reasons for supporting.[274]

If we accept that responsibility requires our acceptance and choice, then why is it that we have so far arguably failed to accept and choose to adequately act according to the demands of climate responsibility? Such failure seems widespread on the

[272] Ina Schmidt, *Die Kraft Der Verantwortung - Über Eine Haltung Mit Zukunft* (Hamburg: Edition Körber, 2021), chap. 1 (my translation and paraphrasing).
[273] Jonas, chap. 4.
[274] Schmidt, p. 30.

individual, corporate, as well as political levels and despite our vast and continuously increasing knowledge about the phenomenon of climate change. I argued in chapter 2 that the search for a new concept of climate responsibility can be motivated by the argument that currently, there are too many competing concepts claiming to adequately, comprehensibly, and usefully capture what climate responsibility is. This in turn makes it hard to know it when we see it or at least to strive for it when we search it. Some view climate responsibility as essentially comprising individual negative consumption duties – for example, to refrain from activities such as flying, eating meat, driving a car, or even turning on the lights. Others view it as essentially applying to the productive level as positive duties of economic agents who could and should take decisions to develop and employ greener technologies and to offer goods and services that are less carbon intensive. And even others argue that climate responsibility pertains first and foremost to our societies' institutional and political levels. After all, this is where the structures are shaped which co-determine whether we as individual or corporate agents act climate responsibly. According to the first view, everyone should bear climate responsibility, because everyone's consumptive choices lead to the emission of greenhouse gases which cause climate change. Climate change occurs as a result of emissions. Responsibility for climate change should thus be accepted by those who emit them – all of us – potentially in some to be defined relation to our respective emissions levels. The second understanding regards measures of *economic capability* to make productive choices as basis of climate responsibility. Climate responsibility as a duty should thus be accepted by the large group of those with the *economic capability* to bear it or who benefitted from climate changing activities[275]. If this view holds, responsibility should be accepted potentially in some proportion to wealth or income derived from economic activities that lead to greenhouse gases. On the third understanding, structures should soak up all climate responsibility corresponding to the individual activities taking place within them. This would mean that climate responsibility comes with structural and representative power.

[275] see also Edward A. Page, 'Give It up for Climate Change: A Defence of the Beneficiary Pays Principle', *International Theory*, 4.2 (2012), 300–330 <https://doi.org/10.1017/S175297191200005X>.

Beyond these simple versions, however, there are more complex conceptions under which climate responsibility may pertain to only very few, if any, tangible agents. While, for example, the overall phenomenon of climate change is connected to the overall rise in greenhouse gas emissions, connections between individual emissions units and incremental climatic changes or even harmful effects thereof, are rarely – if ever – possible. If responsibility should be framed and distributed based on fault liability and correspond to how much damage exactly was caused by an agent's individual emissions units, it is crucial whether these damages can ever be measured and traced back to corresponding emitters precisely enough[276]. Larger than individual agents (e.g. corporations, nations, supranational regions, or the global population as a whole), would then have to be identified as those to accept responsibility shares based on the connection between their emissions and climatic changes. But even on such larger scales, making such connections between emissions and individual effects is a science that is only just emerging[277]. Also concerning is the question whether such levels of agency can meaningfully be consulted for identifying climate responsibility bearers as collective agents? Similarly, what measures of wealth should be candidates for the basis of a duty to act on climate change? Should emissions of the past, present, or projected future count? In general, we have to discuss what the prerequisites of climate responsibility are, how they should respectively be conceptualised, related to one another, and how they can meaningfully be attributed to and accepted by what type and level of agency. These questions are all relevant and can be asked and answered at different degrees of complexity and nuance.

Out of this overwhelming and controversial conceptual plurality, too many different, often incompatible and contradicting, behaviours can currently claim to be "climate responsible"[278]. Such conceptual plurality and disagreements over climate responsibility in turn feed into and intensify numerous and potentially momentous problems to effective and equitable climate governance[279]. Climate responsibility and the choices regarding its effective and equitable distribution currently pose such

[276] Jamieson, *Reason In a Dark Time*; Steve Vanderheiden, 'Globalizing Responsibility for Climate Change', *Ethics & International Affairs*, 25.01 (2011), 65–84 <https://doi.org/10.1017/S089267941000002X>.
[277] Link: Attributionsforschung (Friederike Otto: https://www.eci.ox.ac.uk/people/fotto.html)
[278] Okereke.
[279] For a comprehensive overview over explanations of disagreement on climate change, see Hulme.

issues because it is both indispensable and at the same time ill-defined. On the one hand, a practicable concept of climate responsibility is so central that climate negotiations' main purpose arguably is to find agreement on this concept[280]. On the other hand, the conflicting interests behind different conceptualisations of climate responsibility are so diverse that progress on finding a common understanding has been slow[281]. Some even argue that the subject should not be addressed but be abandoned completely to avoid the creation of further conflict over climate policies[282].

Climate responsibility – like other forms of responsibility – may also come as a choice requiring our acceptance. So far, we appear to be evolutionarily, economically, ethically, and politically ill-equipped to agree on what climate responsibility is, let alone act in accordance with it[283]. In light of the disagreements mentioned here, we seem in need of further conceptual guidance to make a defensibly right choice.

To contribute to such conceptual work in this chapter, I develop what a working background concept of climate responsibility should look like that respects the above-mentioned parameters. By a working concept, I mean one that fulfils the criteria of normative defensibility, empirical measurability, and practical usefulness developed in the previous chapters. In search of such a working background concept, I argue here that the literature has identified *sustainability*, *harm*, and *capability* as conceptual building blocks underlying climate responsibility[284].

Sustainability is required to distinguish "good" from "bad" in the context of climate change. To cut short the potentially never-ending inquiry into what this means, I employ the idea of a *sustainability threshold*. I argue for using the already scientifically developed and politically agreed-upon temperature limits of the Paris Agreement to roughly locate the sustainability threshold[285]. Harm is needed to identify irresponsible behaviour as that leading to *unsustainability* which can in turn be

[280] Douglas Bushey and Sikina Jinnah, 'Evolving Responsibility-The Principle of Common but Differentiated Responsibility in the UNFCCC', Publicist, 6.102 (2010), 1 (p. 1).
[281] Brunnée and Streck.
[282] Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'; Eric A. Posner and David Weisbach, *Climate Change Justice* (Princeton: Princeton University Press, 2010).
[283] Jamieson, Reason In a Dark Time.
[284] Andrew Eshleman, 'Moral Responsibility', *The Stanford Encyclopedia of Philosophy*, 2016 <https://plato.stanford.edu/entries/moral-responsibility/>; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Jamieson, *Reason In a Dark Time*; Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Shue, *Climate Justice - Vulnerability and Protection*; Shue, 'Global Environment and International Inequality'.
[285] United Nations, Paris Agreement.

translated into a moral requirement to accept climate responsibility. Sustainability and the corresponding threshold demarcating it from unsustainability determine what should count as harm, i.e., as irresponsible behaviour. Harm is thus conceptualised as individual or aggregated contributions (greenhouse gas emissions inconsistent with the sustainability threshold) to the collaborative causation of climate change[286].

The third climate responsibility building block – *capability* – limits the scope of what duties one can reasonably expect agents to accept in relation to their harmful activities. Capability as relevant for climate responsibility, I argue, comes in the subcategories of *knowledgeability* and *economic capability*. For both I again develop and defend respective thresholds to distinguish climate responsibility constituting activities from those that should not count as such. I again cut short a potentially irresolvable quest for determining whether an agent is above or below the *knowledge threshold* by simply proposing to work with existing self-declarations of *knowledge*. I think a convincing argument can be made that nations have been above the *knowledge threshold* at least since 1990 when the Intergovernmental Panel on Climate Change published its First Assessment Report. There are prominent arguments for earlier knowledge thresholds[287]. However, to exclude the possibility of excusable ignorance and so raise the practical usefulness of the concept, I defend 1990 as lowest common denominator. After 1990 there can be no more question that the knowledge threshold has been crossed. And regarding the *economic capability threshold*, I suggest starting with a right to development. It implies protecting a corresponding level of income below which agents should not be expected to bear climate responsibility[288]. The right to development is – perhaps unfathomably – still not yet fully established and continues to be questioned[289]. The economic capability threshold may thus need further support which it finds in prior agreement in the climate regime, most notably the principle of CBDR-*and respective capabilities*. With these preliminary considerations, we already see the contours

[286] The measurement of emissions as combination of income- and consumption-based emissions will follow in the next chapters.
[287] Baer and others; CSO Equity Review, 'After Paris: Inequality, Fair Shares, and the Climate Emergency'.
[288] Kartha and others, i.
[289] Moellendorf, Roser, and Heyward; Callies and Moellendorf; Darrell Moellendorf, 'Responsibility for Increasing Mitigation Ambition in Light of the Right to Sustainable Development'.

of how the basic building blocks of climate responsibility are related to each other. If harm, knowledgeability, and economic capability come together above the respective thresholds, agents acquire the moral agency and a moral demand for accepting climate responsibility.

The main building blocks of climate responsibility mentioned here have been identified before. Similarly, many of the core disagreements over the superordinate concept of responsibility are old philosophical stomping ground. Still, there is no broad agreement on which of these components should be conceptualised how exactly, play which role exactly, and on how exactly they should be related. This chapter thus aims to provide some focus and arrive at a more parsimonious[290] yet still working conceptualisation of climate responsibility. The focus here lies on the goal characteristics of normative defensibility which pertains to the background concept level of the methodological framework.

So, climate responsibility arises when we choose to accept forward-looking duties to act on climate change. Climate responsibility should correspond to current and backward-looking activities above the *knowledge* and *economic capability thresholds* which are inconsistent with the *sustainability threshold* and thus *harmful*. Climate responsibility in this sense and in accordance with Schmidt then comes not as obligation to be imposed upon agents from the outside. Instead, responsible actors have good reasons for converging on this concept of climate responsibility because they care about *sustainability* and want to act responsibly in light of their *harmful* activities, *knowledgeability*, and *economic capability*, despite the risks and uncertainties they face. I will spend the remainder of this chapter on further explaining and elaborating what this means.

After this introduction, section 4.2. will make some preliminary theoretical remarks to prepare the later substantive discussions. Section 4.3. discusses the *sustainability threshold* and *harm*. The *capability thresholds* are discussed in section 4.4. and section 4.5. consolidates the major points of the discussion and concludes by looking back and outlining the next steps for the following chapters.

[290] Gerring, 'What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences'.

4.2. Preliminary theoretical remarks

In this section, I discuss some preliminary theoretical remarks that are helpful to keep in mind to better understand how the argument progresses in the remaining chapter. This includes first, a distinction between *retrospective* and *prospective* responsibility (subsection 4.2.1.). It covers second, a distinction between *superficial* and *deep justifications* (subsection 4.2.2.). It involves third, a brief discussion of Peter Singer's *drowning child analogy*[291] as well as my own corresponding *drowning orphan analogy* (subsection 4.2.3.) and last, some very brief remarks on the interrelationship between *responsibility* and *justice* (subsection 4.2.4.).

Work on the notion of responsibility covers contributions to many fields and is most prominently rooted in philosophy, political theory, and legal theory. It has also found a central place in such fields as economics where it appears, for example, as instrument related to different forms of ownership and creates incentives, affects prices, and can so influence behaviour. Age old philosophical questions of free will, epistemological inquiries into the capacity for knowledge, as well as moral questions of what we ought to do or omit in light of facts remain as disputed as ever. Political theory has been interested in responsibility to erect better governance and representative structures, order the relationship between states and citizens, (re-)distribute resources and rights, and influence international affairs. And legal theory in turn requires concepts of responsibility to justify disciplining and punishing those who break laws and rules or offend against popular norms and institutions. All such engagements ask what responsibility is, what it requires, who can bear it and which kinds of behaviour should feed into it or be demanded by it[292]. In the process, scholars and practitioners from different backgrounds have posed fundamental challenges to the concept of responsibility which are threatening to shatter naïve understandings if we allow for deep philosophical contemplation. They include problems of free will, agency, and control and can add helpful nuance but sometimes also unnecessary complexity.[293]

[291] Peter Singer, 'Famine, Affluence, and Morality', *Philosophy and Public Affairs*, 1.3 (1972), 229–43 <https://www.jstor.org/stable/2265052>.
[292] Eshleman.
[293] Page, 'Give It up for Climate Change: A Defence of the Beneficiary Pays Principle'.

All this is to say that there are many different understandings and guises of responsibility. Think only, for example, of what might be entailed in causal versus moral responsibility, individual versus shared versus collective responsibility, historical versus current versus intra- versus intergenerational responsibility and so on. Instead of addressing each and all of them in turn, this section has to find and take defensible shortcuts to get to the positive creation and conceptualisation this chapter is tasked with. Some distinctions can help in narrowing down the complexity to arrive at a meaningful level of parsimony.

4.2.1. Retrospective versus prospective responsibility

As a first step in cutting through the thicket, a fundamental distinction between two faces of responsibility is in order. There is one understanding of responsibility that looks back, i.e., relates to past, already done deeds, and another, forward-looking, understanding that relates to what ought to be done[294]. While the two notions are conceptually related in that they can link agents and their behaviours to outcomes and morally appropriate reactions and consequences, their perspectives differ. The first understanding of responsibility relates to what agents have already done and to the outcomes they have contributed to or influenced through their behaviour. Responsibility in this backward-looking sense descriptively refers to past behaviours of agents that cannot be altered anymore. It can include mere causal as well as legal and moral dimensions while the latter two require the previous introduction of rules. Humans, non-human animals, as well as even objects can have such backward-looking responsibility in the sense that they can play necessary parts in the creation of outcomes. Intuitively, this understanding of responsibility could be described as "guilt" without, however, necessarily involving the moral dimension beyond the mere causal or legal ones[295]. To avoid the religious and potentially demotivating connotations of this term, I prefer and from now on use the term *retrospective responsibility* when referring to this backward-looking dimension.

[294] David Miller, 'Distributing Responsibilities', *The Journal of Political Philosophy*, 9.4 (2001), 453–71 <https://doi.org/10.4324/9780203623992>; David Miller, 'National Responsibility and Global Justice', *Critical Review of International Social and Political Philosophy*, 11.4 (2008), 383–99 <https://doi.org/10.1080/13698230802415862>; David Miller, 'Cosmopolitanism : A Critique', *Critical Review of International Social and Political Philosophy*, 5.3 (2002), 80–85 <https://doi.org/10.1080/13698230410001702662>; Jonas; Page, 'Give It up for Climate Change: A Defence of the Beneficiary Pays Principle'.

[295] Jonas, p. 173.

The second, forward-looking, understanding could alternatively be described and intuitively understood as willingly accepted *duty* or *obligation*[296]. To contrast it most clearly with retrospective responsibility, I will refer to it as *prospective responsibility*. This understanding does not describe what agents have already done and – perhaps unexpectedly – also not necessarily what they will in fact do in the future. Instead, it relates *prescriptively* to what they *ought*, from a moral standpoint, to do. Prospective responsibility relates to agents' current actions, to what they ought to have done in the past, and to what they ought now – based on past and present – to responsibly plan on doing in the future. In this sense, someone might have prospective responsibility to do something because they have entered a contractual obligation such as a professional role (e.g. policeperson, judge, teacher). Prospective responsibility may also arise because it is morally or legally required by mere membership to a jurisdiction without relation to any professional function.

So, while the overall term responsibility is often used indiscriminately for both retrospective and prospective responsibility, I will keep up the distinction where helpful. To further specify the distinction in the context of climate change, I will refer to *retrospective climate responsibility* as past activities that have contributed to bringing about the phenomenon of climate change. The terms *duty*, *obligation*, or *prospective climate responsibility* will then relate to what prospective responsibility shares should be borne by whom given prior agreement on what should be done overall in response to climate change. In other words, prospective responsibility comes with *superficial* or contractual *justifications*, rather than directly relying on a *deep* justification. The next chapter then addresses how retrospective and prospective responsibility should be systematically related to and inform one another.

4.2.2. Deep versus superficial justifications

The contractual sub-category of prospective responsibility just mentioned introduces a further distinction that is important to the later discussion of climate responsibility. Prospective responsibilities can either arise based on *deep* or *superficial* justifications[297]. The difference, in essence, is that deep justifications relate

[296] Jonas, chap. 4 II. 2.
[297] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Jonas.

prospective responsibility to globally accepted and widely held moral values that are typically rigorously derived, for example, by logic and in reference to some higher, shared, substantive values. Superficial justifications, by contrast, simply follow from one's commitments, promises, and contractual obligations without necessarily relying on or requiring reference to underlying, shared, global values. They are more concerned with internal consistency and typically ask what duties ensue once there is prior contractual agreement on some goal. The distinction is important in practice, when deep justifications are out of reach, but it is required to agree on responsible paths of action.

This distinction is crucial to how I propose to proceed in the search for a working concept of climate responsibility. As introduced above, responsibility and responsible behaviour must by definition and most essentially be directed at bringing about states of the world that we can – at least for convincingly defensible reasons – regard as good[298]. If this were not the case, behaviour that was directed at bringing about bad states of the world or not caring either way could also be called responsible. The concept would lose its meaning or even be turned on its head. To distinguish responsible from irresponsible behaviour, we must therefore at least to a working extent[299] be able to distinguish good from bad states of the world. While this may sound trivial at first, it points to some of the perhaps greatest, most fervently contested, and ultimately unsettled endeavours in the history of philosophy, politics, religion, and many other fields. The issue of telling good from bad has proved particularly thorny with regards to climate change. Dale Jamieson rightly points to our inherent and evolutionarily developed inability to distinguish good from bad properly and comprehensively when it comes to climate change[300]. It is one of the main reasons, we are ill-equipped to capture the problem and develop a morality system as well as effective policy and economic responses that both feel right and just as well as effectively responding to climate change. He argues that our predominantly individual, common-sense understanding of moral responsibility fails to capture climate harms in conceptual ways that could gain traction for holding people responsible and could motivate us to change our behaviours. The

[298] Schmidt, chap. 1.
[299] Meaning one that is normatively defensible, practically useful, and empirically measurable.
[300] Jamieson, *Reason In a Dark Time*, chap. 3.8.

"hardest problem" as Jamieson refers to it, is that "evolution did not design us to solve or even to recognize this kind of problem. We have a strong bias toward dramatic movements of middle-sized objects that can be visually perceived, and climate change does not typically present in this way"[301].

Alongside several other contributions[302], Jamieson's ensuing elaborate examination of why we have failed – in philosophy, politics, economics, and other fields – to adequately respond to climate change offers important analyses of the challenges and complexities in formulating this response. The debates surrounding what a perfectly adequate response should look like indeed remain unsettled and the question of what is good and bad ultimately unanswered – perhaps unanswerable. And yet, the search for an appropriate response to the challenge of climate change cannot wait for us to come up with an ideal or perfect reply that is agreeable to all[303]. Instead, given the time constraints we face and the complexity of the matter, I think there are three promising and non-exclusive options[304]. In all of them we must proceed pragmatically and use what helpful tools and shortcuts we can. Option A is to draw on the history of thought and work with existing conceptualisations of good, bad, and corresponding harm already developed in order to gather as much agreement as possible. If option A is insufficient and we find the moral tools already in our pocket inadequate, we may have to go beyond what is already there. Option B would then be to adjust existing concepts to the fundamentally new challenges posed by climate change. And if even that is not enough, we may have to further engage option C and develop a fundamentally new morality creating new concepts and moral intuitions as we go along. Jamieson spends large parts of his "Reason in a Dark Time" arguing that the existing instruments fall indeed far short of the challenges we face. In response, he argues we need a mixture of options B and C to develop a morally defensible answer[305]. In any of these options, however, I think we must hurry but be careful not to rush. We must look for shortcuts where possible

[301] Jamieson, Reason In a Dark Time, chap. 101.
[302] Posner and Weisbach; Hulme; Stern, 'What Is the Economics of Climate Change ?'; Stern, *The Economics of Climate Change - The Stern Review*; M L Weitzman, 'A Review of the "Stern Review on the Economics of Climate Change', *Journal of Economic Literature*, 45.September (2007), 703–24 <https://doi.org/10.1257/jel.45.3.703>.
[303] Jamieson, Reason In a Dark Time, chap. 9.
[304] Compare Jamieson's distinction between 'preservation', 'rehabilitation', 'extension', 'revision', and 'creation' Jamieson, Reason In a Dark Time, pp. 169–70 & 186–87.
[305] Jamieson, Reason In a Dark Time, chaps 6 & 7.

without cutting short what is essential. We must make haste to find a working – i.e., a *sufficiently* normatively defensible, *sufficiently* practically applicable, and *sufficiently* measurable – conceptualisation and distribution of climate responsibility. At the same time, continuing our search for a deeper, more carefully crafted, ultimately better conceptualisation is still meaningful. But while such a deep justification may hold a stronger claim on being right, it would most likely take us too long. To develop it before we run out of time and into the reality of "dangerous anthropogenic interference with the climate system" is increasingly unlikely[306]. As policymakers, public and private organisations, and individuals we cannot but work with the non-ideal tools at our disposal. We should carefully divide our time and resources between replacing or sharpening the knives we hold in our hand and continuing to cut into the urging matters we face.

In other words, I follow Jamieson's argument and agree that the complexity of the challenges posed by climate change overburden our existing moral, political, and economic systems. Simultaneously, however, I think we should not throw our hands up in despair and do nothing or wait for a perfect answer or technology to miraculously arrive on its own. Instead, I think we can still find sufficient agreement and large enough common ground on important, helpful shortcuts to move ahead. This would allow us to continue developing a working understanding and conceptualisation of climate responsibility in order to immediately be able and respond to the current challenges. At the same time, it may even create space for continuing our debates on the deeper understanding of both climate responsibility and other concepts needed in more sophisticated attempts at building a more complete, new morality for a warming world. The history of climate governance can in fact be described as a sequence of endeavours to meet the challenges with the tools we have while at the same time developing new ones that promise to do a more adequate, i.e., effective, equitable, and efficient job.

So, what could these helpful shortcuts or broadly agreeable lowest common denominators be on which a working concept of climate responsibility could be built? The history of philosophy has been marked by uncountable attempts at narrowing down the corridors within which reasonable debate over an answer may take

[306] UN; Darrel Moellendorf.

place. While certainly not being able to do these attempts justice here, I can at least point to the most important among them that are most relevant to the current purpose.

First and perhaps most fundamentally, just because the question "what is good" remains debated and just because responsibility requires being directed at the good, does not mean we cannot reasonably engage with the question what responsibility is before we have settled the question what is good. Instead, it just means that we cannot yet – or ever – give a precise answer with ultimate certainty or absolute inevitability. What we can do, however, is give reasons and arguments in support or against different answers which in turn can be stacked against each other and evaluated based on their respective merits and shortcomings. We may thus not be able to narrow down exactly what responsibility is, but we can still agree that it must have something to do with being able to give reasons for one's choices and actions. This in turn requires being able to argue why we regard certain understandings of the good towards which we direct our arguably responsible actions as more appealing than others. Responsibility in this sense refers to one's ability to present convincing reasons and arguments, i.e., to give a justifiable response when being questioned morally[307].

So, the most basic point is that the search for responsibility is not generally in vain just because we cannot yet or ever fully agree on what is the ultimately good. Beyond that, the greatest contributions throughout the history of philosophy have shown that good and bad may depend on three – often compatible but other times irreconcilable – levels. First, what is morally good or bad may depend on our will, intentions, and the motives underlying our behavioural choices, actions, and outcomes. Second, it may depend on how virtuous or vicious our characters and actions can in themselves be regarded as. And third, it may depend on whether the consequences of our actions, i.e., the outcomes we (help) bring about can arguably be viewed as good or bad. The corresponding philosophical strands of deontology, virtue ethics, and consequentialism as well as the works of their most influential

[307] Schmidt, chap. 1.

respective representatives (Immanuel Kant[308], Aristotle[309], and John Stuart Mill[310]) regard these three levels as respectively morally decisive. They are, however, too deeply divided and too fundamentally different in their respective approaches that their conflictive conclusions could be adequately addressed in the present search for climate responsibility. Respectively making an exclusively deontological, virtue ethical, or consequentialist argument here of what should be regarded as good or bad risks opening up too many flanks to the respective other philosophical traditions. This approach would thus fail to be helpful to my search for a working background concept of climate responsibility. The road to climate disaster may be paved with the best intentions, the most virtuous characters both at the political, economic, and individual levels of decision-making, or most advanced attempts at calculating the highest possibly attainable utilities. At the same time, without the respective strengths of all these philosophical approaches, we may not progress as effectively, equitably, and efficiently as possible either, meaning that I think we need to find out on which aspects of these individual approaches all of them could agree.

An important pragmatic shortcut I therefore suggest, is taking a way around the problem of finding out what should be regarded as good and bad in an exclusively deontological, virtue ethical, or consequentialist fashion. I instead suggest building the background concept of climate responsibility on an encompassing foundation agreeable to all three philosophical approaches[311]. It can be found in the moral value of keeping one's promises, contractual and legal obligations, as well as sticking to political agreements. This relates to the distinction between "deep" and "superficial" justifications[312]. From a deontological perspective, keeping one's promises is all important. Lying, deception, paddling back from one's agreed duties would all be viewed as in some way or other treating others not as ends in themselves but as mere means to one's own ends. It would in this sense undermine the categorical imperative. From a virtue ethical perspective, too, keeping one's promises is an

[308] Immanuel Kant, *Critique of Pure Reason*, ed. by P. Guyer and A. Wood (Cambridge: Cambridge University Press, 1998); Immanuel Kant, *Groundwork of the Metaphysics of Morals*, ed. by Mary Gregor and Christine M. Korsgaard (Cambridge: Cambridge University Press, 1998).
[309] Aristotle, Nicomachean Ethics, ed. by Terence Irwin (Indianapolic Indiana Cambridge Massachusetts: Hackett Publishing Company Inc, 2019).
[310] John Stuart Mill, On Liberty and Other Essays, ed. by John Gray (Oxford, 2008).
[311] Not unlike Rawl's method of an 'overlapping consensus' developed in John Rawls, *A Theroy of Justice* (Harvard University Press, 1971) <https://www.jstor.org/stable/j.ctvjf9z6v>; and John Rawls, *Political Liberalism* (New York: Columbia University Press, 2005).
[312] Jonas, pp. 178–79; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*, p. 124.

important way to exercise one's virtue of truthfulness and draws on other virtues such as temperance, courage, friendliness, patience, and justice. The consequentialist case is somewhat trickier. From a consequentialist and particularly utilitarian perspective, it may at times be preferable to break one's promises or to not make them in the first place, so long as this raises expected utility. However, even from a consequentialist perspective, especially considering the prominence of rule consequentialism, a reliable institution of making and holding one's promises is typically regarded as beneficial. The resulting atmosphere of trust and co-operation holds promise of eventually higher utility than its alternatives of mistrust, dishonesty, and ultimately fear of deception[313]. Darrel Moellendorf regards the duty to keep promises contractual obligations in climate agreements as important and often practically useful "second order" obligations that we hold even if there is not (yet) underlying deep agreement on good and bad[314].

Most importantly, therefore, I think we should logically, practically, and morally be able to agree that once we have entered contractual relationships and have made promises built at least on working understandings of what is good and bad, responsible behaviour ought to be regarded as that which is directed at the former and cannot be that which is directed at the latter. I may have a different view from others about what is good and bad. But once I agree with someone at least on a working concept of what we together regard as good or bad in a certain, bounded context, and even perhaps only for a limited amount of time, we should no longer disagree about the question that the responsible thing to do would be to (help) bring about what we agree is good. We may, therefore, not ultimately or as a matter of undisputable fact know what is good and bad in terms of climate change. But once we agree on something despite our potentially persisting imperfect knowledge, we can begin distinguishing responsible from irresponsible acts.

For example, while we can agree that we want to avoid "dangerous climate change", we may not know at what temperature increase exactly we will ultimately have crossed the boundary and entered a world with "dangerous climate change". And while we may find agreement on such respective temperature limits too, it may

[313] c.f. Brad Hooker, 'Rule Consequentialism', in *The Stanford Encyclopedia of Philosophy*, ed. by Edward N. Zalta, 2016 <https://plato.stanford.edu/archives/win2016/entries/consequentialism-rule/> [accessed 17 April 2018].
[314] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change, pp. 139–40.

remain in question what exactly and practically follows from them. With each more specific agreement about what should be considered *sustainable* or *unsustainable* respectively, a correspondingly more concrete understanding of climate responsibility can be built. I will return to this point in subsection 4.3.1. below.

4.2.3. The drowning child and drowning orphan analogies

Philosophical reasoning often progresses by employing analogies and giving examples. Related to climate change, many analogies for describing the science (e.g., "the greenhouse", or "the bathtub"), as well as the related policy dilemmas (e.g., "tragedy of the commons", "market failure") have been proposed to exemplify crucial insights. What such examples, analogies, and models have in common – and are often perhaps too rashly criticised for – is that they simplify reality to direct attention to what is regarded as most important. Focusing on what is essential can help to then draw conclusions which strive for external validity regarding the more complex reality to which they pertain.

Although it was originally written in response to the suffering ensuing from the 1971 Bengal refugee crisis and to promote a corresponding ability-based understanding of responsibility, the landmark "drowning child analogy" by contemporary Australian moral philosopher Peter Singer has become a cornerstone analogy for climate responsibility too[315]. The analogy is also helpful to lead us through the arguments in this chapter so let us briefly recap it here to then revisit it in the following sections where appropriate.

Peter Singer asks us to imagine coming across a child drowning in a shallow pond. Our clothes might be ruined if they get in touch with muddy pond water and there is no one but us witnessing the drowning child. Peter Singer argues anyone should and indeed would agree that in this scenario we have a moral duty to save the child from drowning even if this ruins our clothes or implies similar consequences of relative insignificance, for example, that we would be late for work. Singer then goes on to argue that if we agree to the baseline argument, our duty to save the child must remain unchanged even if there are others around who could as well save the child. It remains further unchanged even if our costs of saving the

[315] Singer, 'Famine, Affluence, and Morality'; Avram Hiller, 'A "Famine, Affluence, and Morality" for Climate Change?', *Public Affairs Quarterly*, 28.1 (2014), 19–39.

child would be higher than "just" the clothes we are wearing. And it remains in place even if we do not meet the child by chance because it happens to be nearby but when we learn of any drowning child anywhere we could interfere[316]. The only thing that matters, according to this analogy, is that we have the ability to save the child at no significant cost to ourselves. In Singer's own and generalisable words "if it is in our power to prevent something bad from happening, without thereby sacrificing anything of comparable moral importance, we ought, morally, to do it"[317]. Our ability to save the child combined with the utilitarian argument that the costs to us would not be of equal moral significance, lead to the conclusion that we should choose to accept and act on a moral responsibility to save the child.

The drowning child analogy has over the years been subjected to different versions of support and criticism and been transferred to different contexts. In this tradition, several contributions to the relatively recent literature have drawn on the drowning child analogy to arrive at conclusions about climate responsibility[318][319]. In Avram Hiller's "A 'Famine, Affluence, and Morality' for Climate Change?", for example, the author argues that climate change related harms should be regarded as logically analogous to the harm suffered by Singer's "drowning child". A duty to respond by acting against or preventing to contribute to climate change arises not necessarily because one may have contributed to the phenomenon, or because others do not step in. It arises simply because one has the ability to act and thereby prevent something bad from happening[320]. One's moral obligation, i.e., one's prospective climate responsibility here arises out of one's ability to effect positive change to climate change.

Beyond the moral conclusions contained in the drowning child analogy, it is helpful to my search for a background concept of climate responsibility. It points to some of the necessary conceptual ingredients – or building blocks – needed to construct a background concept of climate responsibility. First, we learn, responsibility requires a distinction between good and bad states of the world. In the

[316] Singer, 'Famine, Affluence, and Morality', pp. 231–32.
[317] Singer, 'Famine, Affluence, and Morality', p. 231.
[318] Elizabeth Cripps, Climate Change and the Moral Agent: Individual Duties in an Interdependent World (Oxford: Oxford University Press, 2013).
[319] Hiller.
[320] Hiller, p. 24.

drowning child analogy, this most simply corresponds to a child that is saved versus one that drowned. In the case of climate change, it corresponds to a world without and a world with harms resulting from climate change. Second, we learn that knowledge of the good and bad alternatives as well as our ability to interfere is required for us to have responsibility. While geographical distance or group membership do not matter in Singer's analogy, someone who can be expected to have prospective responsibility must know about the harm underway and must know about their own ability to interfere. Third, we learn that the ability to interfere is regarded as the key basis of prospective responsibility. And fourth, we see that once we have these characteristics, we combine in us what is required to be a moral agent capable of bearing prospective responsibility. We are then indeed morally called upon to accept this responsibility.

What is notoriously missing from this example, however, is an answer to the question how the child got into the pond to begin with. The question what created the bad outcome we face, however, appears to be crucially relevant for retrospective as well as prospective climate responsibility. The creation of the phenomenon is widely accepted as relevant input into the ensuing quest for distributing prospective responsibilities[321]. Without including how climate change was brought about, climate responsibility would be blind on its backward-looking face. Greenhouse gas emissions and other types of climate-changing behaviour would no longer be relevant to the question who should be regarded as climate responsible. It is important to appreciate, however, that the inclusion of retrospective responsibility does not contradict Singer's conclusion that ability to prevent harm (which includes knowledge) alone may be a sufficient precondition of prospective responsibility. In Singer's analogy, ability is just the only *relevant and available* input into prospective responsibility which shows that it can be sufficient. It does not show, however, that if there were other relevant inputs, they should not matter or should be trumped by ability.

To increase the external validity and acceptability of the drowning child analogy in the context of climate change the question of how the bad outcome was brought about is relevant. It helps to better understand how prospective climate

[321] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.

responsibility should respond to the creation of harms. Hiller seems to agree that we should include the question what created a bad outcome. In his well-known climate change related equivalent of the drowning child analogy, he employs the notion of the "Sunday drive". It serves as example of an act which – through its contribution to climate change and the correspondingly expected harmful effects – should be avoided if this prevents something bad from happening[322].

To explore this further, let me discuss an extended version of the drowning child analogy which includes individual contributions to the collective causation of *harm* that offer further insights about climate responsibility. Since the situation with climate change is more complicated in several and relevant ways, the basic drowning child analogy should be adapted to capture them. I refer to the following analogy as the *drowning orphan analogy* for easier reference and distinction from Singer's drowning child analogy and to deliberately preclude the potentially relevant existence and role of primary caregivers. The drowning orphan analogy serves several purposes, some of which go beyond what the drowning child analogy offers. First, it includes an account of what brought about the bad outcome to be avoided. Second, it shows that individual contributions matter and it may be able to measure them but that they cannot be directly related to resulting individual harms. Third, it incorporates the idea that capability (both in its knowledgeability and economic capability dimensions) matters. Fourth, it includes a temporal dimension to illustrate relevant aspects of intergenerational climate responsibility. Fifth, it shows that there are different kinds of costs involved both in action and inaction. And last, it shows that co-ordination is required as individual capabilities are insufficient to preventing the bad outcome.

First, let us start the drowning orphan analogy earlier and imagine an orphaned child sitting on its own in a secluded cave that provides it with enough to survive. Suppose the cave is hard to reach even if there was knowledge of a passable path to it. It has a tilted floor, so different areas of the cave are higher lying than others. The cave is situated in a convoluted cave system in a large mountain permeated by mines. Working in and further developing the mines in turn represents the whole

[322] Hiller, p. 24.

economy of the scenario and provides sustenance and income, pleasure and meaning to the whole population living in it.

Imagine further that over a long period of time, groups of unacquainted strangers would take turns working in the mines. Their work crucially requires pumping groundwater out of and digging new mines and chambers into the mountain. Slowly but steadily, the passages built to lead the water out of the mountain start eroding and some of the water that escapes finds its way into the orphan's cave. Furthermore, long periods of work have contributed to undermining the mountain's structural integrity. The groups continue coming and going and continue pumping and digging with ever greater speed enabled by ever newer technologies. As important additional feature, suppose that the groups are each respectively large enough to keep the water flowing. At the same time, none of the groups alone worked long enough in the mines to completely fill up the orphan's cave or weaken the whole mountain enough to collapse. At some point in time, each group is respectively exhausted and exits the scene, never to be seen again. Also, the groups are respectively large enough that each individual group member can, and indeed does, at times take a break from pumping and digging and lets the others push on. Eventually, they join in again and continue helping so that others may take a break and rest. Some of the individuals depend on working in the mines to make a living, some do it because they found out how to make excess economic gains, and some do it for fun.

As the scenario progresses, the orphan's cave is slowly but steadily filling with water and losing oxygen on which the orphan depends for survival. The last group standing and working in the mines begins to realise what is happening. Having developed a new science and corresponding technology for scanning the whole mountain, the last group begins to learn about the cave, the orphan, and the dismal state of the mountain's structural integrity. Some participants stop mining immediately, others cannot or do not want to stop, and yet others refuse the new science unveiling what is happening. Overall, the realisation and acceptance grows that mining may have to stop completely or be reinvented fundamentally should people choose to prevent the orphan from drowning and the mountain from eventually collapsing.

After numerous, long negotiations, agreement is reached that the orphan must be pulled out of the cave and that if this is done soon enough, it may just make it. Furthermore, agreement is reached that the mountain is to be saved, meaning that new ways of mining which provide as much or more to the population, will have to be developed and soon. However, neither one of the group-members has the ability to save the orphan on their respective own or develop the new ways of mining. At the same time, neither one of them are respectively required to help either. Debates ensue over how far and over the ways in which the orphan could be saved, what should happen to those who depend on current ways of mining to make living, and – perhaps most contentiously and generally – who should contribute how much.

Like the drowning child analogy – and any illustrative example that is not a fully detailed depiction of the real world – the drowning orphan analogy may be criticised for being simplistic[323]. It is an analogy and, in this sense, does not have to be overly detailed or even realistic in its entirety. Its purpose is to bring across and focus on the main tasks outlined above and so serve to illustrate the following arguments. In relation to the building blocks of a climate responsibility background concept, the drowning orphan analogy holds valuable insights which despite their potential simplicity retain sufficient external validity to warrant further discussion. In contrast to the drowning child analogy, the drowning orphan analogy illustrates some of the complexity and difficulty involved in identifying different forms of climate change related harmful behaviour and in holding people prospectively responsible in corresponding effect. While the drowning child analogy would be enough to support a conception of prospective climate responsibility built on ability alone, more nuance is required to arrive at a conception that also accounts for contributions to bad outcomes. Furthermore, the drowning orphan analogy allows for the discussion of different levels of agency and whether and how the responsibilities of some agents are influenced by those of others. It also demonstrates that the search for an agreeable distribution of prospective responsibilities based on contributions to the bad outcome is likely to be immediately fraught with numerous disagreements.

[323] Jamieson, Reason In a Dark Time, chap. 6.2.

However convincingly, earlier groups mining the mountain may claim that their actions did no harm as the orphan was still in no danger when they worked, and the water entering the cave had not even covered its floor. Later groups may argue that they only followed in the footsteps of earlier groups and that the water already leaking into the mountain had begun moving on its own. In this argument, the water was solely following the momentum built by earlier pumping activities. All groups but the last may claim ignorance of the harm brought about by their actions. And, most importantly for the idea of individual responsibilities, each individual group-member may convincingly argue that their own contribution was irrelevant for the eventual outcome which had occurred no matter what they did. This is what contemporary climate ethicist Dale Jamieson refers to when arguing that our current ways of relying on conceptions of individual moral responsibility are ill-equipped and insufficient to capture and distribute climate responsibility.

Just as it is hard or impossible to find out how much each individual digging or pumping contributed to harm, so it is hard or impossible to determine the harmful effects of individuals' emissions. Once emitted, individual CO_2 molecules, as most prominent example of greenhouse gases, may travel the world and contribute to global warming for hundreds of years. But they may just as well be captured and stored minutes after emission either by natural processes and sinks (such as photosynthesis or oceans) or technological solutions (such as carbon-capture and storage). In such latter cases, they never develop any climatic effect. And to complicate things even further, CO_2 and other climate changing emissions may be emitted first, then be captured in sinks such as oceans, and then be re-emitted following natural effects or the climate change already underway.[324] While this may make measuring individual contributions to climate change based on individual emissions not entirely impossible, it certainly complicates measurement enough to make it impracticable and to offer argumentative ammunition to those who are – however justifiably – opposed to individual responsibilities for climate change. These problems and their relation to the drowning orphan analogy will be revisited below.

[324] Jamieson, Reason In a Dark Time, p. 162.

4.2.4. Responsibility and justice

Responsibility and justice are deeply interrelated[325]. The same holds for climate responsibility and climate justice[326]. As I alluded to in the introduction section 4.1. above, responsibility most basically requires first searching and defining what is good and then choosing to strive for it. Justice can serve as moral goal to be regarded as good and responsibility can and should in turn take justice as goal into account and attempt to direct action towards it. For climate responsibility, this brief reasoning holds several implications. First, sustainability as goal towards which climate responsibility is directed can be reached in either just or unjust ways, a distinction that comes in degrees. A sustainable outcome that can simultaneously be described as just is morally preferable to one that is to be regarded as unjust. This is why the international climate regime has enshrined equity as goal characteristic and it follows directly if the right to development is taken seriously. Climate responsibility and its equitable distribution should thus most fundamentally encourage acts that can be defended as both supporting sustainability and justice. In essence, climate justice here implies that the distribution of climate responsibilities should take harmful contributions, capabilities for bearing climate responsibility, and relevant vulnerabilities into account while distributing burdens of a process aimed at bringing about a just outcome.

With the distinction between retrospective and prospective responsibility and the analogies as well as superficial versus deep justifications discussed here in mind, I will now turn to the search of climate responsibility building blocks. This will include addressing some of their most serious issues, and how they could and I think should be dissected, re-interpreted, and then re-combined, to erect a more solid background concept of climate responsibility.

4.3. Sustainability and harm

This section develops the first building blocks of climate responsibility: *sustainability* and *harm*. They are interrelated in that sustainability – and the corresponding *sustainability threshold* separating sustainability from unsustainability –

[325] Rawls, *A Theroy of Justice*; Miller, 'National Responsibility and Global Justice'; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*, chap. 153.

[326] Caney, 'Justice and the Distribution of Greenhouse Gas Emissions'; Simon Caney, *Justice beyond Borders: A Global Political Theory* (Oxford: Oxford University Press, 2005) <https://doi.org/10.1057/palgrave.cpt.2007.15>; Caney, 'Just Emissions'; Shue, *Climate Justice - Vulnerability and Protection*.

determine what should count as climate responsibility related harm. Such harm essentially arises when activities lead to unsustainability. However, as I will further develop in section 4.4. below, this broad definition of harm must in a next step be further restricted by capability.

4.3.1. The sustainability threshold – distinguishing sustainable from unsustainable acts

Throughout its history from the early 1970s to the 2015 Paris Agreement and its subsequent operationalisation and implementation, international environmental governance has searched for effective and equitable guiding principles. They are meant to simultaneously enable the goals of development, i.e., advancing our standards of living on earth, and of protecting its natural foundations[327]. From an abstract and collective perspective, climate change is thus a concern most essentially because it threatens current and endangers future living standards. Abstractly and collectively again, our productive and consumptive activities have their essential purpose in enabling and sustaining as well as improving and enhancing living standards. In the drowning orphan analogy, the whole mining endeavour is meant to provide and enhance living standards.

But if these same patterns of production and consumption or their side-effects undermine their own long-term purposes and the natural foundations they depend upon, they cannot be sustained. "Sustainable development", therefore, rose to prominence in the 1980s as a "fundamental norm"[328]. It was popularised, for example, by the so-called "Brundtland Report" which represented an early and significant attempt to combine the two potentially conflicting aims of development and sustainability[329]. Climate change had not yet risen to anywhere near its current salience back then. Even within international environmental governance, it was still trumped in significance by other concerns such as the depletion of the ozone layer or disastrous risks of nuclear catastrophe. However, international governance

[327] This point, motivating the whole dissertation is more thoroughly developed in sections 2.1. and 2.2.

[328] In Wiener's sense of the word although she does not apply it to sustainable development but to sustainability Antje Wiener, *A Theory of Contestation* (Heidelberg: Springer, 2014).

[329] Lavanya Rajamani, 'From Stockholm to Johannesburg: The Anatomy of Dissonance in the International Environmental Dialogue', *Review of European Community and International Environmental Law*, 12.1 (2003), 23–32 <https://doi.org/10.1111/1467-9388.00341>; United Nations World Commission on Environment and Development, 'Brundtland Report: Our Common Future', *United Nations*, 1987 <https://doi.org/10.1016/0022-2364(91)90424-R>; Jamieson, *Reason In a Dark Time*.

structures had at least begun to realise the important and multifaceted interrelations between environmental sustainability and prospects of economic and human development.[330] Sustainability in development was beginning to emerge as the "good" towards which action was to be directed. All major climate agreements have since further established this overarching goal in the climate governance regime.

This is a suitable place for returning to the distinction between deep and superficial justifications made in subsection 4.2.2. above. Despite a persistently looming lack in ultimate moral knowledge, we already have – perhaps still broad, but ever more precise – agreement on what is good and bad as respectively *sustainable* and *unsustainable* in terms of climate change. In chapter 2, I examined how the international community has been arriving in a stepwise fashion and with plenty back and forth at ever more agreement on the phenomenon and consequences of as well as response to climate change. This process so far culminated in the 2015 Paris Agreement and countries' ensuing pledges to act. We are continuously narrowing down on the relevant thresholds distinguishing *sustainability* from *unsustainability* scientifically and have politically and legally binding agreement on temperature limits. The 1992 UN Framework Convention on Climate Change still rather broadly spoke of "dangerous anthropogenic interference with the climate system". The second article of the Paris Agreement has since translated this into the 1.5°C and 2°C temperature limits[331]. And on such already found agreements and the ensuing promises made, instead of a deep, underlying, potentially unobtainable moral agreement about good and bad in general, I suggest beginning to base the background concept of climate responsibility.

Building on such established agreement, climate responsibility requires a sustainability threshold that distinguishes sustainable from unsustainable behaviour. The sustainability threshold thus aims to distinguish good from bad in terms of climate change, i.e., what is climate responsible from what is climate irresponsible. Climate responsible action is that which can be shown to be in line with sustainability while the opposite holds for climate irresponsible acts. Prospective climate responsibility should then be distributed in some – to be further specified – relation

[330] For a more thorough discussion of the history of climate science and governance, s. chapter 2.
[331] UN; United Nations, *Paris Agreement*.

to climate irresponsible, i.e., unsustainable acts. The previous and next chapters go into more detail regarding the exact types and extent of agreement we have on what to regard as good or bad in terms of climate change. Here, at the philosophical level of the background concept, it is enough to say that we agree that crossing a sustainability threshold beyond which we enter a world with a high risk of dangerous climate change, i.e., one above the agreed-upon temperature limits is bad and irresponsible and that it would be good and responsible to remain below the limits.

4.3.2. *Harm* as contributions to unsustainability

Based on this sustainability threshold, we can now enter the discussion and conceptualisation of harm as further building block of climate responsibility. A normatively defensible conception of climate responsibility requires as essential building block an understanding of harming as emitting greenhouse gases that are inconsistent with the sustainability threshold.

Harm is widely regarded and intuitively accepted as an essential basis of responsibility[332]. As I discussed above, Singer regards ability to prevent harm as essential and sufficient constituting element of responsibility. But in his drowning child analogy, there was no-one with retrospective responsibility for the bad outcome, meaning it is silent on the relationship between active harming and responsibility. Besides retrospective responsibility, there are other bases of prospective responsibility that can be defended as sufficient in the right circumstances. But if retrospective responsibility can be defined, an agent's prospective responsibility should in some way or other correspond to their retrospective responsibility for bringing about harm. To give a brief overview on conceptualising harm, Andrew Linklater draws on the work of many other contributors to authoritatively and comprehensively distinguish between nine different forms of harm in his "The Problem of Harm in World Politics" as follows[333]:

1. Deliberate harm (e.g., murder)
2. Humiliation and stigmatisation (e.g., insult)
3. Undetected and unintended harm (e.g., harm brought about by spreading as of yet undetected diseases)

[332] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[333] Andrew Linklater, The Problem of Harm in World Politics (Cambridge: Cambridge University Press, 2011), pp. 51–61.

4. Negligent harm (e.g., resulting from failure to take "reasonable precautions to avoid harming others")
5. Exploitation (e.g., unfairly benefiting from others' vulnerability)
6. Complicit harm (e.g., disadvantaging others by association with institutions and their practices)
7. Acts of omission and other negative understandings of harm (e.g., not helping to end or to not bring about harm)
8. Public harm (e.g., damaging "social or political institutions" with the responsibility to establish or protect "what might be called 'primary' harm conventions")
9. Structural harm (e.g., adverse effects to people or groups "by systemic forces that bind them together").

Linklater's conceptual map is an example of existing concepts we can draw on. From it, we can see that harmful actions can generally be regarded as different forms of (contributing to) bringing about different forms of bad states of the world. Bad states of the world are all those in which rights holders[334] experience some form of harm, in the sense of a constriction of their rights, that can in relevant ways be connected to the actions or omissions of other agents. If the last form of harm is included, it can also relate to structures. In the basic version of the drowning child analogy, we can now see that harming appears only in a passive form. "Not helping the child" falls under Linklater's harm variant number seven, i.e., "acts of omission". More encompassing analogies such as the drowning orphan analogy would then further be interested in how the child got into the cave to begin with and whether there was blameworthy behaviour involved in filling it with water. Similar considerations would then go into determining responsibility for the mountain's imminent collapse or the equivalent "tipping points" in relation to climate change. Depending on how exactly the groups in the drowning orphan analogy go about their mining activities and how exactly the inter- and intragroup relations are structured, their behaviour could count as harm under many if not all of the categories Linklater lists. To answer what should generally be conceived as harmful actions,

[334] Which according to many thinkers, most influentially Peter Singer, should include non-human animals as well: 'All Animals Are Equal', Philosophic Exchange, 5.1 (1974), 103–16.

we must therefore first be able to determine what counts as experiences of harm in the party wronged. And second, we must determine what should count as relevant connection between their experiencing harm and the actions of others which would in turn become instances of harming.

A second general and important observation we can make here is that the nine forms of harm Linklater lists did not fall from the sky or appear simultaneously. Instead, they each first had to be experienced and suffered, then consciously identified, socially ever more accepted, until they could ultimately politically and legally be established. In the drowning orphan analogy, this issue comes up in relation to new knowledge and its dissemination about the previously unknown dangers involved in mining. Such processes of recognising different forms of harm as such have typically taken a very long time and are still ongoing in all categories, at least concerning their respective detailed understandings and the extent of their recognition. Think, for example, of the concept of genocide which took long before it achieved political and legal recognition as a new category of harm[335]. Does this mean that there was no genocide before it was identified as such? The physical acts of harming involved cannot be changed ex post. But their classification as genocide has entailed a new political and legal status and recognition that can more easily and systematically be translated into corresponding prospective responsibilities. With its recent official recognition of having committed genocide during its occupation of Namibia in the late 19th and early 20th century, for example, Germany has now pledged financial aid as a way of taking on prospective responsibility in response to the atrocities[336]. This, however, also demonstrates that what is recognised as harm has apparently always been a matter of at least some choice and social acceptance rather than mere material or objective fact. It also demonstrates that the above list can be and is in fact constantly in flux with new interpretations being added to or replacing existing ones. With these general remarks in mind, let us turn to the climate change context.

From the second general observation about Linklater's list arises a third which is related to the three options mentioned above for how to proceed with our moral

[335] c.f. Samantha Power, A Problem From Hell: America and the Age of Genocide (New York: Harper, 2002).
[336] BBC, 'Germany Officially Recognises Colonial-Era Namibia Genocide', 2021 <https://www.bbc.com/news/world-europe-57279008>.

concepts given the new challenges posed by climate change. When deciding whether to rely on existing concepts (option A), change them (option B), or come up with completely new ones (option C), we can now appreciate that the lines distinguishing these options are blurry and vague. Instead of being exclusive, all of them have always been in constant and simultaneous employment. Climate change may indeed pose new challenges to our morality, but the fact that it does pose new challenges is not new. In this sense we can proceed by asking how far existing, already agreed-upon concepts can reach without change. Simultaneously, however, we can already begin asking in what ways they may have to be adapted or complemented to fit their purpose of identifying and conceptualising prospective climate responsibilities in some correspondence to retrospective responsibilities in the shape of harmful activities. This may require varying degrees of political will and some division of attention, but it is in no regard a qualitatively unusual or fundamentally new endeavour.

So, to conceptualise an understanding of harm relevant to climate responsibility, we should and now can give a somewhat more involved account. For an agent to bear responsibility for a harmful outcome, the outcome must classify as harm and there should optimally be a constituting connection between that agent's behaviour and the resulting harmfully experienced outcome. Whether or not the outcome classifies as harm (and as which kind) can be a matter of just as much debate as the nature and strength of the connection between an agent's behaviour and the outcome. If an agent possessing free will and the autonomy to act on it decided to knowingly perform some action and thereby bring about an outcome over which he or she has full control and which is universally regarded as harm, that agent could be morally demanded to accept full responsibility. At the same time, without the outcome being harmful and without any connection between the outcome and an agent's behaviour, no acceptance of responsibility can be demanded of the agent on the basis of harm. Unfortunately, such pure cases are rarely if ever found. With respect to climate responsibility, we are uncomfortably located somewhere in between these extreme and clear cases.

In most instances, moral and legal responsibility based on harm thus arises when one individual harms another, i.e. when individual causes and effects are

identifiable and can be attributed to individual persons. Conceptualising climate responsibility based on harm, however, poses a problem in this regard because such individual links cannot (yet) be established. The scientific community has arrived at a broad consensus view beyond a reasonable doubt. Climate change is real, it is caused primarily by the increasing stock of anthropogenic greenhouse gases, and they are in turn by and large brought about by excessively burning fossil fuels[337]. Beyond the scientific consensus, the overall connection between rising emissions stocks in the atmosphere and climate change has been recognised politically[338]. And third, the resulting expected and already observable consequences of climate change are recognised as different forms of harm. Not accepting disastrous consequences of the increasing number and intensity of droughts, storms, and floods as forms of harm would be very surprising to say the least. However, while these overall links between the increases in global atmospheric greenhouse gas stocks and the global phenomenon of climate change have been established beyond a reasonable scientific doubt and have been agreed upon in international political agreements, they still cannot be broken down into individual harmful acts and corresponding outcomes. Individual harm-based conceptions of climate responsibility thus indeed fall apart, as discussed along Jamieson's reasoning above, if they require connections between individual emissions and individual harmful outcomes.

The drowning child and drowning orphan analogies help illustrate this further. In the basic version of the drowning child analogy there is one individual with knowledge of unfolding harm and the ability to step in and stop it. Clearly, this individual is the only one who could prevent harm from occurring and therefore can be identified as fully responsible for the harm (specifically: for being retrospectively responsible for the omission to prevent harm) if he or she decides not to step in. It is, however, currently impossible and may never be possible to build an argument for harm on which to rest climate responsibility such as:

1) Some person A drove to the supermarket emitting X amount of greenhouse gases into the atmosphere along the way.

[337] IPCC, 'Climate Change 2014 Synthesis Report Summary Chapter for Policymakers'.
[338] See subsection 4.4.1. below as well as chapter 2.

2) These emissions led to increased greenhouse gas stocks in the atmosphere which in turn caused an incremental temperature increase of Y °C in the atmosphere.
3) The temperature increase of Y °C in turn created the build-up of a storm at some future time and at some distant place.
4) The storm harmed another person B by Z $.
5) Therefore, person A is retrospectively responsible for the harm inflicted upon B and should correspondingly accept being prospectively responsible for compensating B for Z $.

We simply cannot currently establish the individual links necessary to make this argument. And even if it were possible scientifically, how could such an argument hold up in court, especially when there were other contributing factors – or persons and their emissions – connected to the harm, if causation and harm fall to different jurisdictions, or occur over long periods of time during which the emitters may have died? In Jamieson's sense we can thus indeed say that the current moral and legal terms built around individual moral responsibility are inept to deal with causes and effects of harmful climate changing behaviour.

So, what choices have we to overcome the current inability to establish an individual harm-based conception of climate responsibility? Three ideas come to mind that correspond to the above-mentioned options of working with existing concepts, extending them, or replacing them. First, we could improve our ability to detect and trace links between climate changing individual causes and effects and then work with existing concepts of individual harm-based climate responsibility. Second, we could attempt to establish links between larger than individual climate changing causes and effects and assign collectively shared but divisible responsibility for them. Or third, we could change the understanding of harm needed.

The first option would require improving our technical ability to track individual emissions to their climate changing effects and harmful outcomes. This option, however, appears as very unlikely to ever become a reality, let alone in the limited time left to not breach the sustainability threshold corresponding to the temperature limits. Our ability to understand the factors influencing climate change is constantly improving. But it remains unlikely that it will ever be possible – let alone anywhere

near cost-effective – to trace individual emissions through the earth's climate to potential future damages done to distant values and rights holders. And even if it were – however unlikely – one day possible and astonishingly cost-effective to do so, it would still remain much harder and maybe impossible to do the same with historical emissions. They have already mixed with the earth's atmosphere and other emitters' emissions. Together, they have already caused and are continuing to cause climate change related damages around the world but were emitted by people who are now dead. In other words, we may have to give up the idea of causally and simultaneously observably linking individual emissions to individual harmful outcomes. In the drowning orphan analogy, it may be futile to ask which miners contributed how much to the eventual water in the orphan's cave or to the mountain's collapse.

The second option would imply that instead of trying to link individual emissions to individual harmful outcomes, one could adopt a more macroscopic level of agency for responsibility bearers. This might allow linking the emissions of larger than individual emitters (e.g., corporations, industries, whole countries or regions) with harmful consequences, again measured more macroscopically. A prominent and relatively recent example of such an attempt to hold a large emitter responsible for harmful climate changing effects is that of a Peruvian farmer who sued a German energy supplier over the harmful effects of greenhouse gas emissions on a melting glacier in Peru[339]. But although the example shows that this way of trying to link individual emitters with climate change related harms is gaining some prominence, it also shows the shortcomings of this option. They essentially reduce to the same shortcomings discussed under the first option. It may be possible to link some large emitters – such as countries, or even corporations such as large enough energy suppliers – at least roughly with corresponding harmful effects. But this will likely be the exception, rather than the rule. Greenhouse gases stay in the atmosphere and contribute to climate change for hundreds, sometimes thousands of years. We may currently inhale molecules that Julius Ceasar exhaled with his last breath – a

[339] Christoph Seidler, "'Wir Wollen Auf Die Klimaverhandlungen Einfluss Nehmen"', *SPIEGEL ONLINE*, 10 November 2017 <https://www.spiegel.de/wissenschaft/mensch/klimaklage-gegen-rwe-germanwatch-chef-milke-im-interview-a-1177274.html>.

particularly unsettling thought given the current pandemic[340]. Once in the air, they mix with gases from other emitters, making it impossible over the long run to track which emissions can be attributed to which emitter, no matter their size[341]. And even if it was possible to link individual emitters, small or large, with individual harms, it is questionable whether there will be the necessary legal institutions to prosecute and whether the emitter in question is then capable of bearing some form of prospective responsibility for the harm created. The company may no longer exist or be bankrupt. It may have emitted for good reason or at least without knowing about the bad consequences. Or it may have had no viable alternative to emitting.[342] These issues make the first and second option for dealing with our inability to express harm in the usual legal ways unappealing. To further illustrate this point, I will readdress them in the next two sections.

If neither the first nor the second option appear realistically practicable or otherwise appealing, what is left is to somewhat more markedly change our understanding of harm and of attributing the corresponding climate responsibility. If it is impossible or at least impractical to connect individual actions with individual harmful outcomes but if it is at the same time possible to connect overall aggregate or collective emissions with overall collective or individual harmful outcomes resulting from climate change, harm may have to be reframed. A helpful starting point for such reframing would be drawing on Linklater's categories six (complicit harm) and nine (structural harm). Such harms will eventually also have to be attributable at higher than individual levels of agency. The idea of collective responsibility is rather and rightfully controversial[343]. Climate responsibility, however, is an example to which I think it could helpfully be applied as will be discussed further below in section 4.5.

Since the overall link between collective emissions and global warming has been established and accepted scientifically and politically, we may find agreement

[340] Jonathan Safran Foer, We Are the Weather - Saving the Planet Begins at Breakfast (New York: Farrar, Straus and Giroux, 2019), pp. 6–7 & 174.
[341] Jamieson, Reason In a Dark Time, p. 163.
[342] In chapter 6, I will even explain that corporations should not be viewed as economic actors retaining prospective climate responsibility. Instead, all responsibility goes to the respective ends of supply chains, i.e., primary inputs and final demand and is from there aggregated to the national level of agency.
[343] Marion Smiley, 'Collective Responsibility', in *Stanford Encyclopedia of Philosophy*, ed. by Edward N. Zalta, Summer 201, 2017 <https://plato.stanford.edu/cgi-bin/encyclopedia/archinfo.cgi?entry=collective-responsibility> [accessed 11 May 2018].

in basing climate responsibility on the *average expected effects of emissions* rather than on individually observable and actually observed ones. Measuring all countries' national greenhouse gas emissions in the same way instead of depending on potentially differing harmful effects, the international climate regime is already following this logic in practice. Acting in ways that have a contributing effect on climate change – even if just an average expected effect rather than a factually observed one – would then suffice as constituting element of a harm-based background conceptualisation of climate responsibility. Harming as constituting element of climate responsibility would then be represented by emissions flows and pathways contributing to emission stocks that are incompatible with sustainability. What matters for such a conception of climate responsibility, is thus that one's individual emissions on average – although perhaps unobservably and not per molecule – have the average expected effect we can in fact observe in all emissions collectively.

So, given first, we have agreement that we should strive towards avoiding dangerous climate change, i.e., that we should not breach the sustainability threshold corresponding to the 1.5°C or 2°C temperature limits of the Paris Agreement. Given second, we also have agreement that the overall greenhouse gas emissions stock is connected causally to the overall phenomenon of climate change and the increasing likelihoods of harmful outcomes that follow it. Given third, we further have agreement that in order to avoid dangerous climate change with a high likelihood, we have a fixed remaining emissions budget which will be depleted very soon if emissions pathways are not changed drastically and rapidly[344]. And given fourth, we have at least implicit agreement that although we do not know what path exactly individual emissions units will follow and what effects exactly they will have along the way, we know that each – on average – contributes to the increasing stock of greenhouse gases in the atmosphere. Then, it follows that *unsustainable* emissions as contributions to the *unsustainable* stock of greenhouse gases in the atmosphere can and should be conceptualised as harmful – on average.

[344] The Berlin-based Mercator Research Institute on the Global Commons and Climate Change estimates (based on the latest IPCC Special Report) that the 1.5°C limit will be breached in 6 years and 7 months while we have a little over 24 years remaining until the 2°C limit will be breached: Mercator Research Institute on Global Commons and Climate Change.

On such an account of harm we can build a moral demand for agents to accept prospective climate responsibilities. In the drowning orphan analogy, the actions of individual miners were not individually but only jointly sufficient to bring about the harmful outcome. However, this does not alter the fact that the individual actions most likely albeit perhaps not observably contributed in respective correspondence to the individual amounts of water pumped or units of ground dug out of the mountain. Without further information on the exact effects each individual's contribution had to the overall harmful outcome, assuming it had the average effect seems most sensible. Individual contributions can and I think should in this sense and in proportion to the average expected effect of the individual contributing force be regarded as harmful and under this justification as basis of prospective climate responsibility. Even the fact that individual emissions were not only not sufficient but also not necessary to bringing about the harmful outcome cannot convincingly help the case that these individual emissions did no harm or should be exempt from feeding into climate responsibility. For all we know, without any individual emissions at least the harm would likely have occurred later or to a lesser extent. Each individual contribution most likely acerbated, amplified, and accelerated the occurrence of harm and so made the endeavour of preventing or mitigating it more costly and urgent.

By conceptualising harm in this way the collective retrospective and corresponding prospective responsibility can be split into shares to be distributed in accordance with individual contributions. The resulting climate responsibility shares may not hold the same moral sway as if the corresponding individual effects could have and in fact had been observed. After all, the individual harmful effects remain unobserved. But such thinking in such shares shows that accepting some measure[345] of climate responsibility can and should be expected of agents based on and in correspondence to their retrospective responsibilities, i.e., their emissions shares that are incompatible with sustainability.

The drowning child analogy helps us appreciate why someone who had nothing to do with how the harm they are witnessing was brought about may bear responsibility just because they are able to help. The drowning orphan analogy further helps

[345] The following chapters address in detail what I mean here.

us appreciate why those who brought about the harm should arguably bear prospective responsibility in proportion to their contributions. Similarly, the drowning child analogy argues generally that anyone with the ability to help has a responsibility to help. The drowning orphan analogy, by contrast, shows with greater nuance that there may be different kinds and orders of retrospective and prospective responsibility. If a previously uninvolved passer-by came across the drowning orphan scenario at its latest stage, he or she may also have a responsibility to help so long as he or she is able to without morally significant cost to themselves. However, the drowning orphan analogy shows that those who already contributed to bringing about the harmful outcome arguably have a *higher order* or *primary responsibility* for pulling the orphan out. After all, without their harmful actions it would not have ended up in the lake to begin with. Their higher order responsibilities may not release the innocent passer-by of all responsibility – for example, he or she may still have to step in if those with retrospective responsibility fail to fulfil their corresponding duties. But such moral demands on the passer-by who has no retrospective responsibility hold relatively weaker moral sway so long as the agents with retrospective responsibility for drowning the orphan and collapsing the mountain are equal to the passer-by in any other way.

But what about the water pumped and earth dug by those with retrospective responsibility who already exited the scene? Assume that the water that already entered the orphan's cave will have to be removed as further water is still flowing in from the soaked mountain. Given this task, and given that the currently available responsibility bearers are the only one's who can fulfil it, they are the one's who have to fulfil it in Singer's sense. Crucial, then, is in what proportion they should contribute to this rescue. If a relevant connection can be made between past retrospective responsibility shares of those who exited the scene and present agents, this connection should play a constituting role in the distribution of prospective climate responsibilities. In the context of climate change, this becomes relevant, for example when holding countries responsible for past emissions even though individual past emitters are already dead. If, on the other hand, no such connection can be made, the distribution of prospective responsibilities – for the whole rescue – should correspond only to the retrospective responsibilities of the present agents. The

innocent passer-by would thus be exempt so long as the retrospectively responsible present agents are able to bear prospective responsibility for the whole rescue.

However, this last point shows that a concept of climate responsibility that only relied on the foundation of harm would run the risk of itself harming responsibility bearers in undue ways. In this regard, those contributing to a response could themselves become the ones being harmed in relevant ways. If the distribution of costs associated with prospective responsibilities places undue burdens on individual responsibility bearers, burdens may have to be redistributed once more. If, for example, climate responsibility resulted directly and proportionally from any and all types of emissions that are inconsistent with sustainability, regardless of how and why these emissions occurred, a purely harm-based concept of climate responsibility would exhibit inherent contradictions and flaws. It would disregard whether the respective emitters were capable of bearing the responsibility, and ignore whether they could be regarded as excusably ignorant of the harms they created. There are limitations to the extent in which retrospective contributions to harm can directly be translated into prospective climate responsibility.

Challenges to such purely harm-based constructions of responsibility are therefore numerous. Philosophical holes have been shot into any component of the purely harm-based conception constructed above. Most important is perhaps the free will challenge. It is a prominent example of a capability-based objection to a harm-based understanding of responsibility. If determinism holds, if it is incompatible with the existence of free will, and if free will is a necessary condition for bringing about harm that raises moral responsibility, there can be no moral responsibility[346]. Other challenges to the idea of holding agents responsible for harms are that the agent did not know about the harm, could not have acted otherwise, had a good reason for bringing about the harm, or is already dead. I will address the challenges of knowledge and economic ability in the next section and turn to the problem of dead emitters in the next chapter.

[346] c.f. Timothy O'Connor, 'Free Will', *The Stanford Encyclopedia of Philosophy*, 2016 <https://plato.stanford.edu/archives/sum2016/entries/freewill/>.

4.4. *Capability* as enabling and limiting climate responsibility based on harm

Besides the climate responsibility prerequisite of harm that translates emissions incompatible with the sustainability threshold into prospective climate responsibility, there is a further basic building block that must be addressed here at the level of the background concept. Climate responsibility may stand or fall with the capability to bear it.

What if those identified as engaging in harmful activities with respect to climate change are in some relevant way incapable of bearing the corresponding climate responsibility? For one, this could refer to their retrospective responsibility[347]. Those who physically contributed to the phenomenon of climate change – or to filling the cave with water in the drowning orphan analogy – may not have been *economically able* to do otherwise. For example, they may have been economically dependent on their harmful contributions because this may have been their only available way of making a living. Or they may have lacked the cognitive ability and *knowledgeability* required to know or understand what harms they were contributing to in the first place. Similarly, but now regarding prospective responsibility, those identified as potential responsibility bearers based on harm may also lack the required *capability* to bear the burden of prospective responsibility. This could be the case if, for example, they did not know how to avoid behaving in harmful ways even though they know about the harms they have been contributing to. Or they may even know of effective, i.e., technically viable ways to avoid harm but cannot afford taking corresponding action.

What these questions boil down to is the notorious argument – most often although not uncontroversially contributed to Kant – that "ought" implies "can"[348]. It follows logically, that without capability to fulfil a moral duty, the duty can develop no power as it is unfulfillable. Someone relevantly incapable of pulling out the proverbial child from Singer's pond cannot have a moral duty to do so. In turn, but perhaps more contested, capability may be a necessary but not necessarily a sufficient requirement of prospective responsibility. Although Singer strongly objects to this, arguing that prospective responsibility in the drowning child analogy follows

[347] Jonas, chap. 4. II. 1.
[348] c.f. Kohl.

simply from the ability to help as sufficient condition, "Hume's guillotine" separating "is" and "ought" continues to hold considerable power[349]. Whether "ought" in the sense of accepting prospective climate responsibility is in fact agreed upon as following "is" in the sense of capability alone may depend on the circumstances which can lead to partial or complete exemption from responsibility. As a necessary rather than sufficient building block of climate responsibility, however, capability is widely recognised – albeit in different ways. This section will address the most relevant capability dimensions of knowledgeability and economic ability in turn[350].

This section does not address the question of denial at length but only in its relation to knowledgeability. Denial refers to different forms of aversion against acknowledging facts or corresponding moral judgments that may hold unwanted implications for deniers and are therefore rejected. Denial can come in various degrees of consciousness and structural complexity. It ranges from unconscious reactions acted on to avoid consciously or unconsciously undesired consequences up to systematically concerted and consciously crafted efforts to spread uncertainty, misbelief, distrust, and often lies in order to duck or influence unwanted outcomes. The question of denial is an important one in climate science and policy. It only appears as somewhat bracketed here, however, because my present main concern is different[351]. It is to develop what climate responsibility is, who bears retrospective responsibility for harmfully contributing to climate change, and who has the respective capability to act in accordance with prospective responsibility. Addressing denial in greater depth than regarding its role in distinguishing excusable from inexcusable ignorance would add a layer of analysis that is not needed for this analysis. Instead of asking what climate responsibility is and who should and could bear it, it would ask whether those identified as potential responsibility bearers would in turn actually be willing to accept their respective responsibilities or try to deny and avoid it. There is an already large and currently growing body of literature on the

[349] Max Black, 'The Gap between "Is" and "Should"', *The Philosophical Review*, 73.2 (1964), 165–81 <www.jstor.org/stable/2183334>; Rachel Cohon, 'Hume's Moral Philosophy', *The Stanford Encyclopedia of Philosophy*, Fall 2018 (2018) <https://plato.stanford.edu/archives/fall2018/entries/hume-moral/>.
[350] The next chapter will further discuss why further dimensions should not be drawn upon to limit climate responsibilities.
[351] See also section 1.2.

question of climate denial which I touch upon at different points throughout the thesis.[352]

4.4.1. The *knowledge threshold* – excluding excusable ignorance

So, what if those who contributed to the phenomenon of climate change did so without knowledge of it and its harmful effects? Should this change how much climate responsibility they can be asked to accept? This section addresses how *knowledge* of climate change, its harmful effects, and one's contribution to it influences one's climate responsibility. It argues that establishing and objectively locating a *knowledge threshold* below which agents cannot and above which they can be expected morally to accept climate responsibility is hard – perhaps impossible. However, I also argue that we can again resort to a helpful shortcut when deciding whether we are above or below the knowledge threshold. Once we agree and self-declare that we know enough to bear climate responsibility, we are certainly above the knowledge threshold. So, while it may take very long or be impossible to find out which agents knew what when as a matter of fact, I think we can agree that such "knowledge by decree" could serve as climate responsibility building block besides harm. I do not think the discussion should necessarily end here. There are important arguments to be made for not including a knowledge-threshold at all. According to those arguments, since we now know about the harmful effects of actions that may have occurred during excusable ignorance, this knowledge develops moral power. I agree. However, I still include a knowledge threshold here and in the subsequent systematisation and measurement of climate responsibility in order to minimise disagreement. While it is still possible to argue about the role of knowledge prior to the knowledge threshold, I think the discussion becomes irrelevant after having passed the knowledge threshold. Once a self-declared knowledge-threshold has been passed, knowledge-based arguments against accepting responsibility become self-undermining.

Knowledge is thus a problematic prerequisite of responsibility because it comes in essentially unmeasurable degrees. In its relationship to responsibility, there are four states of knowledge that appear relevant. A) complete and utter ignorance, B)

[352] e.g. Jamieson, Reason In a Dark Time, chap. 3.5.

excusable ignorance, C) inexcusable ignorance, and D) at least agreed knowledge. The problem – again – is that we cannot appropriately measure these respective "knowledge levels" and therefore are unable to clearly tell them apart. A further and related problem is that once knowing enough implies costly consequences, there is a strong incentive to deny knowledgeability. Accordingly, once there is such denial we may yet have to attempt and assess how much knowledge there objectively is. So, agreement to have enough knowledge may suffice to fulfil the knowledgeability requirement of climate responsibility. Denial of enough knowledge, in turn, does not necessarily mean one should in fact be treated as being below the knowledge threshold. Without further information, it just means that the actual level of knowledge is unknown and may have to be further examined.

There is disagreement over what sort and degree of knowledge is required until an agent can bear responsibility[353]. Some argue that even with complete ignorance one may have certain responsibilities and duties (for example, not to harm). This holds even if one can only act on these duties once one becomes "aware enough" of them. From a legal perspective, the notion that ignorance is no excuse, is well established, especially when harm was brought about by ignoring some law or social norm an agent *should have* known about. However, this refers to contexts in which a legal rule already exists, and the potential responsibility bearer *should have* and *could have* known about it and so be expected to abide by it[354]. At times, however, the legal context, as well as the specific norms, rules, and laws in question may not even be in place yet or may still be evolving. The possibility of assigning responsibility may then in turn depend on whether someone actually knew enough about the connections between their behaviour and potentially harmful outcomes. Think again of Linklater's list of harms outlined above. If no-one knew about these harms, could there be responsibility for them? And what if some but not all members of society knew about them? What if there was agreement that everyone should know about these harms, enough knowledge was made publicly available, and there were systems in place to confront potential responsibility bearers with the knowledge required? Consider how long it took for even this list and our current

[353] Eshleman; Alexa Zellentin, 'Compensation for Historical Emissions and Excusable Ignorance', *Journal of Applied Philosophy*, 32.3 (2015), 258–74 <https://doi.org/10.1111/japp.12092>.
[354] c.f. Linklater's third and fourth forms of harm: .

corresponding legal systems to develop. What if the list is or should be much longer still but we are just not yet aware of its additional items? Can we have responsibility for them, nonetheless?

In its deepest form, knowledge might refer to something very like "obtaining truth" or "dispelling any doubts" fulfilment of which varies greatly with the level of detail required. If knowledgeability is framed as being in possession of such full awareness and understanding of the intricate and detailed causes and effects of climate change, no-one can be viewed as knowledgeable. Such a knowledge requirement would stop our endeavour of conceptualising climate responsibility in its tracks. On the other hand, an overly undemanding, i.e., very low, knowledge threshold would be problematic too. If any intuition or belief about potential causes and consequences of climate change was a sufficient requirement of climate responsibility, almost everyone would have fulfilled it a long time ago but most likely in very contradicting ways. Large parts of the global population – even in highly developed countries – are unaware of or at least do not believe in climate change[355]. A working concept of climate responsibility must therefore adequately address the question whether and to what extent climate changing behaviour was known to which types of agents and when.

It is unclear and perhaps impossible to know how deep knowledge about harmful consequences of actions must reach and where the line between excusable and inexcusable ignorance for holding someone responsible in fact lies. In the previous subsection on harm, the level of analysis played a role when trying to link individual emissions with individual harmful effects. Related to knowledgeability, this topic comes up as well when asking which kinds of agents know enough to bear climate responsibility. If larger than individual agents are regarded as potential responsibility bearers, knowledgeability typically increases as individual knowledge often (although not necessarily always or without losses) accumulates. While there are still large ignorant parts of the global population – and probably of each national population – once we aggregate to larger levels of agency (regional, national, global) knowledgeability increases.

[355] e.g. Jamieson, Reason In a Dark Time, chaps 3.1. & 5.4.

Related to the level of agency, knowledgeability concerns not just who in fact holds enough knowledge to be a suitable climate responsibility bearer. It is also relevant to ask "who *should* know enough?" in the sense that there can be different forms of a *responsibility to know*. Without going into much detail on this point, the question who has by role a responsibility to have, protect, and acquire knowledgeability must be considered. Asking the question in this way points to a possibility for pinpointing the difference between mere ignorance and *excusable* ignorance or innocent ignorance and negligence[356]. It may also serve as promising option to counter denialism.

As with excusable ignorance of knowledge as a prerequisite to be exempt from responsibility in general, there can be excusable ignorance of knowledge relevant to climate responsibility. People below a certain age, educational, or socio-economic level can be excusably ignorant of knowledge required for bearing climate responsibility if it would be unreasonable to expect them to know enough. Members of groups like the ones mentioned here and potentially many others may excusably have more pressing concerns than to acquire knowledge about climate change and their respective responsibility for causing and responding to it. With respect to climate change, it is also clearly the case that there are levels of agency which by role and agreement have a responsibility to know enough about climate change to satisfy the knowledge threshold.

Following negotiations between several governments as well as the World Meteorological Organisation and United Nations Environment Programme in the 1980s, the Intergovernmental Panel on Climate Change (IPCC) was created in 1988. It was charged with assessing the natural and social-scientific foundations and consequences of climate change. Shortly after its creation, the IPCC was formally recognised by the UN General Assembly's Resolution 43/53 in December of 1988 and tasked with producing a first assessment report for policymakers which it submitted to the General Assembly in October 1990. On this first comprehensive knowledge basis provided by the IPCC, negotiations for a framework convention on climate change began immediately.[357] The IPCC is one of the most

[356] Linklater, pp. 51–61.
[357] Jamieson, Reason In a Dark Time, p. 33.

encompassing international scientific bodies with representatives from 195 countries. It collects and assesses work of thousands of leading climate change researchers from all related fields around the world and draws conclusions on their findings[358]. Since its creation, it has produced regular assessment reports for policy-makers which in turn have come to agree to take the IPCC's findings seriously on board in their decision-making. When the UN Framework Convention on Climate Change was signed in 1992, it contained the previously arrived at acknowledgement of the international community that climate change is anthropogenic, i.e., caused in large parts by anthropogenic emissions of greenhouse gases and the simultaneous destruction of natural sinks. The UN Framework Convention even defines climate change as anthropogenic[359]. It also contained the international community's agreement that the challenge of climate change must be addressed through measures of mitigation and adaptation and that "dangerous anthropogenic interference with the climate system" is to be avoided. Throughout the Convention, several provisions are included according to which policy should progress taking the best available science into account. The Convention formally established its own Subsidiary Body for Scientific and Technological Advice (SBSTA) to – among other tasks – "provide assessments of the state of scientific knowledge relating to climate change and its effects"[360]. From this point onwards, it was arguably no longer relevant whether the international community as a matter of objectively observable fact had enough knowledge about climate change. It had openly acknowledged the required knowledgeability required for bearing climate responsibility and established institutions to ensure its continued and improved knowledgeability.

Knowledgeability as prerequisite of climate responsibility can thus be built most straightforwardly on the assessment reports of the IPCC and SBSTA. These reports are ever more sophisticated and detailed depictions of 1) the physical basis of climate change, 2) the likely impacts it will have and how societies can adapt to them, and 3) how further and especially dangerous climate change can be mitigated. There is growing public awareness of the issues associated with climate change. Research institutions, think tanks, corporations, public education programmes,

[358] IPCC, 'About the IPCC', 2021 <https://www.ipcc.ch/about/> [accessed 1 May 2021].
[359] United Nations, *United Nations Framework Convention on Climate Change*.
[360] United Nations, *United Nations Framework Convention on Climate Change*.

investment divisions, and civil society movements all over the world are also producing knowledge on climate change. But there is perhaps no greater accumulation of knowledge about climate change than that amassed and maintained by the IPCC. Consequently, if there is a centralised accumulation of knowledge about the causes and consequences of climate change, the IPCC's knowledge basis is. And members to the international climate governance regime have accepted a self-imposed responsibility to heed its advice.

But how far does this knowledge basis accumulated and produced by the IPCC reach below the national level? The regular assessment reports are essential references in scientific contributions to climate change related fields, are officially recognised by intergovernmental institutions around the world, and they typically find a wide medial echo after their respective publication. But this echo quickly trails away, and even among the scientific community or policymaking elites, details contained in the assessment reports often have a relatively short lifespan. Recent movements such as "Fridays For Future" or "Scientists For Future" have contributed to a growing interest and concern in subnational actors. But assuming that large enough parts of the general public anywhere around the globe would know (or even care) enough about climate change to be able to bear climate responsibility would be unrealistic. What this implies is that some high enough levels of agency have indeed uncontroversially crossed the knowledge threshold required for bearing climate responsibility. Other, sub-national levels of agency, however, to often remain below the threshold. Also, in contrast to countries which are members to the international climate governance regime, sub-national actors have not yet agreed to a corresponding "responsibility to know". It follows that, if knowledgeability about climate change is a prerequisite for climate responsibility, and if knowledge about the essential details of the IPCC assessment reports can be regarded as knowledge threshold, the fraction of individual polluters in the sense of the previous subsection that also has enough knowledge to be able to bear climate responsibility is – small. It is in all likelihood too small to avoid "dangerous climate change" if only those above the threshold would take action. Larger than individual institutional and structural actors are therefore required that can and in fact do have the required

knowledgeability and can subsume the prospective climate responsibilities corresponding to their members' aggregated emissions shares.

So, once we abstract from the individual level and look – for example – at the political institutional level, excusable ignorance related to the knowledge base accumulated and disseminated by the IPCC disappears. With the international agreement to found the IPCC and to heed its reports, with the international agreement to acknowledge climate change as real and anthropogenic, and with the international agreement on temperature goals and the principle of common but differentiated responsibilities, governments around the world have thus decided to know enough to make responsible political decisions based on this knowledge and to bear climate responsibility for these decisions. They may retreat on the agreement that they know enough. They may, for instance, systematically deny climate change – the recently succeeded US President was a most important example of such an attempt. But once a government has acknowledged to have enough knowledgeability and imposed a duty on itself to continuously hold up this knowledgeability and acquire ever new knowledge about climate change, it cannot simply paddle back and deny what it previously acknowledged to know. It is thus no longer of primary relevance how much knowledge has in fact been acquired, in how much detail, and by whom. For decades, it has now been more relevant whether the international community has decided to know enough and to work on continuously knowing enough to uphold their knowledgeability as prerequisite of bearing climate responsibility. The history of international environmental governance thus clearly shows that the knowledge threshold required to bear climate responsibility has been crossed by the national level of agency in 1990 at the latest[361]. Knowledge in the form and depth required for a working background concept of climate responsibility may still come in degrees. But the degrees of knowledge below the knowledge threshold no longer matter. Nation states as climate responsibility bearers have crossed it by international decree.

[361] CSO Equity Review, 'Fair Shares: A Civil Society Equity Review of INDCs'; 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'.

4.4.2. The *economic capability threshold* – distinguishing those able and unable to pay

The previous subsections identified a sustainability threshold, harm as emissions not consistent with it, and a knowledge threshold only above or after which agents can bear climate responsibility. A further essential building block of climate responsibility should also be included: *economic capability*. Most fundamentally, economic capability should be a building block of climate responsibility since the most essential and major goal of the internationally concerted response to climate change is to protect current living standards and enable further economic and human development. It aims to achieve these goals by effectively and equitably avoiding the adverse effects resulting from dangerous climate change. If, however, responding to the challenge of climate change itself severely challenges living standards and development prospects, it may undermine its own purpose. For example, by designing and distributing burdens associated with bearing prospective climate responsibility in ways that overburden those with little economic capability, the response runs counter its own goals. In the drowning orphan analogy, if saving the orphan or the mountain itself entails a high likelihood of posing morally equivalent costs and dangers to those setting out on the rescue mission, they may not be morally required and hence have no responsibility to even embark on it.

As I already argued above, for agents to bear retrospective climate responsibility, they must have had the capability to behave otherwise, i.e., to refrain from emitting greenhouse gases and so contribute to harm. If they could not have behaved otherwise, they could not be morally expected to either. I supported this reasoning above by referring to the ought-implies-can argument according to which a moral expectation cannot exceed an agent's capabilities. Turning to the drowning orphan analogy again, let us remember the different socio-economic types of agents in the mines. In the analogy, some participants depend for their survival on mining further into the mountain. Others, by contrast, do it for economic benefits or even just for fun. Filling the orphan's cave with water, however, is not intended by any of them. It rather happens as unwanted yet first unknowingly, then knowingly accepted consequence of economic activities which in turn are pursued and needed to support living standards or at least to make economic gains.

Economic activities in the drowning orphan analogy can then be categorised as either contributing to economic agents' *subsistence* or *decent living standards* on the one hand, or to living standards that exceed the subsistence or *decent* levels. In the climate change context, they have commonly been referred to as *luxury living standards* but simply mean that the decent level is exceeded[362]. The corresponding harmful activities, i.e., the emissions resulting from the respective categories of economic activities, can then be categorised accordingly. They, too, can now either be termed *subsistence*, *survival*, or *decent minimum living standard emissions* on the one hand, or *luxury emissions* on the other. What differentiates them in ways pertinent to climate responsibility is that one sort of emissions – luxury emissions – can be avoided at relatively low moral cost, while the others cannot. Avoiding subsistence emissions means imposing undue burdens on potential responsibility bearers that could include such costs as poverty, poor health, or even life[363].

Luxury emissions can in turn serve to signal the economic capability to bear prospective climate responsibility. Related to retrospective responsibility, they indicate that agents emitting luxury emissions have contributed to climate change in ways that exceed what was necessary for them to reach survival or decent minimum living standards. And related to prospective responsibility, luxury emissions can then similarly serve as signal for the economic capability to contribute to an effective response to climate change. Taking only luxury emissions into account in the distribution of prospective climate responsibility, the distribution meets the goal of equity if this implies not placing burdens on those incapable of bearing them. A working concept of climate responsibility should therefore establish whether and which agents have the necessary economic capabilities to bear retrospective and prospective responsibility respectively. At the level of the background concept, the identification of economic capability as prerequisite of responsibility and the qualitative distinction between luxury and subsistence emissions as useful indicator of an agent's economic capability is sufficient. Subsequent systematisations and measurements of climate responsibility will then have to add further specifics.

[362] Shue, *Climate Justice - Vulnerability and Protection*; Shue, 'Global Environment and International Inequality'.
[363] Unless technological innovation is included as further feature of the analogy. This, however, would be a question of what appropriate response measures to the phenomenon of climate change could be whereas here I am concerned with the question how responsibility for the costs associated with such and other measures should and could reasonably be distributed.

The *economic capability threshold* correspondingly divides those economically capable from those incapable of bearing climate responsibility. As established here it shows how a climate responsibility distribution based on emissions as harm in relation to the sustainability threshold is enabled but also limited by economic capability. As enabling requirement, it ensures that any agent bearing climate responsibility must be above the economic ability threshold. As limiting factor, it secures that no agent below the economic capability threshold should be expected to bear climate responsibility.

The systematised concept and measurement levels of climate responsibility discussed in the following two chapters will then have to address the question where a reasonable economic capability threshold dividing those economically capable from those unable to bear climate responsibility should be located. I follow Baer et al.'s arguments that as a prerequisite of climate responsibility, per capita income as approximation of economic capability can serve as most promising measure. It indicates economic capability well, is strongly related to other developmental indicators (including education and life expectancy), relatively easy to measure, and can be compared across countries.

4.5. Agency and concluding remarks

This chapter is motivated by the argument that current conceptualisations, interpretations, and implementations of climate responsibility need a more thorough and rigorous normative foundation. It argues that a new working background concept of climate responsibility can help overcome some of the unnecessary disagreements identified in previous chapters. With the drowning orphan analogy and argumentative method of building on existing political agreement, the chapter developed the building blocks of a working background concept of climate responsibility.

As I have developed here, harm in the form of unsustainable emissions levels, knowledge about the major causes and effects of climate change, and economic capability to avoid contributing to climate change as well as bearing costs associated with responding to it, should thus be viewed as building blocks of climate responsibility. In this sense, they also form the basis of an understanding of agency from which accepting climate responsibility can reasonably and morally be

expected. An agent who meets none or only some of these characteristics cannot reasonably be regarded as or expected to accept climate responsible. If some agent emitted unsustainable amounts of greenhouse gases but was *excusably* unaware of the harms so created, they could not be meaningfully held responsible either. If someone knows about climate change but did not contribute to it and did not have enough economic capability to contribute to a response, they too should not be regarded as climate responsible. Harm, knowledge, and economic capability in the forms developed and defended here are thus necessary conditions of climate responsibility. Jointly, they are also sufficient meaning that agents who meet all of them can morally be expected to take on the role of climate responsibility bearers. Fulfilling these requirements, however, is a matter of degree. The appropriate responsibility shares assigned to such agents should thus depend on the *extent* to which they fulfil these requirements, a matter which will be addressed in greater detail in the following chapters 5 and 6.

Viewing agency for bearing climate responsibility in this light, it is obvious that not everyone is a suitable candidate for bearing climate responsibility. Too many individuals do not fulfil even at least one of the prerequisites and few individuals or other sub-national agents fulfil them all. Too many individuals do not emit greenhouse gases that can be considered harmful on their own even though they should be considered harmful in proportion to their average expected effect and corresponding share in the overall stock of emissions. Similarly, too many individuals still excusably do not know enough to fulfil the requirement of knowledge about climate change. And too many individuals do not have the economic capability to avoid their contribution to climate change without endangering their own subsistence and so disqualify as climate responsibility bearers.

Nation-states, on the other hand, typically simultaneously fulfil all the requirements established here. All nation-states (at least under the proviso that each nation inhabits at least some wealthy enough inhabitants[364]) typically emit at least some greenhouse gases that must be considered harmful in light of the limited emissions budget left. They furthermore have crossed the knowledge threshold by decree. And they have at least some economic capability to avoid at least some of their

[364] Baer and others; Baer, Athanasiou, and Kartha; Baer.

contributions to the harms following climate change and to bear some of the burdens associated with a response. They also are the appropriate agents able to aggregate climate responsibility shares of their respective citizens. On that basis, countries as potential climate responsibility bearers represent their citizens in forging international agreements meant to determine how to collectively respond to the phenomenon of climate change. This relevantly distinguishes nation-states from other larger-scale agents such as corporations who in many cases might otherwise also be argued to fulfil the three requirements of climate responsibility.

Drawing these building blocks together, the working background concept developed here thus conceptualises agents' climate responsibility shares as corresponding to their respective emissions shares that are a) harmful, i.e., incompatible with sustainability, as well as b) above the knowledge and c) economic capability thresholds. It requires a sustainability threshold to distinguish good from bad states of the world and builds on harm as average expected effect of individual greenhouse gas emissions that are incompatible with sustainability. I argued that the already internationally agreed-upon temperature limits of the Paris Agreement serve as broadly agreed-upon major step in narrowing down the location of the sustainability threshold and correspondingly help identify harmful emissions that should inform climate responsibility shares. Given the severely limited emissions budget left until the sustainability threshold is breached however, few (if any) emissions remain that do not count as harmful in relation to the sustainability threshold. A complete decarbonisation of the world-economy is necessary within the next decade(s) in order reach the goals of the international climate regime[365].

Still, I further argue that knowledge required for bearing climate responsibility was not always in sufficient supply, meaning that emissions before a knowledge threshold should be excluded from counting towards climate responsibility. Furthermore, as the sustainability threshold motivating climate responsibility is itself motivated by the protection of current living standards and future development prospects, the distribution of climate responsibility should itself not undermine these goals. It follows that only emissions above an economic capability threshold should count towards climate responsibility. This last threshold distinguishes luxury

[365] Mercator Research Institute on Global Commons and Climate Change.

emissions which should count towards climate responsibility from subsistence emissions which should not translate into climate responsibility. The resulting distribution of prospective climate responsibility shares should then – as I argue more thoroughly in the next chapter – be applied to divide all retrospective climate responsibility. In other words, those above the respective thresholds have to shoulder burdens corresponding to all emissions both above and below the thresholds.

While the chapter offers a working understanding of climate responsibility and defends it normatively, it does not provide a deep justification[366]. The aim of this chapter is different. It attempts to show that such deeper questions of justice may not need a final answer to make progress. They should not serve as excuse for avoiding the subject of conceptualising and distributing climate responsibilities. Providing a deep justification would likely take too long to effectively avoid dangerous climate change. It is also not necessarily required. Based on overarchingly agreed aspects of previous work in the field of climate justice as well as already found political agreements, a more concrete working conceptualisation of climate responsibility that is normatively defensible, practically useful, and empirically measurable can be erected on the basis of a superficial justification. A superficial justification takes existing agreements seriously and argues that what follows from existing agreements already suffices for a working concept of climate responsibility.

The next chapters will have to further operationalise the proposed conceptualisation. There I will derive actionable principles for a more systematic conceptualisation. I further discuss how such a systematised understanding could be practically useful, and begin fleshing out some details of its empirical estimation. I thus further narrow down the location of the respective thresholds established here and further specify their respective interrelations. This also implies revisiting the question why additional limitations to climate responsibilities as based on harmful emissions beyond the knowledge and economic capability thresholds, such as a potential *political capability threshold* should not be included.

[366] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change, p. 139 ff.

5. Systematising climate responsibility

5.1. Introduction – locating and interrelating the responsibility thresholds.

The methodological framework[367] tasks this chapter with systematising climate responsibility. In Adcock and Collier's measurement validity framework, the corresponding research step is that of "formulating a systematised concept through reasoning about the background concept, in light of the goals of research"[368]. The overall research goal of this thesis is to rethink climate responsibility which specifically involves reconceptualisation and measurement such that the resulting understanding of climate responsibility is normatively defensible, empirically measurable, and practically useful. While all of these goal characteristics are addressed in each of the main chapters 4 through 6, the focus here lies on practical usefulness. Practical usefulness, as I employ it, however, is not to be misunderstood as aiming for a politically uncontroversial or immediately implementable concept, for example, in the form of a draft law proposal. The way of rethinking climate responsibility proposed here substantially extends current ways of thinking it. In suggesting a new and different distribution of prospective responsibilities than the one currently employed, it will necessarily produce powerful political opposition in those who profit from the current ways of thinking climate responsibility. Its practical usefulness therefore rather derives from a thorough and honest attempt to take prior climate agreements and their goals seriously and ask what actionable principles can be derived from them. It thus extends climate responsibility, but the extension still proceeds in the direction of the already agreed-upon goals. Embedded in this overarching objective, the purpose of this chapter is hence to arrive at "a specific formulation of a concept […]"[369] of climate responsibility which is normatively defensible in light of the background concept (previous chapter), practically useful as an equitable approach to burden-sharing in international climate policies, and empirically measurable (next chapter).

In the previous chapter, I discussed broad meanings and prerequisites of climate responsibility and narrowed down the corridors within which this chapter can now

[367] See Figure 3-1.
[368] Adcock and Collier, p. 531.
[369] Adcock and Collier, p. 531.

continue the search for a systematised concept of climate responsibility. Regarding the background concept, I concluded, first, that responsibility generally prerequires a conceptualisation of a good, that is, desirable state of the world towards which responsible choices and behaviour should be directed. For climate responsibility, this "good state of the world" is broadly captured by the goals of sustainability and sustainable development[370]. Second, climate change related harm should form a further building block of climate responsibility. To serve this function, harm should be conceptualised as agents' emissions which are in their average expected contribution to the harmful effects of climate change inconsistent with the sustainability threshold derived from the goal of preventing dangerous climate change[371]. Third, however, the background concept respects that not all emissions that are inconsistent with the sustainability threshold are created equal. While all emissions inconsistent with the sustainability threshold should be considered as harm and generally feed into *someone's* climate responsibility, the all-important question thus becomes *whose* respective climate responsibilities they should feed into. For emissions to count towards an agent's climate responsibility, the background conceptualisation thus concluded that agents must be equipped with sufficient knowledgeability and economic capability. This means that only within the further planks of a knowledge threshold and an economic capability threshold respectively, can we arrive at a bearable and in this sense equitable and practically useful conceptualisation of climate responsibility.

The problem presented in the current chapter is thus that it is very hard or even impossible to objectively locate these thresholds and derive actionable principles for interrelating them. Locating the thresholds relies in part on controversial value judgements and involve potentially unobservable characteristics such as responsibility bearers' respective levels of knowledge. To circumvent these difficulties, I continue with the argumentative method already employed in the previous chapter and rely on helpful heuristics to more specifically determine where we are with respect to the thresholds. The heuristics come in the form of prior political agreements and declarations. These disclose what has already been agreed upon meaning

[370] Wiener, *A Theory of Contestation*; Antje Wiener, 'A Theory of Contestation - A Concise Summary of Its Argument and Concepts', *Polity*, 49.1 (2017), 109–25 <https://doi.org/10.1086/690100>; Moellendorf, Roser, and Heyward; UN.
[371] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change.

that climate responsibility can now build on existing agreements rather than on perhaps deeper but also more controversial foundations. The 1.5°C and 2°C temperature limits formulated in the Paris Agreement help locate the sustainability threshold. The agreement to establish the IPCC and to heed its advice determines that countries are already (and have been since 1990 at the latest) above the knowledge threshold. And the agreement on the right to sustainable development helps narrow down which emissions are respectively above and below the economic capability threshold. In other words, existing political agreements help cutting short the potentially never-ending deep discussion of whether these thresholds should be respected and where they are located. The thresholds' locations have thus not been established as objective, indisputable facts, but by decree. And the search for a sufficiently normatively convincing, practically useful, and empirically measurable climate responsibility concept can now proceed to the next level.

The current chapter will thus pick up where chapter 4 left off. Relating the building blocks to one another, it discusses in the upcoming section 5.2. the most important unitary climate responsibility principles established in the literature: the *Polluter-Pays Principle*, *Ability-to-Pay Principle*, and *Beneficiary-Pays Principle*. It then examines their respective major strengths and weaknesses. I show that neither of these principles is alone sufficient as basis of a systematised climate responsibility concept that both abides by the demands of the background concept and is eventually measurable. The argument thus advances in section 5.3. to discuss some of the most prominent combinations of the principles in the literature. The ones discussed here are the UN Framework Convention on Climate Change's differential treatment principle of CBDR-RC, Simon Caney's "hybrid principle"[372], Dominic Roser and Christian Seidel's "far reaching proposal"[373], and Baer et al.'s "Responsibility-Capability-Index"[374]. The chapter examines all these combined principles and finds their respective shortcomings to be sufficiently severe to warrant a search for a new combination. I thus draw on all prior principles to develop a new hybrid principle, the *Economic-Activity Principle* in subsection 5.3.6. Section 5.4. briefly

[372] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[373] Proposed in Roser and Seidel, chap. 16.
[374] e.g. Baer and others.

discusses "political capability" as further potential threshold and measurability of the *Economic-Activity Principle* before section 5.5. concludes.

Overall, I argue that a systematised conceptualisation of prospective climate responsibility built on the *Economic-Activity Principle* developed here should correspond to the average of *income-* and *consumption-based emissions shares* of countries as responsibility bearers that have been emitted after the knowledge threshold, above the economic capability threshold, and that are incompatible with the sustainability threshold. The proposed systematised concept is measurable (s. next chapter) and fulfils the requirements established by the background concept. It respects the *Polluter-Pays Principle* as its demands rise and fall with agents' emissions. The combination of income- and consumption-based emissions furthermore allows for a more defensible identification of who the polluters are than previous principles and hybrids and ensures that the systematised concept also incorporates the *Beneficiary-Pays Principle*. And lastly, it also recognises the *Ability-to-Pay Principle* but according to a negative rather than positive understanding. This means that it serves as qualitative differentiator exempting agents below it but not as quantitative differentiator of climate responsibility shares above it. The systematised conceptualisation of climate responsibility developed here is therefore responsive to all major prior principles and ensures they respectively qualify each other. The *Polluter-Pays Principle* only counts *inasmuch as* it simultaneously satisfies the *Beneficiary-Pays* and *Ability-to-Pay Principles* and the same holds the other way around. I argue that this mutual cross-qualification of the most important climate responsibility principles ensures that the previously unduly neglected word "respective" in the CBDR-RC principle gets to play the role I think it is meant to fulfil.

5.2. Unitary principles of climate responsibility

The question who should shoulder which share of the burdens associated with an effective response to climate change has been at the core of international environmental governance for decades. It will likely continue to do so for the foreseeable future. A response is effective and equitable if it enables reaching the Paris Agreement's temperature limits in a way that simultaneously enables further

development[375]. Reaching both goal characteristics centres on how the UN Framework Convention's cornerstone principle of common but differentiated responsibilities and respective capabilities (CBDR-RC) is interpreted and implemented.

The most fundamental questions whether we should do something at all about climate change, and how much we should do about it are deeply value laden matters of justice. They respectively determine whether there are costs of reaching sustainability in the first place and how high these costs will be[376]. The question who should shoulder which share of these costs is then tertiary in the sense that it arises once the first two have been addressed. However, it also directly relates to matters of justice associated with those concerning the first two questions. Answering the third question may thus have justice-related distributional impacts that in turn influence the ways in which we want to respond to the first two. If the costs of responding at all to climate change are higher than letting it continue unchecked, we may not want to respond at all. If the costs associated with specific levels of temperature increases are higher than those following others, we may want to find and choose the most cost-efficient. And if the ways of distributing these costs in themselves hold costs to different kinds of rights-holders this may in turn determine whether and to what extent we want to respond to climate change. Most significantly, if they negatively affect the rights and interests of the "least-advantaged" they may have substantial impact upon our approaches to answering all three questions. Considering the justice-concerns of the least advantaged is not only a widely supported aim in the philosophical literature on justice, but also explicitly enshrined in the international climate regime principles aiming at equity by including differential treatment[377]. The three questions are therefore circularly related and cannot be answered on their respective own. However, they can at least be discussed individually while holding answers to the respective other two constant. Holding the answer to the respective other two questions constant can be done as a hypothetical thought experiment or by reference to prior agreement. The latter way is how I am

[375] e.g. Niklas Höhne and others, 'Assessing the Ambition of Post-2020 Climate Targets: A Comprehensive Framework', *Climate Policy*, 18.4 (2018), 425–41 (p. 1) <https://doi.org/10.1080/14693062.2017.1294046>.
[376] Roser and Seidel, pts I & II.
[377] John E. Roemer, 'The Ethics of Intertemporal Distribution in a Warming Planet', *Environmental and Resource Economics*, 48.3 (2011), 363–90 <https://doi.org/10.1007/s10640-010-9414-1>; Marco Grasso, 'A Normative Ethical Framework in Climate Change', *Climatic Change*, 81.3–4 (2007), 223–46 <https://doi.org/10.1007/s10584-006-9158-7>; John Rawls, *A Theory of Justice* (Harvard University Press, 1971) <https://www.jstor.org/stable/j.ctvjf9z6v>.

proceeding here. When asking what follows for the third question (distribution of climate responsibilities) take the answer to the first one to be that we should act on climate change and the answer to the second to be that the extent of our action on climate change should be guided by the Paris Agreement's temperature limits, equity, and a right to sustainable development.

Essentially and in other words, some ways of "splitting the bill" following the Paris Agreement's temperature goals would run counter the fundamental reason for responding to climate change in the first place. If they distribute burdens among the international community in ways that themselves endanger development prospects and living standards, meaning those same values a response to climate change aims to protect, the answer itself may become futile. If the response to climate change threatens current living standards and development prospects in such ways, it may become self-undermining. If saving the orphan from drowning or the mountain from collapsing creates qualitatively equivalent or even more suffering than it prevents, it may not be sensible to even embark on the rescue mission.

An effective response to climate change requires profoundly and rapidly transforming the unsustainable aspects of our current ways of production and consumption. Such transformations imply drastic deviations from past and present *business-as-usual* paths of imposing externalities on the environment and future generations. Business-as-usual paths were often chosen as cheapest in the short-term, fastest, and easiest available, but many times also simply as the only available ways of development. Deviating from business-as-usual behavioural patterns and even only beginning to internalise at least some of the externalities previously generated, therefore typically comes with high mitigation- and adaptation-related costs[378]. These costs for sustainable deviations from unsustainable business-as-usual pathways can in turn be distributed in various potentially drastically differing ways again relevant distributional justice. However, the fact that deviating from business-as-usual would imply high costs should not distract from the costs that staying on business-as-usual productive and consumptive pathways would entail. For all we know, these would be much higher than if we respond decisively to climate change

[378] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.

and try to avoid breaching the temperature limits[379]. Although there is notorious and deep-rooted dispute among both economists and policymakers as to how much exactly should be done and which parts of the overall costs of action and inaction should be borne by current as opposed to future generations, there is general agreement that some action is better than complete inaction[380]. Much more stringently, there also is general agreement that the temperature limits of the Paris Agreement should not be breached[381]. An important difference between the respective costs of action and inaction in the face of climate change is that there appears to be much more room to manoeuvre the costs of action than those of inaction which would hit the world harder and arguably more unjustly than the international climate governance regime would like to have it[382]. But this depends to a crucial extent on the action-guiding principles chosen to develop conceptualisations and distributions of climate responsibility.

The principles chosen to guide our response to climate change are the main tools at our disposal to adjust the parameters of effectiveness, equity, total costs, and cost-efficiency. At least in order not to be self-undermining, the response to climate change should thus be structured in a way that distributes burdens such that a) the temperature limits are not breached (an effectivity goal related to the sustainability threshold) and b) decent minimum living standards[383] and development prospects are protected (an equity goal related to the economic capability threshold). The questions of how the total costs should be minimised and how their distribution fares under efficiency considerations are side-lined in the present analysis. Effectivity regarding the temperature goals and equity in protecting minimum living standards are the first responsibility requirements addressed here that principles of climate responsibility must respect.

At the same time, and relevant to distributional justice concerns, the phenomenon of global climate change was not created by accident but by choice – economic choice in particular. The individual or collective economic choices involved in creating the phenomenon of climate change should thus be taken into account when

[379] Roser and Seidel, pts II & III.
[380] Nordhaus; Stern, *The Economics of Climate Change - The Stern Review*.
[381] United Nations, *Paris Agreement*.
[382] See also chapter 2.
[383] For a promising approach to finding this level, see for example Baer et al., p. 35 which I follow in chapter 6.

asking what climate responsibility is and how it should be distributed. This holds whether they were excusably ignorant, conscious, or unconscious, i.e., choices before or after the knowledge threshold. Those who contributed to the creation of a problem, i.e., those retrospectively (co-)responsible for harm, should bear part of the costs related to it *because* they (co-)created it and it would not have occurred without their actions[384]. This element of emissions as harmful economic choice is the third fundamental responsibility requirement to be taken into consideration by climate responsibility principles.

The response to climate change should reflect a) effectivity regarding the temperature goals and sustainability threshold, b) equity regarding their protection of living standards, especially minimum living standards related to the *economic capability threshold*, and c) harmful economic choices that created the phenomenon of climate change. If this holds, how can and should climate responsibility be systematised? This section discusses the most prominent unitary principles of climate responsibility proposed in the literature and sheds light on how they respectively fare regarding the requirements formulated here. All of them contain a *positive understanding* in that they identify some agents as climate responsibility bearers and a *negative understanding* in that they exclude other agents from bearing climate responsibility.

5.2.1. Retrospective and *respective* prospective responsibility

At the systematised concept level of climate responsibility, retrospective and prospective responsibility can and should be discussed further and then systematically related to each other. This helps arrive at an understanding of climate responsibility that can inform current and future action based on relevant past and present characteristics of agents as responsibility bearers. To recap, I distinguish between retrospective climate responsibility as relevant past actions and behaviours and prospective climate responsibility as past, present, and future climate related duties. In other words, retrospective climate responsibility relates to what agents have in fact done up until the present moment, while prospective climate responsibility relates

[384] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Sanford E. Gaines, 'The Polluter-Pays Principle: From Economic Equity to Environmental Ethos.', *Texas International Law Journal*, 26 (1991), 463–96 <https://heinonline.org/HOL/LandingPage?handle=hein.journals/tilj26&div=25&id=&page=>.

to what one ought to have done, currently do, or do in the future.[385] While retrospective responsibility in its general sense and as understood until this point is therefore generally descriptive, prospective responsibility prescribes goals which can be met or missed.

The prescriptive nature of prospective responsibility, however, offers an intriguingly insightful gateway for connecting the two responsibility perspectives. While retrospective responsibility was until this point understood to always arise in that it referred to agents' causal responsibility for bringing about *any* outcomes, it can also be more applicably conceptualised *in relation to* prospective responsibility and in this regard only arise under specific circumstances. In its relation to prospective responsibility, retrospective responsibility then becomes prescriptive too. By prescribing goals, prospective responsibility can determine whether retrospective responsibility arises in this *respective* sense. If the goals prescribed by prospective responsibility are met, no retrospective responsibility arises. If they are missed, retrospective responsibility arises to the extent (if measurable) of the deviation from the goals. Consider the drowning child example. In the purely descriptive understanding of retrospective responsibility which collapses into causal responsibility, the passer-by has retrospective responsibility for the outcome regardless of whether he or she chooses to save the child. In the more specific, *respective* understanding of retrospective responsibility, however, prospective responsibility would first prescribe the duty to save the drowning child. Retrospective responsibility then only arises if the passer-by fails to live up to this duty. If he or she fulfils the duty, no retrospective responsibility arises. Such retrospective responsibility, once it has arisen, then proportionately influences the current and future dimensions of prospective responsibility in turn. If retrospective responsibility has arisen, prospective responsibility may have to adapt to account for this fact, for example in order to now prescribe specific remedial duties on top of previously already existing general ones.

This connection between the two responsibility perspectives is particularly helpful in the more concrete context of climate responsibility. Here, prospective climate responsibility can then be understood to set *sustainable behaviour* as goal

[385] Jonas, chaps 4. II. 1.-2.

while at the same time respecting the demands of the economic capability and knowledge thresholds. Retrospective responsibility then arises *if and only if* the goal of sustainable behaviour is not met and it arises in proportion to the extent of the difference between actual and sustainable behaviour. To understand how such a manifestation of retrospective responsibility in turn impacts prospective responsibility, let us briefly discuss this at a more concrete level.

The sustainability threshold corresponding to the internationally agreed-upon temperature limits only allows for a limited remaining *budget* of greenhouse-gases to still be released into the atmosphere. If the budget is exceeded, the stock of greenhouse gases reaches unsustainable amounts and causes such temperature rises that the sustainability threshold is crossed and we enter a world with dangerous climate change[386]. Corresponding to this overall budget, we can determine sustainable flows of emissions, also referred to as sustainable emissions pathways. Taking the economic capability and knowledge thresholds into additional account further reduces remaining permissible emissions above and within the thresholds. Acting in accordance with demands of prospective climate responsibility then entails staying on those emissions pathways that can be sustained without breach of either threshold. If emissions exceed sustainable levels prescribed by prospective climate responsibility, retrospective climate responsibility arises in proportion to those excessive emissions that go beyond the sustainable budget and its corresponding emission pathways.

As a consequence of excessive emissions, the remaining permissible emissions budget and corresponding sustainable emissions pathways disappear even faster than originally envisaged. Prospective responsibility must consequently set a new and now even more stringent goal of sustainable behaviour in relation to the – now further curtailed – remaining emissions budget. Excessive emissions, which lead so to retrospective climate responsibility and in turn increase the demands of prospective climate responsibility, therefore directly constrain the remaining option space. To remain within the space permitted by the thresholds, emitters now have to adjust their emissions levels downward or find other ways of compensating the excess

[386] The Mercator Research Institute on Global Commons and Climate Change estimates that only between 6 and 25 years are left until the temperature limits are breached: Mercator Research Institute on Global Commons and Climate Change.

emissions. Once the budget is exceeded, *negative emissions* (achievable no longer by emissions reductions but by enhancing sinks) become necessary in order to live up to the demands of prospective responsibility and re-enter the permissible budget. To emitters, this may arise an additional obligation, i.e., an increased demand posed by prospective climate responsibility. Changes in retrospective climate responsibility therefore translate into corresponding changes in prospective climate responsibility which in turn prescribe new goals to be met if even further retrospective responsibility is to be avoided. With this discussion in mind, we can now turn to the climate responsibility principles.

5.2.2. The Polluter-Pays Principle

Among unitary climate responsibility principles, the *Polluter-Pays Principle* is perhaps the most prominent one and finds broad support but also criticism in theory and practice[387]. The whole endeavour of measuring countries' greenhouse gases and their respective reduction targets (under the Kyoto Protocol) or pledges (under the Paris Agreement) can be viewed as to a large extent drawing on a logic of remedial responsibility[388]. According to remedial responsibility, polluters should pay. In other words, those who created the problem of climate change by excessively emitting greenhouse gases should be those who fix it, i.e., bear or compensate for the resulting costs and so be regarded as those who should accept prospective climate responsibility. In its general motivation based on the responsibility building block of harm, the principle is intuitively appealing as it asks those people to pay for solutions to a problem who contributed to its creation (a positive duty) and exempts those who did not contribute (a negative reading resulting in exemption). In this way, it discourages pollution, encourages finding alternatives to polluting activities, and can prevent the further creation or intensification of problems as well as determine how to distribute responsibilities for problems already created.

However, the *Polluter-Pays Principle* faces several important challenges, especially in the context of climate change. The first is that many of the emitters who

[387] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'; Gaines; Ursula Kettlewell, 'The Answer to Global Pollution - a Critical Examination of the Problems and Potential of the Polluter-Pays Principle', *Colorado Journal of International Environmental Law and Policy*, 3 (1992), 429; Barbara Luppi, Francesco Parisi, and Shruti Rajagopalan, 'The Rise and Fall of the Polluter-Pays Principle in Developing Countries', *International Review of Law and Economics*, 32.1 (2012), 135–44.

[388] Miller, 'Distributing Responsibilities'; Miller, 'National Responsibility and Global Justice'.

emitted greenhouse gases in the past but whose emissions still have a climate changing effect, are dead. They can therefore no longer be asked to pay for mitigation corresponding to their own emissions. In terms of the above distinction and interlinks between retrospective and prospective climate responsibility, the *Polluter-Pays Principle* on its own does not answer who should bear the additional prospective climate responsibility corresponding to the excessive emissions and ensuing retrospective climate responsibility of those who are dead. If only those polluters who are still alive bear climate responsibility for only their own emissions, the *Polluter-Pays Principle* would not be enough to satisfy the sustainability threshold.

The second major challenge to the *Polluter-Pays Principle* is that it does not distinguish between rich and poor polluters, meaning that it neglects the economic capability threshold. If it were strictly and unrestrictedly applied, poor polluters would end up with prospective responsibility amounting exactly to their own emissions even if these were emitted below the economic capability threshold. The *Polluter-Pays Principle* alone would thus ask them to pay even if this would impoverish them or more generally impinge upon their ability to sustain decent living standards.

A third important challenge to the *Polluter-Pays Principle* is that it does not take into account whether polluters emitted greenhouse gases in knowledge of their contribution to the phenomenon of climate change and the harmful effects resulting from it or did so excusably ignorant. Unadjusted application of the *Polluter-Pays Principle* alone would not respect the *knowledge threshold*. It would imply that someone knowingly contributing to harm would be viewed as just as responsible for paying for the resulting harmful effects, or rather, their rectification, as someone who did so under excusable ignorance. The *Polluter-Pays Principle* in pure form equates merely "causal" with "moral" responsibility[389]. It indiscriminately translates any causal retrospective responsibility into the same extent of prospective responsibility.

Fourthly, the *Polluter-Pays Principle* does not answer the question who should shoulder mitigation-related burdens resulting from emissions that the polluters simply do not want to pay for. If some polluters' emissions do not comply with the

[389] Miller, 'Distributing Responsibilities', p. 455.

sustainability threshold but exceed it on purpose, then it remains unclear who should respond in accordance with their unaccepted responsibility shares. Given that the problem of dangerous climate change has been identified for a long time but we have not yet taken effective measures to prevent it, the challenge of willingly rejected prospective climate responsibilities is substantial.

Fifthly, Simon Caney points out that the *Polluter-Pays Principle* on its own is incomplete as it presupposes a theory of justice answering what people are entitled to in order to then quantify their deviation or overuse of their entitlements which in turn would result in their responsibility to pay under the *Polluter-Pays Principle*. Without such a background theory of entitlements the *Polluter-Pays Principle* itself would not be enough to distribute mitigation burdens[390].

And lastly, while the principle appears clear on this point at first sight, the *Polluter-Pays Principle* does not even specify clearly who should be regarded as polluters. Does it refer to those directly physically causing the emission of greenhouse gases, or respond to more indirect, broader understandings of causation such as *economic causation*? This can have profound effects on the ensuing distribution of responsibilities and will be discussed more thoroughly below[391]. The list of challenges to the *Polluter-Pays Principle* mentioned here is not exhaustive but suffices to show that despite its intuitive appeal, the principle comes with serious drawbacks regarding the background, systematised, and measurement levels of climate responsibility.

In terms of the present discussion, the *Polluter-Pays Principle* does itself not suffice to establish or locate the thresholds identified as relevant to the distribution of climate responsibility. As discussed before, I do not, however, think that we necessarily need a new, complete, and fully agreed-upon theory of justice underlying the principles according to which we assign climate responsibility in order to proceed[392]. Instead, I argue we can rely on superficial justifications and existing contractual obligations to derive working conclusions about the distribution of climate responsibilities[393]. The first reason is simple: given the 1.5°C and 2°C temperature

[390] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[391] See also section 5.2.4.
[392] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[393] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Jonas.

limits specified in the Paris Agreement, there may be no entitlements to luxury greenhouse gas emissions beyond subsistence levels anymore as even the current ways of providing subsistence may already result in emissions that breach the sustainability threshold. If we are to remain within the temperature limits to which the international community of states has agreed and committed itself, we may need to completely decarbonise the world-economy as fast as possible which corresponds to sharply decreased emissions pathways in the meantime[394]. This implies that we need to immediately begin adopting ways to avoid not just some, but *all* current and future greenhouse gas emissions very soon.

Under this perspective, debating which emissions we are still and generally, i.e., without specific justification, "entitled to" seems to miss the point. But of course, this first reason is not only simple, it is *too* simple. Human development and poverty eradication in large parts of the world are still infeasible without greenhouse gas emissions. Even if all luxury emissions exceeding them could or would suddenly disappear, and even if sustainable technologies are developed and deployed rapidly, emissions associated with development and subsistence levels will continue to challenge, and most likely even exceed, the sustainability threshold. Too rapidly trying to reduce the emissions of advanced economies by stopping their fossil-fuel-powered energy supplies, fossil-fuel-powered transportation infrastructures, and other ways of still fossil-fuel-dependent production and consumption, could furthermore result in unrest and chaos, the costs of which might well outweigh the risks associated with climate change.

However, just because emissions reductions will be costly and challenging, does not mean that there is a general right or entitlement to emit greenhouse gases per se. Arguing again alongside Caney, since emissions have never been an end in themselves, a general right to them is misplaced[395]. Instead, there may be rights to development which would in turn justify greenhouse gas emissions[396]. But even then, they do so only to the extent that other ways of reaching these ends are infeasible. The right to development adopted by the UN General Assembly Resolution 41/128 in December 1986, in turn, is more established in international human rights

[394] IPCC, *Global Warming of 1.5 °C*; Mercator Research Institute on Global Commons and Climate Change.
[395] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[396] Baer.

law (although it remains contested). Taking it seriously and given that the climate regime has enshrined the right so sustainable development would entail that we do not necessarily require a new and deep theory of justice to establish that emissions needed to reach the economic capability threshold enjoy special protection.[397] Instead, we can proceed as suggested above, i.e., begin from the Paris Agreement's temperature limits and in turn search for meaningful locations of the knowledge and economic capability thresholds that do not violate a right to development or contradict declarations of acceptance of the IPCC's assessments. What still needs to be addressed is thus who should and is able to pay *given that* these limits and rights should be protected according to prior agreement.

In light of these objections, many scholars, including Simon Caney[398], Dominic Roser, and Christian Seidel[399] come to the – I think convincing – conclusion that the *Polluter-Pays Principle* alone is insufficient to guide a reconceptualisation, measurement, and implementation of climate responsibility. It neglects the sustainability, economic capability, and knowledge thresholds, is on its own ill-equipped to find either of them, and undermines itself by not clearly identifying polluters as well as leaving the costs for emissions of those unable or unwilling to pay unaddressed.

5.2.3. The Ability-to-Pay Principle

The *Ability-to-Pay Principle* is the most prominent alternative to the *Polluter-Pays Principle*. It also enjoys substantial support in the literature[400]. According to the *Ability-to-Pay Principle*, the *Polluter-Pays Principle* should be side-lined mainly because of the above-mentioned weakness that it does not distinguish between wealthy and poor polluters. By contrast, the *Ability-to-Pay Principle* places the capability building block and the corresponding thresholds at the heart of climate responsibility. One important justification underlying the negative dimension of the *Ability-to-Pay Principle* is thus that agents can generally not be asked to shoulder moral duties if they are unable to fulfil them which draws on the "ought-

[397] United Nations, 'Declaration on the Right to Development'; Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*, chap. 5; Sengupta.
[398] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[399] Climate Justice - An Introduction, 1st edn (New York: Routledge, 2017).
[400] e.g. Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change, p. 173 ff. Shue, Climate Justice - Vulnerability and Protection; Shue, 'Global Environment and International Inequality'; Roser and Seidel, p. 140 ff.

implies-can" argument (see previous chapter)[401]. Regardless of their potential contributions to pollution, it would be questionable to ask someone to bear prospective climate responsibility if they lack the necessary resources to fulfil such duties or if their emissions had been unavoidable.

But even if agents could as a matter of physical fact bear climate change related duties, the *Ability-to-Pay Principle* contends further that they should only be required to do so, if this does not lead to their impoverishment. Not only their physical but their economic capability should be considered in the distribution of responsibilities. Many have thus argued convincingly that the assignment of prospective climate responsibility should respect an *Ability-to-Pay Principle* with some additional room for development to protect agents' resources which are tied up in development or poverty eradication[402]. This relates back to my motivating argument that a response to climate change which disregards the economic capability risks undermining its own fundamental purpose of protecting living standards and enabling development. By exempting emissions below the economic capability threshold from counting towards prospective climate responsibility, the *Ability-to-Pay Principle* is a negative principle. Its negative reading only justifies the exclusion of emissions needed to reach subsistence living standards as well as capabilities to develop and does not prescribe a responsibility distribution among those able to bear it.

On a positive reading, by contrast, the *Ability-to-Pay Principle* further holds that prospective climate responsibilities should not only protect economic capability but be distributed in proportion to it. Beyond the "ought-implies-can" argument, support for positive reading of the *Ability-to-Pay Principle* can be found, for example, in Peter Singer's drowning child analogy discussed in the previous chapter[403]. The analogy asks us to imagine a child drowning in a pond and a passer-by who has the ability to save the child at no significant cost to themselves. Arguing the passer-by should pull out the child means employing the *Ability-to-Pay Principle*. According to the According to *Ability-to-Pay Principle*, the passer-by has a moral duty to

[401] c.f. Rohlf.
[402] Holz, Kartha, and Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5 C-Compliant Global Mitigation Effort'; Baer.
[403] 'Famine, Affluence, and Morality'.

save the child if and simply because he or she has the ability to do so and irrespective of whether or not he or she had any part in bringing about the situation in which the child finds itself. Here, ability is a necessary and sufficient condition of responsibility. Supporters of the *Ability-to-Pay Principle* as an appropriate positive basis of climate responsibility argue that climate change is essentially analogous to the drowning child analogy: the world faces climate change related dangers, those able to pay for mitigation and adaptation related burdens *could* prevent it or at least lessen its dangers, and therefore, they have a duty to take on corresponding prospective responsibilities[404]. The fact that there are multiple agents rather than just one capable of bearing prospective responsibility does not exempt anyone from their duty. Instead, according to the positive reading of the *Ability-to-Pay Principle* responsibilities should be distributed such that they reflect the distribution of abilities[405].

However, while the drowning child analogy is intuitively plausible and its general denial would indeed be morally appalling, the analogy with climate change is overly simplistic[406]. In the climate change scenario, all emitters – past and present – collectively pushed the proverbial child into the pond. I further elaborated in the drowning orphan analogy and including the *Polluter-Pays Principle* that contributions leading to the harmful outcome should be considered too. Many if not most of miners in the drowning orphan analogy had good reason for their harmful actions: to enable human and economic development and thereby higher living standards. Interestingly, the reason for mining and endangering the orphan and mountain was thus to develop those same abilities which in turn enable emitters to pull it out again and bear climate responsibility.

But should a passer-by still be expected to help simply because of their ability, if those who created the problem are in many cases still around, can be asked to rectify the ill effects of climate change, and frequently have the ability themselves to live up to all prospective responsibilities? Should ability alone be regarded as sufficient basis of climate responsibility even in the closer to real drowning orphan analogy or even in the real world response to climate change? In the hypothetical

[404] Hiller.
[405] Darrell Moellendorf, The Moral Challenge of Dangerous Climate Change, chap. 5.
[406] Hiller.

scenario that there is no-one around who bears retrospective-responsibility, but many with enough ability, the positive *Ability-to-Pay Principle* indeed serves as appealing basis of climate responsibility. However, the complete absence of harmful contributors who are simultaneously able to bear responsibility is typically only fulfilled for bad outcomes that happened accidentally without anyone's fault and knowledge. While it is intuitively plausible *in general* that someone able to end accidental suffering without incurring undue burdens on them has a duty to do so, the *Ability-to-Pay Principle* may not *generally* be the most suitable principle to rely on for the *specific* case of distributing climate responsibilities.

The occurrence of large parts of the phenomenon of climate change cannot reasonably be viewed as accident but can instead be traced back to anthropogenic greenhouse gas emissions and the economic choices underlying them. We know what we are doing and we choose to do it consciously. If a general and exclusive version of the *Ability-to-Pay Principle* were applied without further qualification, those who created their abilities without pollution would bear just as big a burden as others with the same abilities who have contributed to climate change by emitting greenhouse gases. Consequently, if the *Ability-to-Pay Principle* were adopted as the sole basis of climate responsibility, critics argue it might create costly disincentives to create wealth sustainably. If behaving sustainably brings with it the same obligations as emissions-intensive but potentially cheaper or easier ways of creating abilities, why do it[407]? This reason against the *Ability-to-Pay Principle* was most prominently voiced in the international climate regime by the US. They justified both their refusal to ratify the Kyoto Protocol and their withdrawal from the Paris Agreement arguing that other large emitters of greenhouse gases were exempt from emission-reductions, making these treaties and their ensuing governance regimes "unfair" to the US[408]. To be clear: in both cases, the US's argumentation and conclusion was questionable at best. And the general existence of agents culpable of bringing about bad outcomes and simultaneously capable of rectifying them does not fully release others with the ability to help from prospective responsibility. But these duties must be regarded as subordinate because the *Ability-to-Pay Principle*

[407] Posner and Weisbach, chap. 4 among others.
[408] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing"/Developed" Dichotomy in International Environmental Law'; Trump.

could indeed contribute to unfairness if it asks someone to pay for someone else's pollution when they themselves had no part in it and given that there are sufficient identifiable polluters around who could and accept to bear climate responsibility themselves.

I therefore agree with Roser & Seidel, as well as with Caney that the *Ability-to-Pay Principle* – on its own and especially on its positive reading – is not a suitable guide to distributing prospective climate responsibility either. Regarding its negative reading which protectively corresponds to the economic capability threshold, however, it should be included in the systematisation of climate responsibility.

5.2.4. The Beneficiary-Pays Principle

A third, relatively widely discussed principle of climate responsibility is the *Beneficiary-Pays Principle*. It is not based on the physical acts of harming directly but on benefiting from harming activities which can directly be caused by oneself or by others. According to the positive reading of the *Beneficiary-Pays Principle* as informing the distribution of climate responsibilities, those who benefit or have benefitted from greenhouse gas emissions should shoulder prospective responsibility in corresponding proportion to their benefits. The negative reading of the *Beneficiary-Pays Principle* then entails that anyone – including polluters or those with ability – who did not benefit from pollution should not enter the club of potential responsibility bearers. It shares characteristics with the two principles discussed previously in that it has a relation to harm like the *Polluter-Pays Principle* and a relation to *economic capability* like the *Ability-to-Pay Principle*.

If present beneficiaries of past emissions can be identified, the *Beneficiary-Pays Principle* would overcome an important restriction of the *Polluter-Pays Principle* as responsibility for past emissions could be transferred to current beneficiaries. The *Beneficiary-Pays Principle* is also appealing because it not only asks *where* emissions occur or *who* emitted them directly, but relevantly asks *why* they were emitted: to benefit from them in some way. The *Beneficiary-Pays Principle* therefore adds an economic qualifier to identify responsibility bearers which makes it practically useful to appreciate how decisions to emit in real world markets are influenced by economic considerations. If agents are driven or influenced by economic motives in their decisions to emit, the question who *economically causes*

emissions thus becomes just as relevant as the one who *directly* or *physically* emits. This is plausible when considering again that emissions are no end in themselves. They should instead be viewed as nuisance or by-product that is accepted to reach other goals. *Benefit* serves as summary of these goals of human and economic development and with them higher standards of living[409]. Under the *Beneficiary-Pays Principle*, accepting the benefits from emissions-intensive activities raises retrospective responsibility and should be reflected in the distribution of prospective responsibilities because benefitting from pollution begets pollution and so economically co-creates the phenomenon of climate change.

As with the previous principles, however, there are several serious objections to the *Beneficiary-Pays Principle*. Without having to list them all, most important is that beneficiaries may also be dead, that they may be unable to pay even though they benefitted, that it may be hard or even impossible empirically to identify them, and that they may not have had any part in or appreciable influence over the emissions they benefitted from. For these reasons, the *Beneficiary-Pays Principle* alone is also not a convincing principle to inform the distribution of climate responsibility.

5.2.5. Shared and cross-qualifying characteristics of the unitary principles

While I find that none of the unitary principles discussed here should on their own serve as basis of climate responsibility because none of them respects all previously established relevant thresholds or their corresponding climate responsibility building blocks, I also think that each of them holds merit especially when distinguishing their respective negative and positive understandings. The *Polluter-Pays Principle* speaks to our common-sense moral view that those who created a problem or contributed to its creation should be those involved in providing a solution. It therefore appeals as positive principle to inform who should bear how much prospective climate responsibility. The *Ability-to-Pay Principle* too holds intuitive merit as it is very hard to disagree that if one has the ability to prevent something bad at no morally significant cost, one ought, morally, to do it. However, I argued that the positive understanding of the *Ability-to-Pay Principle* should only be regarded as subordinate principle of climate responsibility. Only once other, higher-

[409] Caney, 'Justice and the Distribution of Greenhouse Gas Emissions'.

order principles have been exhausted or are inapplicable should it be applied. As a negative principle and in relation to the economic capability threshold, the *Ability-to-Pay Principle* should nonetheless inform the systematised conceptualisation of climate responsibility by exempting those unable to bear it. The *Beneficiary-Pays Principle* in turn brings with it a further relevant quality in that it identifies beneficiaries – rather than direct emitters or those able to pay – as responsibility bearers. This helps incorporate the above-mentioned observation that most emissions do not occur for their own sake but to pursue other – most essentially economic – interest. This point holds especially when referring to emissions above the economic capability threshold. The *Beneficiary-Pays Principle* thus assigns retrospective responsibility based on *why* rather than *where* emissions occur.

Importantly, even though the principles are in the literature often discussed as distinct from each other, they exhibit considerable commonalities and can be intriguingly interlinked. The *Polluter-Pays* and *Ability-to-Pay Principle*s are closely related empirically, because in the past there essentially has been no large-scale creation of economic capability – let alone affluence – without greenhouse gas emissions. At higher than individual levels of analysis this becomes ever more apparent. If we take this consideration into account, we see that those able to pay are empirically also typically those with the highest emissions[410]. The two principles thus often differ not so much regarding the identity of agents they view as climate responsibility bearers. They differ mostly if the emissions intensity of agents' respective capabilities is considered as quantitative basis of respective climate responsibility shares[411]. The identification of responsibility bearers following either of the two principles is therefore likely in broad agreement. They further differ, however, with respect to the underlying justification for which the responsibility bearers are identified as such which appears relevant to the respective acceptability enjoyed by these principles.

The *Polluter-Pays Principle* and *Beneficiary-Pays Principle* in turn can be viewed as equivalent if we take into consideration not only *where* emissions occur and who directly emits them but *why* they were emitted. If we do this, we quickly

[410] Hannah Ritchie, 'Global Inequalities in CO_2 Emissions' (Our World in Data, 2018) <https://ourworldindata.org/co2-by-income-region#licence>.
[411] I will discuss and demonstrate this further in the next chapter when measuring climate responsibility.

see that the underlying reason for emissions is economic benefit either for direct emitters, or those employing them, or the overall goal of development in the interests of current and future generations more generally. The *Polluter-Pays Principle* assigns climate responsibility to polluters, but it does not prescribe a unique way of identifying who should be regarded as such. Even if it is typically read as identifying direct emitters as polluters and in turn as responsibility bearers, it could also be argued that beneficiaries are polluters because they *economically cause* pollution. If not only direct but also indirect, economic causation of emissions identifies agents as polluters and responsibility bearers, the two principles converge.

The *Beneficiary-Pays Principle* and *Ability-to-Pay Principle* are in turn closely linked because *ability* (a stock concept) results as the accumulation of *benefits* (a flow concept). Benefits and ability are both often derived from economic activities that entail emissions. Flow and stock of wealth as ability are thus typically correlated as are the corresponding outcomes we arrive at when applying these two principles of climate responsibility. The *Beneficiary-Pays Principle* can therefore also serve as economic link between the *Polluter-Pays Principle* and *Ability-to-Pay Principle* when emissions embodied in benefits accumulate and become emissions embodied in ability.

Discrete formulations of the *Polluter-Pays Principle* are thus unconvincing. They do not reflect why pollution occurs in the first place (i.e., for economic benefit and the creation and accumulation of ability). Nor do they address whether this goal was achieved such that the polluters are able to shoulder their prospective climate responsibility shares. And they disregard whether pollution was accepted knowingly or not. Discrete formulations of the *Beneficiary-Pays Principle* and *Ability-to-Pay Principle*, in turn, are also unconvincing. If they do not distinguish between harmful, i.e., polluting, and harmless, i.e., environmentally neutral, or even beneficial, economic activities for the creation and accumulation of wealth, they can be criticised based on the *Polluter-Pays Principle*.

Furthermore, if any of the principles are applied *after* any of the other principles have already been applied discretely, problems of *responsibility double-counting* may arise. The economic link between them implies that the individual principles cannot convincingly be regarded as conceptually discrete. If, for example, a pure

version of the *Polluter-Pays Principle* was applied before a pure version of the *Ability-to-Pay Principle* distributes the remaining responsibility shares, some of those who end up with prospective responsibility shares under the *Ability-to-Pay Principle*, already took on responsibility under the *Polluter-Pays Principle* for conceptually overlapping reasons. Disentangling and discounting the resulting responsibilities is complicated which serves as argument for the principles co-qualifying each other and being applied simultaneously from the start.

Their individual shortcomings as well as the intricate connections among the three climate responsibility principles discussed here are the main reason why several influential theorists have turned to multi-principle proposals and combinations of more than one of these principles. Combining the unitary principles in meaningful ways promises to overcome their individual drawbacks. Searching for a new principle is thus the search for the right combination. The right combination may enable a systematised conceptualisation of climate responsibility in ways that simultaneously satisfy all thresholds developed and established in the previous chapter. The next section thus turns to some of the most influential multi-principle proposals in the literature and develops a new one that I think convincingly combines the relevant strengths of the unitary principles examined here. It so develops the goal characteristic of practical usefulness.

5.3. Hybrid principles and formulae

If the previous arguments hold, could combinations appear appealing in the construction of a multi-principle-theory of climate responsibility?[412] In the design of their respective concepts, contributors have drawn on the three principles discussed here in different ways, be it on their own or in different combinations[413]. In this section, I will discuss some of the most important ones and eventually develop a new *Economic Activity Principle* that corresponds more convincingly and usefully to the climate responsibility background concept. It is furthermore empirically measurable.

[412] Miller, 'Distributing Responsibilities', p. 464.
[413] Darrell Moellendorf, *The Moral Challenge of Dangerous Climate Change*; Shue, *Climate Justice - Vulnerability and Protection*; Shue, 'Global Environment and International Inequality'; Page, 'Distributing the Burdens of Climate Change'; Roser and Seidel; Miller, 'Distributing Responsibilities'.

5.3.1. CBDR-RC[414]

In order to reach the Paris Agreement's temperature goals, broad or even universal participation in the internationally concerted response to climate change is key. In order to achieve universal participation, differential treatment is needed because it can enable countries at fundamentally different levels of development to remain in broad agreement on action- and burden-sharing[415]. Without differential treatment in equitable favour of weaker countries, treaty goals and countries' corresponding commitments in the international climate regime would either have to be so low that all could bear them. Or they would require weaker countries to redirect substantial resources from poverty eradication and development towards environmental protection. Both such responses to climate change would therefore undermine their own motivation to protect and enable human and economic development. They would either have to make the regime ineffective (low goals) or threaten living standards (high burdens on poor countries). An effective and simultaneously equitable response to climate change thus hinges upon a broadly agreeable and nuanced formulation of differential treatment and the corresponding distribution of responsibilities and burdens it entails.

Differential treatment provisions granting different forms of support and special rights to disadvantaged countries in international environmental governance emerged in the early 1970s and culminated in the principle of CBDR-RC (see chapter 2)[416]. This hybrid principle has since undergirded the distribution of climate responsibilities in the international climate regime. It identifies countries' emissions and capabilities as relevant building blocks. CBDR-RC has evolved to become one of the most influential, pervasive, and at the same time controversial principles at the heart of international environmental governance. The history of international environmental governance can thus be characterised as ongoing attempt to find agreement on burden-sharing, which essentially boils down to finding agreement on the detailed interpretation and implementation of CBDR-RC[417]. For the most

[414] This section will not go into a detailed discussion of the individual parts of CBDR-RC which are discussed in chapter 2.
[415] Rajamani, *Differential Treatment in International Environmental Law*; Cullet, *Differential Treatment in International Environmental Law*; Cullet, 'Differential Treatment in Environmental Law: Addressing Critiques and Conceptualizing the Next Steps'.
[416] e.g. Cullet, Differential Treatment in International Environmental Law.
[417] Bushey and Jinnah, 'Evolving Responsibility? The Principle of Common but Differentiated Responsibility in the UNFCCC'.

part, this has meant to find a balance between the needs of so-called developing countries on the one hand and the interests of so-called industrialised countries on the other, all in the overall pursuit of avoiding "dangerous anthropogenic interference with the climate system"[418].

CBDR-RC originally appeared as prominent and widely accepted formulation in the 1992 UN Framework Convention on Climate Change and its 1997 Kyoto Protocol. But the initial interpretation of CBDR-RC that assigned top-down burdens to some developed countries listed in Annex I to the UN Framework Convention while fully exempting developing, or non-Annex I countries, from central commitments became so controversial and contested that it has increasingly begun hindering rather than helping progress in climate negotiations[419]. The contestation of CBDR-RC substantially contributed, for example, to the failed attempt at agreeing on a successor to the Kyoto Protocol in Copenhagen 2009[420]. In the 2015 Paris Agreement, the international community thus again afforded CBDR-RC a central place. But the Paris Agreement's implementation details reshaped CBDR-RC fundamentally. Referring broadly to developing and developed countries' obligations "in light of different national circumstances", the Paris Agreement established a bottom-up approach instead of continuing the Annex-based system of the UN Framework Convention and Kyoto Protocol[421]. However, while the current bottom-up pledge and review system of the Paris Agreement overcame some of the contestation surrounding CBDR-RC, the climate regime continues to shy away from unambiguous, bold formulations. These are needed however to specify the practical role the principle should play in guiding the voluntary *nationally determined contributions* submitted by countries[422].

Differential treatment thus remains a cornerstone of international environmental governance. But its controversial and notoriously vague manifestation in the

[418] UN; Rajamani, Differential Treatment in International Environmental Law, p. 54.
[419] Rajamani, 'From Stockholm to Johannesburg: The Anatomy of Dissonance in the International Environmental Dialogue'.
[420] Lavanya Rajamani, 'Addressing the Post-Kyoto Stress Disorder: Reflections on the Emerging Legal Architecture of the Climate Regime', *International & Comparative Law Quarterly*, 58.4 (2009), 803–34 <https://doi.org/10.1017/S0020589309001584>; Deleuil.
[421] Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'; United Nations, *Paris Agreement*.
[422] Keohane and Oppenheimer; Cullet, 'Differential Treatment in Environmental Law: Addressing Critiques and Conceptualizing the Next Steps'; Izzet Ari and Ramazan Sari, 'Differentiation of Developed and Developing Countries for the Paris Agreement', *Energy Strategy Reviews*, 18 (2017), 175–82 <https://doi.org/10.1016/j.esr.2017.09.016>.

principle of CBDR-RC still struggles to fulfil its purpose of enabling broad, ambitious, and equitable participation. To defend its central place, CBDR-RC should reflect more specific, normatively convincing, practically useful, and empirically informed grounds for *qualitatively differentiating* who should bear climate responsibility and who should be exempt. Among responsibility bearers, in turn, it should specify normatively convincing, practically useful, and empirically informed grounds for *quantitatively differentiating* responsibility shares to be borne by individual members.

So far, however, the earlier existing operationalisations of the principle, for example in the Kyoto Protocol, merely distinguished between one group of countries with obligations and one group of countries that was exempt without offering a detailed justification for the exact groupings. Besides this qualitative distinction between responsibility bearers and countries exempt from obligations, the Kyoto Protocol did not provide a detailed account justifying the ensuing differentiation of responsibilities. Rather, the individualised responsibility shares borne by those with obligations under the Kyoto Protocol were largely a matter of negotiation rather than objective normative criteria. CBDR-RC in the Kyoto Protocol thus represented a negotiation outcome rather than a rigorous reflection upon and justification of principles of justice or empirical differences. And while a more nuanced understanding of CBDR-RC is currently included in the Paris Agreement, its exact justification, interpretation, and actual operationalisation and implementation remain subject to debate and continue to further disagreements. The operationalisation of CBDR-RC contained in the Paris Agreement basically leaves the determination, distribution, and acceptance of responsibilities up to each individual member to the regime.[423] The ambitious temperature limits enshrined in the Paris Agreement were likely only agreed upon because differential treatment took on this new, nationally determined, character. But the current regime offers little principled guidance for what to do when the individual nationally determined contributions fail to reach the overarching common goals. Since the pledges that have so far been made under the new climate regime indeed fall far short of what is required to achieve its goals, the

[423] Rajamani, 'Ambition and Differentiation in the 2015 Paris Agreement: Interpretative Possibilities and Underlying Politics'.

need and search for more principled guidance have risen to prominence once again.[424]

The lack of detail in the normative justification and empirically measurable operationalisation of the differential treatment provisions in international climate negotiations result structurally from the vagueness of the main bases on which CBDR-RC rests. Responsibilities and respective capabilities are themselves only vaguely defined[425]. The relation between them expressed by the word "respective" is also unclear. In its formulation in the UN Framework Convention[426], the capability component does not offer a nuanced picture of what quality and quantity of obligations a country could bear or which trade-offs between contributions to climate governance and other policy fields are defensible. And although there are ever more advanced and sophisticated systems and guidelines in place of how countries should measure and report their greenhouse gas emissions this is not systematically linked to or derived from the principle of CBDR-RC[427]. How exactly to conceptualise and measure the "responsibility" basis of CBDR-RC (based on historical, territorial, income- or consumption-based emissions?) also remains disputed[428]. These issues are related and contribute to the persistent uncertainty on how specifically to operationalise and measure CBDR-RC. Differential treatment arises out of the idea that "like cases should be treated alike while dissimilarly situated cases should be treated dissimilarly" and based on relevant differences[429]. But CBDR-RC currently offers little help in getting from this theoretically appealing starting point to practical guidelines of burden-sharing along which countries' contributions could be assessed. Other international burden-sharing regimes – such as UN funding regulated by the

[424] Jan Burck and others, *Climate Change Performance Index Results 2020* (New Climate Institute, Germanwatch, Climate Action Network International, 2020) <https://ccpi.org/>; Climate Action Tracker; Winkelmann and others; Grasso and Roberts; Jennifer Morgan and David Waskow, 'A New Look at Climate Equity in the UNFCCC', *Climate Policy*, 14.1 (2014), 17–22 <https://doi.org/10.1080/14693062.2014.848096>; Lavanya Rajamani, 'The Increasing Currency and Relevance of Rights-Based Perspectives in the International Negotiations on Climate Change', *Journal of Environmental Law*, 22.3 (2010), 391–429 <https://doi.org/10.1093/jel/eqq020>; Darrell Moellendorf, 'Responsibility for Increasing Mitigation Ambition in Light of the Right to Sustainable Development'; Callies and Moellendorf; Shue, 'Subsistence Protection and Mitigation Ambition: Necessities, Economic and Climatic'; Kanbur and Shue.

[425] Boyte, 'Common but Differentiated Responsibilities: Adjusting the "Developing"/Developed" Dichotomy in International Environmental Law'.

[426] UN.

[427] IPCC, '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories'.

[428] Rajamani, Differential Treatment in International Environmental Law, p. 148 ff.

[429] Cullet, Differential Treatment in International Environmental Law, p. 24.

scale of assessments – are much more advanced and depict in dollars which country should pay how much and why[430].

The history of conceptualising climate responsibility in the international climate regime is thus full of attempts at more concretely narrowing down what CBDR-RC ought to mean and how it should be operationalised and implemented in greater detail. The "Brazilian Proposal", for example, was an early suggestion according to which climate responsibility should reflect the effect countries' historical emissions have had on the climate[431]. According to a view repeatedly expressed by India, by contrast, equal per capita rights to the atmosphere should determine who already exhausted how much of their fair share and should therefore chip in how much to the global response to climate change[432]. As perhaps one of the most prominent observers of differential treatment, Lavanya Rajamani proposed a formalised understanding CBDR-RC as "Capacity + Contribution (Historical + Current + Future)"[433] (see chapter 2). However, while Rajamani's "summary equation" may be one of the most concrete shorthand suggestions for how to operationalise CBDR-RC, it says little about the interrelations among the identified building blocks (capacity on the one hand as well as historical, current, and future emissions on the other), nor about their respective measurements.

In the following subsections, I therefore discuss further proposals which combine the unitary principles and offer interesting interpretations and complements of, or even alternatives to the principle of CBDR-RC.

5.3.2. Caney's hybrid principle: *Polluter-Pays Principle*, then *Ability-to-Pay Principle*

Simon Caney starts his argument for a reconceptualisation of climate responsibility by describing the initial intuitive appeal of the *Polluter-Pays Principle*[434]. According to him, it is a most common and most convincing moral standpoint to hold those who created a problem responsible for rectifying it. He then discusses different problems the *Polluter-Pays Principle* encounters if it remains the sole and

[430] Rajamani, Differential Treatment in International Environmental Law, p. 149.
[431] Müller, Höhne, and Ellermann; Den Elzen, Schaeffer, and Lucas.
[432] Lavanya Rajamani, 'India's Approach to International Law in the Climate Change Regime', *Indian Journal of International Law*, 57.1–2 (2017), 1–23 <https://doi.org/10.1007/s40901-018-0072-0>.
[433] Rajamani, Differential Treatment in International Environmental Law, pp. 149–51.
[434] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.

unqualified basis of climate responsibility[435]. For example, if it is interpreted on an individual basis, the *Polluter-Pays Principle* is insufficient because no individual harms can be related to individual greenhouse gas emissions. Further problems arise, as discussed above, because individual polluters are often already dead, and because individual polluters often are not aware, or excusably ignorant, of the harmful effects of greenhouse gas emissions. According to Caney, however, these shortcomings of the *Polluter-Pays Principle* do not imply that it should be abandoned. Instead, they merely show that it needs complementation by other principles.

Caney thus offers one such complementation and compares the resulting hybrid principle to CBDR-RC. His alternative climate responsibility principle begins with the *Polluter-Pays Principle* alone and reads:

> *"All are under a duty not to emit greenhouse gases in excess of their quota[436]."*

and

> *"Those who exceed their quota (and/or have exceeded it since 1990) have a duty to compensate others (through mitigation or adaptation)."*[437]

But because of the objections to the *Polluter-Pays Principle* related to a) emissions of previous generations, b) excusable ignorance, and c) polluters who cannot be made to pay or are unwilling to accept responsibility, Caney argues that the responsibility for emissions not covered under the *Polluter-Pays Principle* should be distributed according to the *Ability-to-Pay Principle*[438]. In other words, Caney suggests first distributing responsibility according to the *Polluter-Pays Principle* on its own and as far as possible and then applying the *Ability-to-Pay Principle* to pick up the slack and distribute the remaining unassigned responsibility shares.

[435] Many of them are already covered in the previous subsection on the Polluter-Pays Principle.
[436] As I argued before, I think such a quota does not have to arise out of a deep theory of justice but it suffices to work with a sustainability threshold derived from the prior agreements as well as the constraints on the sustainability threshold resulting from the capability thresholds.
[437] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[438] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.

Caney's "hybrid account" therefore differs from pure versions of the *Polluter-Pays Principle* in important ways because only part of the burden is distributed according to it. More specifically, while the *Polluter-Pays Principle* ascribes responsibilities on the poor if they polluted, Caney's hybrid account does not. And while the *Polluter-Pays Principle* does not ascribe responsibilities on the wealthy unless they polluted, Caney's hybrid account does. Caney argues that the *Ability-to-Pay Principle* should be applied only after the *Polluter-Pays Principle* has been exhausted.

But is it not unfair – or at least needlessly unfair – to ascribe *any* climate responsibility solely based on the positive reading of the *Ability-to-Pay Principle* as long as there are agents around with an arguably higher order responsibility because they also polluted? Caney discusses this point[439]. He agrees that requiring the wealthy who acquired their wealth without pollution to pay for costs created by polluters who are too poor to pay is not ideal. He argues that there is no ideal way of distributing the responsibilities shares that cannot be directly and proportionately assigned based on existing polluters' pollution shares. According to Caney, among the non-ideal ways to address this issue we have three options: 1) let poor polluters pay, 2) let the costs be unaddressed, or 3) let the wealthy pay. And he argues that 3) is the best of these suboptimal options. If these are indeed all available choices, Caney's suggestion is sensible.

I think, however, that the non-ideal options that Caney lists are not the best among all non-ideal ways of assigning the leftover responsibility shares. Instead, there is at least one further and I think more convincing option. This distribution of such leftover responsibility shares takes the pollution shares of existing polluters into account but qualifies them according to the *Beneficiary-Pays Principle* to also account for their differing economic circumstances. In a later contribution[440], Caney also qualifies the *Ability-to-Pay Principle*, when he suggests distinguishing between two groups. One whose wealth was created at the cost of pollution, and the other which created its wealth without emissions. The qualified version of the *Ability-to-Pay Principle* he proposes then assigns greater duties to the former than the

[439] Caney, 'Cosmopolitan Justice, Responsibility, and Global Climate Change'.
[440] 'Climate Change and the Duties of the Advantaged', p. 215.

latter group. I will return to this point below because it shares important characteristics with the next multi-principle and feeds into the principle I develop in subsection 5.3.6..

5.3.3. Roser & Seidel's "far reaching proposal": first Polluter-Pays Principle then Ability-to-Pay Principle both respecting capability thresholds

Like Caney, Dominic Roser and Christian Seidel introduce their hybrid principle with a discussion of the strengths and weaknesses of different principles of climate responsibility (*Polluter-Pays Principle*, *Ability-to-Pay Principle*, and *Beneficiary-Pays Principle* among others). They then offer their own *far-reaching proposal* for the distribution of climate responsibility shares[441]. Like Caney's hybrid account, Roser & Seidel's proposal complements the *Polluter-Pays Principle* with an *Ability-to-Pay Principle* but introduces an *excusable-ignorance-threshold* (they suggest 1980 or 1990) and a *subsistence threshold* before and below which no retrospective climate responsibility should be assigned. They argue that climate responsibility corresponding to emissions *after* an excusable-ignorance-threshold and *above* an undefined subsistence threshold should be attributed to responsibility bearers based solely on the *Polluter-Pays Principle*. The remaining responsibility for emissions *before* the excusable ignorance threshold and for emissions of agents *below* the subsistence threshold should then be distributed solely according to the *Ability-to-Pay Principle*. Roser & Seidel's proposal thus combines the *Polluter-Pays Principle* and *Ability-to-Pay Principle* in way that is very similar to Caney's hybrid principle. The "far reaching proposal" applies the *Polluter-Pays Principle* to distribute responsibility for some emissions and then subsequently uses the *Ability-to-Pay Principle* to distribute responsibility for the remaining burden.

Specifically, Roser & Seidel's proposal comes in seven consecutive steps[442]:

> *(1) Determine mitigation and adaptation related costs "A" and the emissions budgets "B" following the Paris Agreement's temperature limits[443].*

[441] Roser and Seidel, p. 158 ff.
[442] I closely paraphrase their steps: Roser and Seidel, pp. 162–63.
[443] Note that this is in line with the way I propose for finding the sustainability threshold.

(2) Locate a sufficiency threshold "S" to determine at what level human beings are "sufficiently well-off" and to single out pure subsistence emissions needed to reach this level[444].

(3) Locate the excusable-ignorance threshold at time t in relation to the "human life span" to determine from what point in time onward "human beings can be made directly responsible for their emissions by means of the Polluter-Pays Principle". The authors suggest 1980[445].

(4) Determine and distinguish emissions before t ("E-before-t") and after t ("E-after-t"), hereby only considering emissions above the subsistence threshold "S", however.

(5) Distribute that share of costs "A" caused by "E-after-t" according to the Polluter-Pays Principle so long as this does not push anyone below "S".

(6) Determine countries' ability to pay. The authors suggest GDP above "S" as example.

(7) Distribute (i) the share of costs "A" caused by "E-before-t"; (ii) that share of costs "A" caused by "E-after-t" that countries could not cover because doing so would have pushed them below "S", and (iii) "the remaining emissions budget converted into reduction costs" based on the Ability-to-Pay Principle such that no country falls below "S".

The authors defend the distribution of costs based purely on the *Ability-to-Pay Principle* in step 7 as enabling "synergies with other issues of global distributive justice (in particular, the fight against starvation, poverty, and water shortages, […])"[446]. As pointed out in my brief discussion of Caney's proposal above, I think

[444] Note that this is in line with the way I propose for finding the economic capability threshold.
[445] Note that this differs from how I propose to find the knowledge threshold. I work with prior political agreements while Roser & Seidel work with the "human life span".
[446] Roser and Seidel, pp. 162–63.

there is a more promising way to distribute responsibility for emissions below and before the respective *thresholds* than offered by the *Ability-to-Pay Principle*. Applying first a pure version of the *Polluter-Pays Principle* and then a pure version of the *Ability-to-Pay Principle* reduces their respective shortcomings but does not overcome them completely. For example, even for those emissions after and above the thresholds, the *Polluter-Pays Principle* exhibits its above-discussed drawbacks albeit perhaps not quite as acutely. And even if the application of the *Ability-to-Pay Principle* is restricted to responsibility shares corresponding to emissions below and before the thresholds does not overcome the issue that it neglects how and why emissions occurred. I will return to these points below in sections 5.3.5. and 5.3.6..

5.3.4. Baer et al.'s Responsibility-Capability Index: Polluter-Pays Principle besides Ability-to-Pay Principle while respecting different thresholds

Baer et al.'s CERF[447] provides a sophisticated and measurable systematisation of climate responsibility to supply international climate governance with an important but missing piece: a gauge for whether nationally-determined contributions towards the goals of the Paris Agreement and countries' climate policies more broadly can be considered as fair[448]. The climate equity reference framework is one of the most advanced attempts at providing such an equity gauge, offering not only underlying normative arguments for its systematisation, but an online calculator[449] that permits the precise determination of national "fair shares" of the overall burdens associated with climate change based on different "equity settings".

I discuss more intricate details of the CERF in as relevant chapters 2 and 6, so will here only briefly address what is most relevant to the systematised level of conceptualising climate responsibility. In brief, the climate equity reference framework develops a "Responsibility-Capability-Index" according to which it determines and distributes countries' climate responsibility shares. "Responsibility" is measured as countries' emissions while "capability" is measured as summed per capita income above a "development threshold". The "Responsibility-Capability-

[447] Formerly "greenhouse development rights framework".
[448] CSO Equity Review, 'Setting the Path towards 1.5°C: A Civil Society Equity Review of INDCs'; CSO Equity Review, 'Fair Shares: A Civil Society Equity Review of INDCs'; CSO Equity Review, 'After Paris: Inequality, Fair Shares, and the Climate Emergency'; Holz, Kartha, and Athanasiou, 'Fairly Sharing 1.5: National Fair Shares of a 1.5 C-Compliant Global Mitigation Effort'; Kartha and others, I; Baer, Athanasiou, and Kartha; Klinsky and others, 'Why Equity Is Fundamental in Climate Change Policy Research'.
[449] The calculator can be found at: https://calculator.climateequityreference.org/

Index" in turn takes a weighted average of the resulting "responsibility" and "capability" to arrive at countries' climate responsibility shares.[450]

The two main problems of the climate equity reference framework are first, that its corresponding index regards "responsibility" (based on the *Polluter-Pays Principle*) and "capability" (based predominantly on the *Ability-to-Pay Principle*) as equivalent, i.e., interchangeable, inputs into a country's climate responsibility share. The calculator allows for either of these inputs to become zero meaning it could collapse into pure versions of the *Polluter-Pays Principle* and *Ability-to-Pay Principle*. In this way, the framework neglects their important interdependencies (s. section 5.2.5. above): It so risks treating qualitatively different normative justifications for distributing climate responsibility shares as equivalent. As a result, responsibility double-counting is a prominent issue in the eventual "fair shares". Second, both measures of responsibility (territorial and consumption-based emissions accounting) offered by the climate equity reference calculator are problematic. They fail to fully capture *why* emissions occur and therefore only give a partial answer to the question who should be regarded as climate responsibility bearers because economic causation is not taken into account.

Both problems I identified here are related to an underdeveloped normative foundation upon which the framework's advanced operationalisation and measurement of prospective responsibility rest. In contrast to the normatively tenuous and not (yet) empirically measurable principle of CBDR-RC, climate responsibility as proposed by the climate equity reference framework is measurable. However, it lacks sufficiently strongly developed ties between its normative foundations and its measurement levels. Within the broad range of options it offers, the framework thus ends up providing little normative guidance.

5.3.5. Combined shortcomings of the hybrid principles

The hybrid principles discussed in this section exhibit different but partially overlapping strengths and weaknesses. Caney's hybrid, for example, applies either the *Polluter-Pays Principle* or *Ability-to-Pay Principle*. Consequently, his hybrid is vulnerable first to (at least some of) the critique of the former and then to the

[450] Climate Equity Reference Project.

critique of the latter principle. Roser & Seidel's "far-reaching proposal" adopts a similar approach but somewhat more involved in order not to expose some of these flanks. However, their arguments for applying either of the two principles on their respective own do not overcome their respective shortcomings. The "far-reaching proposal" still keeps the principles separate instead of allowing them to co-qualify each other. The climate equity reference framework in turn takes a different approach and simultaneously applies both the *Polluter-Pays* and *Ability-to-Pay Principles.* It bases the distribution of climate responsibility shares on a weighted average of their respective results. However, this approach means that the two principles are treated as normatively equivalent inputs which are first calculated besides each other and then squished together. The resulting index is a mixture of partially overlapping and partially contradicting normative underpinnings which risk double-counting of some relevant inputs while neglecting others[451].

Furthermore, none of the hybrid principles discussed here take the economic causation of emissions into proper account. While all of them include both the negative as well as positive dimensions of the *Ability-to-Pay Principle* to protect the corresponding economic capability threshold. But none of them takes the *Beneficiary-Pays Principle* seriously according to which the distribution of climate responsibilities should be based on economic benefits from pollution. The economic reference framework comes closest by allowing to either use territorial or consumption-based emissions as basis of its responsibility input. But neither way of attributing emissions and the corresponding responsibility is on its own convincing (see section 2.3.)[452].

The unitary principles discussed in section 5.2. above should instead be combined so that they qualify and strengthen rather than awkwardly sitting beside each other. In the next subsection, I develop a hybrid principle that draws on all three unitary principles as well as the hybrid principles addressed here.

[451] This problem is discussed further in the next chapter on measuring climate responsibility.
[452] João Rodrigues and others; Rodrigues, Marques, and Domingos.

5.3.6. The *Economic-Activity Principle*: taking economic causation of emissions and *respective* capabilities seriously

Caney as well as Roser & Seidel argue that the *Polluter-Pays Principle* should be applied where possible and that the *Ability-to-Pay Principle* should guide how the remaining burden is distributed. To further include the *Beneficiary-Pays Principle* and so take economic causation of emissions into account, I argue for an *Economic-Activity Principle* of climate responsibility. According to this principle the *Ability-to-Pay Principle* should only serve in its negative dimension as entry requirement for a "club of responsibility bearers" above the economic capability threshold and after the knowledge threshold. Above the thresholds, a combination of the *Polluter-Pays Principle* and *Beneficiary-Pays Principle* should then serve as combined basis for quantitatively differentiating and distributing responsibility shares among the members of this club. The responsibility shares resulting from the application of the *Economic-Activity Principle* should then be consulted to distribute prospective responsibility for *all* costs resulting from emissions that are inconsistent with the sustainability threshold and its corresponding emissions budget and emissions pathways.

The main motivation underlying the *Economic-Activity Principle* is that the *Polluter-Pays Principle*, *Beneficiary-Pays Principle*, and *Ability-to-Pay Principle* have intricate economic interrelations with one another[453]. Neither of the principles on their respective own and neither of the combinations of them in the literature so far properly reflects this economic link. The *Economic-Activity Principle* I develop here builds on all of them but offers a different perspective that puts this economic link into the centre of attention.

In a nutshell, the *Economic-Activity Principle* suggests that countries' prospective climate responsibility shares should correspond to their retrospective climate responsibility shares. Retrospective responsibility shares result in turn as the average of *emissions enabled by income* and *embodied in consumption* above the respective thresholds[454]. Illustrative examples and their empirical measurement can be found in the following chapter.

[453] See subsection 5.2.5. above
[454] All of these terms as well as their measurement are the subject of the next chapter on measuring climate responsibility.

To tackle the issues of conceptual overlap and responsibility double-counting resulting from a consecutive application of the unitary principles, a convincing hybrid principle of climate responsibility needs to draw all three of the unitary principles together and apply them simultaneously. The principles should be formulated in conjunction and co-qualify each other such that polluters are responsible *insofar as* they have derived economic benefits and accumulated abilities from their pollution. Beneficiaries and those able to pay are in turn viewed as responsible *insofar as* their benefits and ability resulted from polluting economic activities. Focussing on emissions enabled by income and embodied in consumption recognises the economic links between pollution, benefits, and ability.

The Economic-Activity Principle and unitary principles

The *Polluter-Pays Principle* is included in the *Economic-Activity Principle* and informs the distribution of climate responsibility. It does so in proportion to emissions enabled by income and embodied in consumption, meaning that it relies on the economic causation of emissions to identify who polluters are. However, there is an important difference between the *Economic-Activity Principle* and the *Polluter-Pays Principle.* While the latter does not assign prospective responsibility shares for emissions of dead, unavailable, or unwilling polluters, the *Economic-Activity Principle* does. It applies the same prospective responsibility shares to the entirety of retrospective climate responsibility, not just to those parts resulting from polluters' own emissions. In this way it runs counter a discrete formulation of the *Polluter-Pays Principle*.

Regarding the *Beneficiary-Pays Principle,* the *Economic-Activity Principle* suggested here identifies agents as climate responsible to the extent that they have derived economic benefits from emissions. Such benefits include producer-surplus in the form of income on the one hand and consumer-surplus resulting from consumption on the other. The *Economic-Activity Principle* distributes responsibility shares based on emissions embodied in consumption and enabled by income and so includes the essence of the *Beneficiary-Pays Principle*. But, since it respects all thresholds, the *Economic-Activity Principle* is distinct from discrete formulations of the *Beneficiary-Pays Principle*.

Does the *Economic-Activity Principle* satisfy the *Ability-to-Pay Principle*? Under the *Economic-Activity Principle*, the *economic capability* of agents only serves as qualitative differentiator between those able to bear climate responsibility and those who should be exempt. Above the *economic capability threshold* and regarding the quantitative distribution of responsibility shares, the *Economic-Activity Principle* only corresponds to the *Ability-to-Pay Principle* insofar as ability and benefits can be regarded as stock- and flow-conceptualisations of income. It thus differs from positive applications of the *Ability-to-Pay Principle*.

The Economic-Activity Principle and other hybrid principles

The *Economic-Activity Principle* is distinct from the other above-discussed multi-principle proposals in several ways. For example, the other proposals apply pure forms of the *Polluter-Pays Principle* and *Ability-to-Pay Principle* consecutively (Caney, as well as Roser & Seidel) or parallelly (Baer et al.). The *Economic-Activity Principle*, by contrast, draws on all these unitary principles but simultaneously qualifies each of them with the respective others. It so avoids conceptual overlap and responsibility-double counting that could result from consecutive or parallel employment of the unitary principles. Unlike all other hybrid principles discussed here, it also does not assign climate responsibility shares based on climate-neutral or even climate beneficial economic activities just because they resulted in benefits and ability. Instead, such creation of benefits and wealth is not connected to harmful emissions and thus not included as relevant for distributing climate responsibility.

Furthermore, the *Economic-Activity Principle* deals differently with the "residual" or "unassigned" responsibility for the emissions of dead, excusably ignorant, unidentifiable, or unwilling polluters. While the other multi-principle proposals call for pure (Roser & Seidel) or qualified (Caney) versions of the *Ability-to-Pay Principle* to distribute such residual responsibility, the *Economic-Activity Principle* calculates and distributes prospective responsibility shares for the entirety of retrospective responsibility. The argument for the distribution of the emissions before and below the thresholds is thus an extension of the argument distributing climate responsibility shares for emissions above the thresholds. This is arguably fairer than pure versions of the *Ability-to-Pay Principle* since economic causation of emissions

and at least some measure of historical responsibility would play a role. The current generation of potential responsibility bearers is arguably the right one to take on prospective responsibility proportional to the retrospective responsibility even of earlier emitters. Earlier generations cannot be held responsible anymore and later generations will not be able to remain within the temperature limits if the current generation does not accept ambitious climate responsibility shares.

Just as the other multi-principle-proposals, however, the *Economic-Activity Principle* is still not a perfectly fair or ideal distribution of the burdens associated with a response to climate change. Polluting beneficiaries above the economic capability threshold are asked to pick up more prospective responsibility than they have retrospective responsibility because the residual responsibility of others is assigned to them too. Their prospective responsibility shares are therefore "inflated" and so correspond to all retrospective responsibility, not just that part which can be directly linked to current emitters. But although it is still non-ideal, the *Economic-Activity Principle* attempts to offer an arguably "fairer" way of assigning the residual than the other multi-principle proposals discussed here.[455]

5.4. Further thresholds and outlook on measurement

5.4.1. Revisiting the potential political capability threshold

In the previous chapter, I argued that the knowledge and economic capability thresholds should be the only planks limiting the distribution of prospective climate responsibility in relation to retrospective responsibility for excessive emissions above the sustainability threshold. They are genuine limits to our ability to bear climate responsibility. Without economic capability, we cannot participate in bearing the costs associated with prospective climate responsibility. And without knowledge we cannot even know there are costs. I briefly discussed other potential threshold candidates such as the ones based on "religious", "moral", or "political ability" to bear climate responsibility – however those are framed. These, and others, are important reasons why we disagree about and have failed to act decisively on climate change[456]. However, I dismissed such candidates as limits on prospective responsibility. They appear too soft and are too dependent on our willingness to act

[455] For more on this point, see Caney, 'The Struggle for Climate Justice in a Non-Ideal World'.
[456] Jamieson, *Reason In a Dark Time*; Hulme.

rather than being tangible candidates of our actual, objectively identifiable ability in ways comparable to economic capability or knowledgeability. Similar concerns could be raised about the knowledge threshold because we could "choose not to know" or deny knowledge. My only counterargument to this is that, fortunately, we currently have political agreement that we are and have been for a while above the knowledge threshold. By decree the international community acknowledged that it has known enough at least since 1990 to take on climate responsible action. Theoretically, this situation could change such that the international community or individual countries would suddenly "decide to know too little to be able to bear climate responsibility" after all. But in light of the growing body of knowledge on climate change, this is an increasingly absurd thought even though one supported by prominent climate denialists. Yet, if such a "choice of ignorance" were to be made, we would be facing the much more serious challenge of objectively identifying whether we are indeed above the knowledge threshold or not. In this case, we would need to search for a deep justification[457] after all.

Regarding "political ability" to bear climate responsibility, we can now return and add to this discussion in light of the systematised conceptualisation of climate responsibility developed here. With the 1992 UN Framework Convention on Climate Change, the international community enshrined the principle of CBDR-RC not just as ancillary but at the core of the international climate governance regime. As laid out in chapter 1, climate negotiations can generally be viewed as having their purpose in negotiating, systematising, operationalising, and implementing the details of this principle. In light of the continuously increased urgency of "dangerous anthropogenic interference with the climate system"[458] it may be fair to say that the international climate regime has so far failed to provide an adequate (i.e., effective) and equitable response to the challenge of climate change. In this respect there is some merit to the view that our political institutional structures are indeed ill-equipped to bear climate responsibility[459].

However, such lack of political readiness, or willingness, or actual success in building effective institutional structures in the international climate regime must

[457] See subsection 4.2.2.
[458] UN.
[459] Jamieson, Reason In a Dark Time, chaps 3.4.-3.7.

not be mistaken for a lack of "political capability". I think it is unconvincing to argue that the international climate regime is politically capable of agreeing on CBDR-RC while at the same time maintaining it could – as a matter of political capability – not principally also agree on any of the other hybrid principles discussed here. Claiming that our political systems generally lack the ability to take on climate responsibility could itself threaten to amount to denialism and stand in the way of erecting those same structures we may currently still be in want of. It would also mean neglecting the reality of the international climate regime's numerous decisions to take on climate responsibilities. The result of these decisions are expressed in all international landmark climate agreements. With these agreements and their resounding and repeated support for the principle of CBDR-RC, the international climate regime has expressed its willingness and readiness to take on climate responsibility in the sense of making an honest effort at finding effective and equitable responses. To then claim "political incapability" for bearing climate responsibility in the more nuanced ways discussed and developed here would be implausible. There are certainly many objectives in the way of a more advanced conceptualisation of climate responsibility. But general "political incapability" is not plausibly one of them.

The principle of CBDR-RC has always been and remained vague. Attempts at systematising and more concretely operationalising it – perhaps even in the sense of developing a formula-approach to it – have repeatedly failed. Still, throughout its history it has continuously been subject to changes and reinterpretations. The hybrid principles discussed here – including the *Economic-Activity Principle* – are all readily available candidates of a more concrete systematisation of CBDR-RC and in that sense face the same challenges of political viability that earlier attempts at operationalising CBDR-RC have faced in the past. However, political viability must not be confused with political capability. While the former can change quickly, the latter is much more immobile. With the acceptance of CBDR-RC – even if only in its vague formulation – the international community has shown that it can agree on far-reaching normative guiding principles. The hybrid principles proposed here would be systematised operationalisations of CBDR-RC which attempt to specify what is currently vague. They would most likely be much harder

to agree on politically. But they would remain true to the foundations and goals of CBDR-RC and to the values it is intended to protect. In this sense, they do not categorically overburden the political capability to find agreement. The UN scale of assessments is a lighthouse example for a very specific (though highly contested) agreement on how to distribute burdens effectively and equitably. The political response to the current pandemic is also often viewed as prime example for the ability of political systems to heed to the advice of science and swiftly respond in the face of danger. Defending a "political ability" threshold to limit climate responsibility would be categorically denying that the international climate regime could achieve the same in the face of climate change.

For these reasons, I think we should reject the inclusion of a "political capability" threshold and argue that a systematised conceptualisation of climate responsibility should only be informed by the sustainability, economic capability, and knowledge thresholds.

5.4.2. Measurability

Besides having a strong normative foundation and realistic chances at practical usefulness, a working concept of climate responsibility should be empirically measurable. Without the possibility to measure it, it cannot fully and specifically guide burden-sharing. Without a detailed and shared understanding of how it should be measured, the concept may have abstract use as a vague guide on the distribution of responsibilities but there will remain deep disputes over its exact interpretation. In terms of Adcock & Collier's framework, it is important for a wholesome concept to exhibit strong connections among the individual conceptual levels. If operationalisation and measurement are invalid, what we measure might not depict what we intend to capture with a given concept. If the conceptualisation in the higher levels of the Adcock & Collier framework is not measurable per se, a concept may not offer much practical use. I will thus discuss operationalisation and measurement questions related to climate responsibility based on the *Economic-Activity Principle*.

In order to measure climate responsibility, it is again important to distinguish between its retrospective and prospective dimensions. Interestingly neither the retrospective nor the prospective sides of climate responsibility are normatively empty

or neutral. Since there are many ways in which either retrospective or prospective responsibility can be conceptualised and eventually measured, the actual choices of how the concept *should* be conceptualised and measured are inherently value laden. However, even though this might imply that they are not equivalent to objective, factual statements in the natural sciences, this does not mean that some may not be inherently more convincing than others.

In the upcoming measurement chapter, I will therefore set out to measure the systematised concept developed here. This will involve pinpointing measurable and exact locations of the respective thresholds. For emissions, it involves taking economic causation seriously and employing a shared income- and consumption-based emissions accounting approach rather than territorial emissions accounting[460]. If emissions are measured based on this shared approach and respect all thresholds, retrospective responsibility shares can directly be translated into prospective responsibility shares. These in turn can be applied to equitably divvy up the total costs of an effective response to climate change.

5.5. Concluding remarks

This chapter took the shortcomings of the principle of CBDR-RC in international environmental governance as starting point for an economic reconceptualisation and systematisation of climate responsibility. It discussed prominent principles of climate responsibility as well as combinations of them in the literature and argued that despite their respective advantages none of them offers a fully convincing and measurable basis of climate responsibility. The *Economic-Activity Principle* proposed in section 5.3.6. attempts to overcome these deficits and offers a normatively grounded, practically useful, and empirically measurable basis of climate responsibility. It incorporates established climate responsibility principles and combines them such that they qualify each other. The proposed combination of principles overcomes the major weaknesses of the individual principles both if applied discretely as well as consecutively. As such, it holds promise to complement other proposals in the literature, specifically Roser & Seidel's "far reaching proposal" and the equity reference framework, on how to systematise CBDR-RC. As such, it

[460] See section 2.3.

might provide practically useful help to overcome some of the struggles surrounding differential treatment in international climate governance after the Paris Agreement.

6. Measuring climate responsibility

6.1. Introduction

This chapter measures the reconceptualised understanding of climate responsibility. The previous two chapters on the *background concept* and s*ystematised concept* levels[461] established that climate responsibility tasks us with the search for a good response to climate change[462]. A good response, I further developed, is one that is guided by the *Economic Activity Principle*. It respects a sustainability threshold, a knowledge threshold, and an economic capability threshold**.** Above and beyond these thresholds, climate responsibility should then correspond to agents' harmful, i.e., unsustainable, activities which can be captured by their emissions. And such emissions, in turn, should be measured by taking their economic causation as basis of emissions accounting and responsibility attribution to agents. Conceptualising climate responsibility based on the *Economic Activity Principle* respects the *Polluter-Pays Principle*, *Beneficiary-Pays Principle* and a negative reading of the *Ability-to-Pay Principle* and ensures they co-qualify each other[463]. It also draws on the strengths of several prior hybrid principles in the literature[464].

I dismissed the individual level of agency, arguing that still too many individuals do not satisfy the requirements of the respective thresholds and that the response to climate change requires more broadly, at best globally, co-ordinated action[465]. Unsustainable emissions can thus be measured at the individual as well as higher levels but prospective responsibility resulting from them should eventually be aggregated at the level of nation states who meet the requirements of all thresholds and can co-ordinate globally. Furthermore, since the individual effects of emissions cannot be observed, harm should be framed in terms of the average expected rather than the de facto observed harmful effects of emissions.

Since it is one of the more controversial components of the *Economic Ability Principle*, let me briefly recap how I locate the knowledge threshold before engaging with the main tasks of the present chapter[466]. Although there have been much

[461] See 3.2.2
[462] Drawing on broader contributions such as Schmidt; Jonas.
[463] See 5.3.6
[464] See 5.3
[465] See 4.5
[466] See also 4.4.1

earlier, many, and important scientific and even official political acknowledgements of the dangers of climate change, I argue that 1990 should be used as lowest common denominator for the knowledge threshold. After 1990 excusable ignorance becomes indefensible. Including it means that only emissions after 1990 are taken into consideration when measuring countries' climate responsibility shares. This is problematic because many developed countries started emitting unsustainable amounts of greenhouse-gases before that date and can at the same time already arguably be viewed as having been economically able to opt for cleaner alternatives. Including a 1990 knowledge threshold, however, is defensible not just from the perspective of the knowledge threshold but also with respect to the general capability for bearing climate responsibility. Uncertainties about climate change were in fact much higher prior to 1990 and there was no IPCC yet to provide a comprehensive knowledge basis on which the international community agreed. Technical alternatives were not as readily available. There was no international UN Framework Convention yet that could provide first movers with any hope that others would contribute too. And the world was predominantly preoccupied with other matters perceived as much more pressing at the time (e.g. the Cold War[467]). From a measurement perspective, too, 1990 is a good starting point because reliable economic emissions and ability indicators reach back to 1990s but often not much further. All this is not to say that there are no good arguments for including an earlier starting date for measurement. It means instead that beginning at *1990 at the latest* should offer no more room for reasonable disagreement. Optimally, knowledge could be objectively measured as gradually increasing. It could then play a gradually increasing role in the measurement of climate responsibility too. Since it cannot be observed directly, however, I resort to the heuristic of existing political agreement that enough knowledge for bearing climate responsibility has been reached. The first assessment report of the IPCC as well as the ensuing international agreement to heed its advice serve as this heuristic and defend 1990 as knowledge threshold.

Overall, the prior chapters developed a concept according to which:

[467] Although every point in history can perhaps make an argument along these lines.

A country's prospective climate responsibility should be measured as its combined consumption- and income-based emissions after a knowledge threshold (1990) and above an economic capability threshold that leaves enough room to develop out of and further eradicate poverty.

On this basis, the current chapter can now address the following further questions to measure climate responsibility:

1) How do I measure the main building blocks of climate responsibility, i.e., economic emissions and economic capability?
2) What are the main results, i.e., which countries should bear which shares of the overall prospective climate responsibility?
3) How do my results compare to mainstream views of climate responsibility based on territorial emissions accounting?

Strong views on climate change and climate responsibility are widespread. Disruptive results like the ones presented here typically raise many questions, everyone's pulse, or at least some eyebrows. To keep calm, it may help to keep in mind that the way of conceptualising and measuring climate responsibility proposed and discussed here is perhaps not the only one in which the requirements of the background and systematised concept levels could be fulfilled. I contend, however, and develop and defend this view throughout this dissertation, that it is currently the most appropriate one. It conceptualises and measures a normatively defensible, practically useful, and empirically measurable understanding of climate responsibility that simultaneously respects the goals of effectiveness and equity in the international response to climate change. What to make of the results is then a question of a broader discourse that cannot be exhaustively or appropriately addressed here. As will become clearer in the following sections, despite the prior conceptual restrictions imposed, there remain other ways in which they could be fulfilled at the level of measurement. There are, for example, different – albeit less convincing – ways in which emissions can be measured and weighted, different ways in which a country's capability could be captured, and different locations of the knowledge threshold. But before it is done, it remains unclear whether they could be defended in a similar fashion.

So, despite other potential measurement options that remain, the present reconceptualisation and measurement means that the defensible option space should be regarded as substantially more restricted than is currently the case in public and political debates on climate responsibility. If the requirements put in place by my background and systematised concepts are included, our understanding of climate responsibility profoundly changes compared to the multiple and inconsistent ways in which we currently view it. If its implications are taken seriously, we would have to develop a whole new way of thinking about and distributing countries' common but differentiated responsibilities and respective capabilities[468].

The results presented below are at the same time shocking and unsurprising. They are shocking because they bluntly show that the singularly narrow focus on territorial greenhouse gas emissions in international climate negotiations and -policies profoundly misrepresents countries' respective climate responsibilities. They may also disturb because they shatter the belief that regardless of the indicator, results will generally be the same and that there is agreement on who should be viewed as responsible for which share of the burden. For example, according to my results, China's prospective climate responsibility share for the 1990-2015 time period amounts to only 6.68% of the global total. By contrast, its 2015 share in global territorial emissions was 27.11% already. India's results are perhaps even more shocking. Its 1990-2015 prospective climate responsibility share is 0.24% of the global total (this is not a typo – see Figure 6-2 below) while its 2015 share in global territorial emissions was 4.69%. Together, although they make up a population of more than 2.5 billion people (up from already about 2 billion in 1990)[469], China and India thus only hold less than 7% of the global prospective climate responsibility for the 1990-2015 time-period. By contrast, representing a combined population of less than 0.9 billion people, the EU28's and USA's combined share in the same 1990-2015 global prospective climate responsibility amounts to more than 48% (see Figure 6-2)

[468] As the historical chapter on CBDR-RC has shown, there is not much hope for this to happen. At the same time, there is a place for this concept as a potential "Equity Gauge" of climate agreements reached and pledges made in the international climate regime.

[469] World Bank, 'Population, Total - India' (World Bank, 2021) <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=IN>.

At the same time, such results should not come as a surprise to those who reflect about how steeply especially China has risen out of poverty since the 1990s and how severe poverty was and still is in many developing countries, especially in India. Emission shares above many developing countries' capability threshold are often negligible compared to those of developed countries which in many cases have been above 90% at least after around the year 2000[470]. Similarly, but with a smaller impact on responsibility shares, it should not surprise that given the vast rises in international trade and the ever more prominent global interconnections of the world economy, responsibility shares differ depending on whether territorial, consumption-based, income-based or combinations of them are considered. These points will be further discussed in the following discussions.

This chapter comes in two further substantial parts and a conclusion. The next section 6.2. contains a discussion of the theory and practice of measuring different emissions indicators as basis of climate responsibility. This includes some of the bigger topics in economics such as national accounting and *input-output analysis* as well as their *environmental extensions*. It also very briefly discusses some potential ways in which to measure countries' capability. Section 6.3. then introduces and explains the proposed indicator of prospective climate responsibility based on the *Economic Activity Principle*[471] and presents and discusses the main results obtained from measuring it[472].

6.2. Measuring emissions and capability

Most fundamentally, the *Economic Activity Principle* requires two broad inputs to measure climate responsibility: emissions and capability. These in turn must more specifically be measured above and beyond the respective thresholds and incorporating economic causality. The sustainability threshold implies that emissions levels that are inconsistent with the temperature limits of the Paris Agreement and their corresponding emissions budgets should count towards climate responsibility. In the previous chapters I established that given the very limited emissions budget left and the very low likelihood of reaching them at current levels of ambition[473],

[470] Kemp-Benedict and others.
[471] Subsection 6.3.1.
[472] Subsection 6.3.2.
[473] c.f. Mercator Research Institute on Global Commons and Climate Change.

all emissions after the knowledge threshold (i.e., after 1990) and above the economic capability threshold that protects development, should count towards climate responsibility. In other words, there are no more emissions left above the knowledge and economic capability thresholds that are compatible with the sustainability threshold. To reflect economic causality, these emissions should furthermore be measured as enabled by income and embodied in consumption rather than on a territorial basis. Territorial emissions accounting is excluded by the *Economic Activity Principle*. While the territorial basis of measuring emissions is helpful in determining *where* emissions occur, it fails to appropriately capture *why* they occur[474].

6.2.1. Incorporating the *Polluter-Pays Principle* & *Beneficiary-Pays Principle* to account for the economic causality of emissions

Including the previously mentioned *Polluter Pays Principle* into an account of climate responsibility means regarding those who emit greenhouse gases as potential climate responsibility bearers. Simultaneously including the *Beneficiary-Pays Principle*, however, means that those who derive benefits from emissions should be regarded as potential responsibility bearers. Combining the two principles, then, means that when setting out to measure climate responsibility, we should measure emissions but in a way that takes not only direct pollution but also more indirect economic benefits into account. Measuring income-based and consumption-based rather than territorial emissions ensures inclusion of the *Beneficiary-Pays Principle*. Think, for example, of a coal-fired power plant. Based on the *Polluter-Pays Principle* alone, one could argue that the employees who keep the plant running should be regarded as responsible, as they are the direct polluters. One could also argue that the company or shareholders owning the power plant should be regarded as polluters. This argument would arguably already be more complicated to defend as they are typically not directly, i.e., physically, involved in the burning of coal and might even be territorially distant. The *Polluter-Pays Principle* alone, in many cases runs into such trouble when trying to identify who the polluters actually are. Including the *Beneficiary-Pays Principle* can enable the inclusion of all employees, suppliers, owners, and customers involved in economic interactions with the power

[474] Marques and others.

plant that derive some form of benefit (i.e., income, interest payments, consumer surplus) from their economic interactions with it as potential responsibility bearers. What is measured are still emissions. But they are now attributed to those who enable emissions by earning income or interest off emitting economic activities and to those who consume the goods and services that embody emissions.

Territorial Emissions

Territorial emissions accounting is the international standard approach to measuring countries' emissions and the recommended and most advanced and reliable estimation suggested in and by the international climate regime complex[475]. Territorial emissions are estimated by measuring the amount of fossil fuels and other energy sources that are extracted and imported into a country's economy and burned there during productive or consumptive activities within the current year (i.e., neither stored nor (re-)exported) and multiplying this amount with the carbon intensity (i.e., greenhouse gases emitted per unit) of the respective energy source and burning method[476]. If territorial emissions are used as basis of a country's climate responsibility, the analysis stops here, and the country be regarded as responsible for all emissions occurring on its territory.

The advantages of territorial emissions accounting and the related territorial understanding of climate responsibility are that estimation methods are highly advanced, data availability is generally very sophisticated, and the idea that sovereign nation states should be held responsible for what occurs on their territory has its merits[477]. However, territorial emissions accounting comes with too many issues[478]. Most severely for the measurement level is that translating territorial emissions into countries' climate responsibilities misrepresents prospective responsibility shares, especially when large quantities of emissions are embodied in imports and exports[479].

[475] IPCC, '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories'.
[476] Ritchie and Roser.
[477] Rodrigues and Domingos; Lenzen and Murray; Wiedmann; IPCC, 'IPCC Guidelines for National Greenhouse Gas Inventories'.
[478] Michael Jakob, Hauke Ward, and Jan Christoph Steckel, 'Sharing Responsibility for Trade-Related Emissions Based on Economic Benefits', *Global Environmental Change*, 66.July 2020 (2021), 1–8 <https://doi.org/10.1016/j.gloenvcha.2020.102207>; G. P. Peters, S. J. Davis, and R. Andrew, 'A Synthesis of Carbon in International Trade', *Biogeosciences*, 9.8 (2012), 3247–76 <https://doi.org/10.5194/bg-9-3247-2012>; Jan Christoph Steckel, 'Developing Countries in the Context of Climate Change Mitigation and Energy System Transformation', 2012, 1–176 <https://www.depositonce.tu-berlin.de/handle/11303/3582>; Hertwich and Peters; Hertwich and others.
[479] See also 2.3.2

Modelling the Economy & Environmentally Extended Input-Output Analysis

To overcome the shortcomings of the territorial emissions accounting approach, many alternative indicators have been proposed, most important of which are consumption- and income-based emissions accounting[480]. Their estimation is a little more involved than that of territorial emissions accounting, so let us take a brief detour into economic theory to understand how they work.

The circular flow model of the economy

To better appreciate who should rightly be regarded as polluters and beneficiaries and to what respective extent, economic interactions among economic agents should be accounted for more comprehensively. The widely applied fundamental circular flow model of the economy typically includes in its most basic form firms and households as principal actors and depicts all economic activities as circular flows between them[481]. Firms use *labour* and *capital* as inputs to produce goods and services, paying *income* and *interest* on them. Households in turn provide labour and capital to firms and use their income and interest earned to buy goods and services for consumption. The proportion of their income and interest earnings that households do not expend on consumption is either saved or collected as taxes and in this way more or less directly flows back to firms as capital inputs.

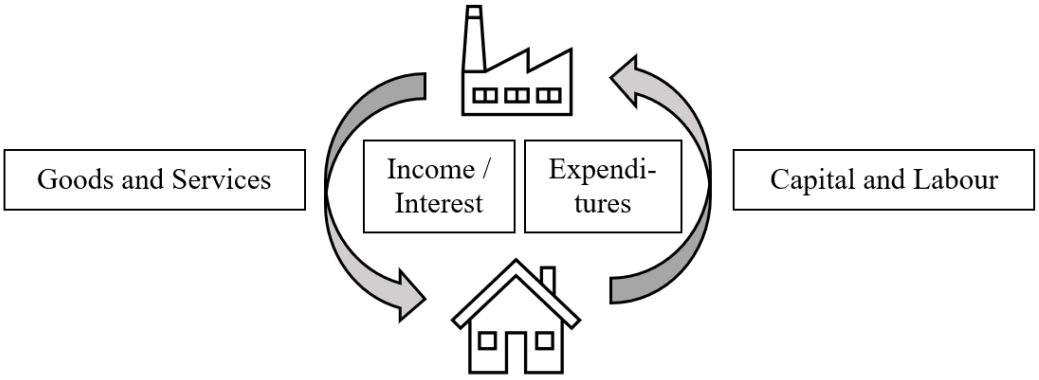

Figure 6-1: Basic circular flow model of the economy

[480] Jiun Jiun Ferng; Bastianoni, Pulselli, and Tiezzi; Rodrigues, Marques, and Domingos; Liang and others.
[481] Consult, for example: John Sloman and Alison Wride, ECONOMICS, 7th edn (Harlow: Pearson Education Limited, 2009) or other Economics textbooks. N. Gregory Mankiw and Mark P. Taylor, MACROECONOMICS, European (New York: Worth Publishers, 2010); Miller and Blair.

The circular flow model of the economy can be broken down into individual supply chains starting at their upstream beginning with *primary inputs* (capital and labour) and ending at their downstream ends in *final consumption* of goods and services. Each and every economic actor in this depiction of the economy simultaneously takes on a dual role of *final consumer* on the downstream end of supply chains, spending income on f*inal consumption* (goods and services), and as a supplier of primary inputs on the upstream beginning of supply chains providing firms with capital and/or labour in exchange for income and/or interest. Firms in this depiction are no primary actors as they are typically owned by the suppliers of capital inputs and thus regarded as intermediary structures. This point is crucial as it results in potentially unintuitive consequences because the *Economic Activity Principle* does not view firms as climate responsibility bearers. Rather, all climate responsibility for the firm's emissions is distributed to its primary inputs and final consumers. For example, every employee working for a firm earns an income from their labour supplied to the firm and spends part of their income on consumption while the rest goes into savings and taxes eventually finding its way (through capital markets and / or the government sector) back to firms which pay interest on it and use it for investment.

Real economies are of course more complex than this simple circular flow model and the model accordingly exists in much more complex forms including e.g., capital markets, government sectors, as well as international trade. However, the basic logic that every economic interaction can be depicted as a supply chain starting with primary inputs and ending in final consumption as well as the idea that every economic agent is simultaneously both a supplier of primary inputs and a final consumer of goods and services remain unchanged. To make the circle complete means that gross national income and gross national product must be identical which is one of the most important fundamental identities in economics[482]. To understand its relevance to the climate responsibility context, let us turn to input-output analysis and its environmental extensions.

[482] Miller and Blair, chap. 2.2.1.

Environmentally extended Input-Output Analysis

Another, and perhaps most parsimonious, way of modelling the economy is input-output analysis with its environmental extensions, which go back to the seminal contributions by Wassily Leontief[483]. It takes the essential elements of the circular flow model of the economy but drastically alters and simplifies the depiction of interactions.

Using input-output representation, a single matrix is enough to depict all transactions among different economic actors including firms, households, capital markets, governments, and the rest of the world. Crucial to the representation of all these transactions in matrix form, is the point that each actor receives inputs and uses them to generate outputs which in turn become the inputs of other actors in the economy leading again to its overall circular character[484]. This means that a single matrix with a respective row and a column for each actor's respective inputs and outputs is enough to simultaneously represent all economic activity in the economy for a chosen period of time. The complexity can again be higher or lower, depending on the level of detail with which economic activities are captured but the two-dimensional character of the matrix is enough to simultaneously show all inputs and outputs.

How can the system depict change such as overall growth, decline, or sectoral transformations and rotations? This is relevant to discussions of responsibility as it can show which actors are able to exert which type of influence over and within the system. Discussions of changes in economic activity in the circular economy model as well as input-output analysis often address the question "what happens to production, if demand increases by a given amount". More generally and more precisely, the fundamental question addressed by input-output analysis is "which additional inputs are required at which point(s) along supply chains to supply an additional dollar's worth of output to final demand?"[485]

One standard model of change, let us call this the *Demand-Pull Depiction* for easy reference, then goes that when final demand or consumption increases, this represents increases in production outputs that are directly linked to final demand,

[483] Wassily W. Leontief; Wassily Leontief.
[484] Miller and Blair, chap. 1.2.
[485] Miller and Blair, chap. 2.

i.e., that downstream of supply chains directly provide goods and services to final consumers[486]. However, in order to increase the outputs of these downstream sectors that are directly linked to final demand, their respective inputs must increase as well, which in turn leads to increases in the outputs of production sectors higher up the respective supply chains. In this manner, the initial change in final demand leads to further changes throughout the economy, which in turn beget further changes until a new balance is reached on a new equilibrium level of overall input and output level of production and consumption[487]. To give an example, if customers buy more groceries, grocery stores increase their outputs by depleting their stocks and demanding more products from their suppliers, which in turn demand more from suppliers even higher up the supply chain and so forth until eventually there is an increase in agricultural production and other upstream input sectors. So, the standard economic rational under the *Demand-Pull Depiction* goes that demand changes first, which in turn leads to ripple effects higher and higher up the respective supply chains which ultimately lead to changes in the overall levels of production and economic output. A more nuanced formulation would be that an increase in demand which cannot immediately be satisfied, leads producers to raise prices, which in turn attracts new producers and / or encourages existing producers to supply more until supply and demand return to equilibrium at a new level of price and quantity.[488]

This *Demand-Pull Depiction*, however, must be criticised least for being economically one-sided perhaps even economically naïve. Small changes in demand are often absorbed by changes in inventories and do not have to lead to greater changes in levels of production if they do not persist over longer time periods. More importantly and concerning the direction of change, is that changes in economic activity by no means have to originate in final demand. In order to raise profits or in the pursuit of other goals, producers, too, may change the quantity, quality, or type of their outputs and so initiate changes higher up supply chains which again ripple up and down the system and may ultimately affect final consumption. Think

[486] Miller and Blair, chap. 2; Justin Kitzes, 'An Introduction to Environmentally-Extended Input-Output Analysis', *Resources*, 2 (2013), 489–503 <https://doi.org/10.3390/resources2040502>.
[487] e.g. Kitzes, pp. 491–92.
[488] c.f. Miller and Blair, chap. 2.

of new inventions, or more efficient ways of producing existing products that change tastes or prices and so ultimately influence final demand. Let us call this alternative model of change in output and expenditures the *Supply-Push Depiction*.[489]

The fundamental question of change addressed by input-output analysis can thus be turned around as well, by asking what changes are triggered in final demand, if supply increases by a given amount. Or rather, what amounts of outputs are required at which point(s) along supply chains in order to generate an additional dollar's worth of income / interest for primary inputs (i.e., labour and capital)?.

Against the background of these two depictions of change in an economy's outputs and expenditures, we can now turn to the more relevant *Environmentally Extended Input-Output Analysis (EEIOA)*.[490] The fundamental idea of *EEIOA* is that the *environmental effects* of economic activities can and should be included in models of the economy such as the input-output model introduced above. Environmental effects are of course a very broad category including all kinds of impacts on the environment (good or bad) that occur, for example, as a result of economic activities. Here, only the climate altering environmental effects leading to global warming, are of interest.[491]

The introduction of these effects into input-output analysis can be achieved in different ways one of which was described above as territorial emissions accounting. In input-output terms, climate changing energy and resource requirements can enter the input-output matrix as inputs, or emissions and other environmentally damaging outputs can enter the input-output matrix as waste or unintended scrap. Whichever way of representing environmental effects in the input-output matrix is chosen, it is important that in the presence of sufficiently detailed and sectorally disaggregated data, environmental effects can be linked to specific other economic activities. This in turn allows for laying responsibility on the agents engaged in these activities. Usually, environmental effects – at least the damaging ones – are not the aim of economic interactions but happen as an unwanted (yet tolerated) side-

[489] c.f. Miller and Blair, chap. 2.
[490] Miller and Blair, chaps 9 & 10; Kitzes; Su, Ang, and Low; João F D Rodrigues and others.
[491] Rodrigues, Marques, and Domingos.

effect in the pursuit of other economic goals[492]. Despite their typically unintended character, agents involved in the economic activities leading to the environmental effects in question can be regarded as economically and, in many cases, more directly causally responsible for them.

Overall, *EEIOA* is the most advanced and prominent way to calculate how much and which emissions are a) embodied at the downstream end of supply chains in final consumption, b) enabled at the upstream beginning of supply chains by primary inputs, and c) traded internationally.[493] The territorial approach to emissions accounting described above only captures some of these interrelations by focusing on fossil fuels and *where* they are burned instead of asking who is directly and indirectly involved in the economic reasons for *why* emissions occur. At the level of measurement, we can now see what unwanted consequences this entails. If the economic activities of final consumption and the supply of primary inputs were to always remain within the same country it would not matter whether climate responsibility ends up with territories, final consumers, or suppliers of primary inputs since all of them would be aggregated to the same national level of agency. But since goods and services are increasingly traded internationally, the question at which end of international supply chains climate responsibility is assigned can have profound implications for the international distribution of climate responsibility shares and – in turn – for how much each country can fairly be asked to contribute to the internationally concerted response to climate change.

Following these initial considerations on the goals of *EEIOA*, let us briefly discuss how it works. As I alluded to above, in order to depict climatic impacts, data on GHG emissions (most conveniently in the form of CO_2 equivalents) at different points of origin along supply chains (e.g. during different production or consumption activities) must be included in the input-output accounting matrix, typically measured in physical units such as tons or kgs of CO_2 equivalents. Once emissions are included the respective economic activities and supply chains containing them identified, the c*limate intensities* of these respective economic activities and supply

[492] See also the drowning orphan analogy in 4.2.3
[493] Rodrigues and Domingos; Gallego and Lenzen; Minx and others.

chains can be expressed. And these in turn can be translated into climate intensities of monetary units.[494]

If, for example, we know that the various production processes involved in the making of a car generate a certain overall amount of emissions, and the car is eventually sold at a given price, we can express the climate intensity of making that car available to final demand as the car's price divided by the greenhouse gases emitted along the supply chains involved in its production in proportion to the price of all cars sold out of these supply chains. The full lifecycle emissions of the car would then of course further include some of the emissions occurring during its use as well as its disassembling and disposal or recycling.

In terms of *EEIOA*, the relevant question to be asked from a *Demand-Pull Perspective* is then "which additional amounts of emissions are necessary at what point(s) upstream the supply chain to make an additional $ worth of output available to final demand?". The equivalent *Supply-Push Perspective* would then ask "which additional amounts of emissions are necessary downstream the supply chain to generate an additional $ worth of income/interest for primary inputs?". The answer then of course varies with the product in question, the production processes leading up to it as well as their respective climate efficiency. Making a dollar's worth of meat, or cheese, or wool, for example, typically involves greater emissions than providing a dollar's worth of legal advice, or a dollar's worth of music on the street. Equivalently, generating a dollar's worth of electricity using coal, will typically lead to more emissions than if the same amount of electricity had been generated using renewable energy sources.

The *Supply-Push* and *Demand-Pull Depictions* outlined here and *EEIOA* more broadly allow answering more specific questions on environmental effects rippling through economic systems. While the circular flow model helps us see the two roles of economic agents as both suppliers of primary inputs and consumers of final demand, *EEIOA* allows us to study the environmental effects of the choices they make and, as a consequence of them, the climate changing effects they have in these roles. We can now return to the question who the polluters and beneficiaries are and arrive

[494] cf. Rodrigues, Marques, and Domingos.

at a more nuanced answer that is directly pertinent to the measurement level than the ones provided in prior chapters.

Who are the Polluters? Measuring Consumption- and Income-Based Emissions

If the goal is measuring and assigning climate responsibility shares of different economic agents, it thus matters how environmental effects enter the input-output matrix and where they end up. There is first an argument for holding those accountable who extract the fossil fuels that further down the line lead to emissions in productive and consumptive economic activities. This view is typically referred to as *Extraction-Based Responsibility* because it assigns all responsibility to those who enable supply chains to emit greenhouse gases[495]. After all, without the extraction of fossil fuels, there would be no climate changing emissions in economic activities, so those directly engaged in fossil fuel extraction should under this perspective be regarded as responsible. The territorial responsibility approach introduced above holds countries responsible for the emissions occurring on their territory on the basis that countries can decide on legislation that allows or prohibits the extraction, imports, and burning of fossil fuels. Income-based responsibility, by contrast, argues that suppliers of primary inputs into economic activities (i.e., inclusive conceptions of capital and labour) should bear climate responsibility. After all, neither fossil fuel extraction nor other emissions-intensive industries could operate without these primary inputs that earn income (or interest) from investing in or working for these industries. The income-based responsibility approach is related to the *Supply-Push Depiction* of the economy outlined in the previous section which captures the ripple effects of primary input choices on the economy's output and emissions. And last, there is an argument for consumption-based responsibility according to which only final consumers should be held climate responsible. This follows the *Demand-Pull Depiction* because their direct emissions during consumption as well as their expenditures on goods and services that lead to emissions upstream are viewed as what ultimately drives the whole economy and motivates emissions upstream.

Depending on the concept of climate responsibility chosen, different ways of measuring ensue in input-output analysis. We have already seen the downsides of

[495] I do not discuss it in detail here. For a more thorough examination, see Liang and others.

the territorial approach above. Neither territorial, nor consumption-based, nor income-based responsibility alone can capture the whole image of the economic interactions just described. They all neglect the economic role of the economic agents they do not focus on respectively. Beyond the respective one-sided nature of either of the responsibility bases discussed here, they all have a further and perhaps most serious shortcoming that stands in the way of translating either of these forms of emissions measures into a fair measure of climate responsibility. All indicators, if applied without complementation, neglect the need for an economic capability threshold below which emissions should not count towards climate responsibility of the respective emitters. The next subsection thus continues by searching an appropriate gauge for economic capability that could complement the emissions indicators identified here in order to allow for a translation into climate responsibility.

6.2.2. Ability to Pay Principle: measuring economic capability = measuring climate responsibility?

The previous subsection identified different emissions indicators' neglect of potential responsibility bearers' ability to pay as a major shortcoming for using them to translate emissions into climate responsibility. Without a meaningful economic capability threshold in place, each gramme of greenhouse gases emitted into the atmosphere would result in the same amount of responsibility no matter whether it exited the exhaust of a millionaire's yacht on Lake Zurich or a rickshaw in Dhaka. While it matters both from a theoretical as well as an empirical perspective whether we measure emissions on a consumption, income, or territorial basis, the difference between these indicators is dwarfed by the differences across countries regarding their economic capability to bear the burdens associated with an effective response to climate change (see Figure 6-2).

So, how should we locate countries' economic capability threshold above which they can bear climate responsibility? Countries' Gross Domestic Product (GDP, both national and per capita), as well as countries' levels of poverty and debt offer interesting candidates for gauging economic capability and for locating the corresponding threshold. The goal is to draw a poverty line and agree that below it, no-one can bear climate responsibility. To find out which countries can bear which climate responsibility shares, it seems promising to work with different poverty

lines (1.9$/day, 3.2$/day, 5.5$/day, and the corresponding poverty headcount ratios and poverty gap indices) as candidates for an economic capability threshold. The poverty headcount ratio, for example, tells us the share of a country's population living below an internationally comparable (i.e., purchasing power adjusted) poverty line as a percentage of its overall population[496]. With the poverty headcount ratio, it could be possible to qualify countries' greenhouse gas emissions in order to arrive at a more nuanced understanding of its climate responsibility that is more closely in line with the requirements of my background and systematised conceptualisations. Ultimately, however, data availability appears still too patchy on the poverty headcount ratio and especially on its relation to emissions to employ it in serious estimations of countries' prospective climate responsibility shares. Historical data are available for some large countries but missing for many smaller and poorer ones and they have not (yet) been related systematically and comprehensively to countries' emissions profiles. [497] High quality data on GDP, by contrast, is readily available and has been related systematically to countries' emissions profiles before[498]. I therefore employ a robust measure of countries' GDP in relation to their respective emissions profiles in order to draw the economic capability threshold.

Overall, this subsection argues that a measure of countries' *Economic Capability* should be included before emissions can be translated into *prospective* climate responsibility. The eventual (combination of) measures chosen will be more thoroughly discussed in the next section on the new indicator of climate responsibility.

6.3. A new indicator of Economic Climate Responsibility

In this section, I draw the prior arguments together to explain which components should be contained in the proposed indicator of climate responsibility and how they should be combined for measurement.

[496] World Bank, 'Poverty' (World Bank, 2021) <https://data.worldbank.org/topic/poverty>; Max Roser and Esteban Ortiz-Ospina, 'Global Extreme Poverty', *Our World in Data*, 2019 <https://ourworldindata.org/extreme-poverty> [accessed 13 December 2020].
[497] To get an idea of the current data availability and quality, please refer to: World Bank, 'Poverty'.
[498] Kemp-Benedict and others.

6.3.1. Components and their combination

First and most importantly, in order to reflect retrospective responsibility, i.e., the harmful contribution to the phenomenon of climate change in line with the *Polluter-Pays Principle*, climate responsibility should be responsive to who contributed how much to the phenomenon of climate change. If the contribution is higher, the respective responsibility shares should be higher and vice versa[499]. This could in principle be achieved by measuring either of the emissions indicators discussed above.

Second, in order to reflect economic, rather than direct physical contributions to emissions, i.e., to also reflect *why* rather than just *where* emissions occur, climate responsibility should reflect economic interactions among emitters. This helps identify – in line with the *Beneficiary-Pays Principle* – who earned income (as suppliers of primary inputs) from downstream enabled emissions and who benefitted (as final consumers) from and paid for upstream embodied emissions. Here, the territorial basis fails to identify economic polluters and beneficiaries while consumption-based and income-based emissions indicators take direct and indirect economic causality of emissions into account. However, neither one of them provides a complete picture. While income-based accounting neglects the economic role of consumers who benefit from and pay for emissions upstream, consumption-based accounting neglects how primary input suppliers benefit from and enable emissions downstream. To reflect both economic supply- and demand-side contributions to the occurrence of emissions, prospective climate responsibility should thus combine income- and consumption-based accounting by summing up emissions calculated on either basis and dividing the result in half. This approach was originally and innovatively developed in Rodrigues et al.[500] which also contain a rigorous mathematical derivation.

To understand why taking the average of an agent's consumption-based and income-based emissions is a fair weighting, consider the following example[501]. My climate responsibility as an employee of the University of St. Gallen results (at this

[499] For a mathematical discussion and axiomatic derivation, see João Rodrigues and others; Rodrigues, Marques, and Domingos.
[500] João Rodrigues and others; Rodrigues, Marques, and Domingos.
[501] Again, refer to João Rodrigues and others for a mathematical derivation and more detail. Rodrigues, Marques, and Domingos.

point of the discussion) as the average emissions intensity of A) my income earned from providing the University with a primary input (labour) B) the emissions intensity of the consumption goods I spend part of this income on (final consumption) and C) the emissions intensity of the interest earned from projects (directly or indirectly) financed by my potential savings (primary capital inputs). Now suppose hypothetically that I, together with other colleagues from our department, regularly enjoyed needlessly driving a yacht on Lake Zurich. This would substantially raise the emissions intensity of my consumption choices compared to my income-based emissions resulting from the income earned at the University of St. Gallen and the interest earned from my green savings at a local sustainable bank. Now suppose, I were interested in reducing my overall climate responsibility and the weighting of income-based emissions contributing to it was less than half. Then I could reduce my consumption-based emissions, for example, by taking one less joy-ride on lake Zurich, but at the same time raise my income-based emissions by the same amount of emissions and still end up with an overall reduction in climate responsibility. This would arguably be unfair if we consider the potentially significantly different global distribution of options for partially replacing countries' income- and consumption-based emissions with one another[502]. Only if the weighting is exactly one half do I treat the emissions enabled by my choices of providing primary inputs as *symmetrical* to the emissions embodied in my consumption choices. Symmetry is thus one of the axiomatically derived main features of Rodrigues et al.'s indicator. So, to simultaneously reflect a combined *Polluter-Pays Principle* and *Beneficiary-Pays Principle* as defended here, climate responsibility should incorporate countries' average of their income- and consumption-based emissions.

Third, climate responsibility should only reflect emissions after 1990 in accordance with the knowledge threshold briefly defended above and more thoroughly defended in the previous chapter[503].

And fourth, climate responsibility should include an economic capability threshold and only take emissions above it into direct account. I suggest the proposed understanding of countries' climate responsibility adopts an economic

[502] Think of the problems of "carbon leakage", for example.
[503] Here, I do not discuss the potential inclusion of progressivity in relation to the Knowledge Threshold. This could be an interesting addition in future research.

capability threshold that builds on the climate equity reference framework (CERF) developed by Baer et al.[504]. This means in a first step acknowledging an individualist basis for the economic capability threshold. Instead of regarding whole countries as either "poor" or "rich", or as "unable" or "able" to bear climate responsibility, the CERF suggests an individualist perspective to capture income inequalities within and across countries and not exclude emissions of rich people from countries' climate responsibility just because these countries can be regarded as poor overall. The authors of the CERF argue, convincingly I think, that no country has only poor people living in it and no country has only rich people. Instead, each and every country has different proportions of poor and rich people in their respective populations which of course then differ in the extent and severity of their national and cross-national inequality[505].

After taking this individualist perspective on measuring ability on board, I further adopt the CERF's assumption that the *emissions elasticity* in relation to income is roughly proportional to 1. This means that what we earn in additional income, we spend – on average – in proportion on additional consumption and that our emissions rise accordingly[506]. While this assumption is not perfectly true in reality[507], the authors argue that it represents a good enough approximation of empirical observations to produce acceptable results[508].

Furthermore, I follow the CERF in assuming that national incomes are distributed following a lognormal distribution which they argue to be a reasonable approximation of actual income distributions[509]. This assumption has the advantage from a measurement perspective that income shares (and according to the previous emissions elasticity assumption corresponding emissions) below any economic capability threshold can be calculated with just a measure of GDP per capita as well

[504] Baer and others; Baer; Kartha and others, I; Baer, Athanasiou, and Kartha.
[505] Kartha and others, i.
[506] Kemp-Benedict and others https://climateequityreference.org/calculator-information/the-climate-equity-reference-calculator-database/; Climate Equity Reference Project.
[507] c.f. Tao Song, Tingguo Zheng, and Lianjun Tong, 'An Empirical Test of the Environmental Kuznets Curve in China: A Panel Cointegration Approach', *China Economic Review*, 19.3 (2008), 381–92 <https://doi.org/10.1016/j.chieco.2007.10.001>; Abdul Jalil and Syed F. Mahmud, 'Environment Kuznets Curve for CO2 Emissions: A Cointegration Analysis for China', *Energy Policy*, 37.12 (2009), 5167–72 <https://doi.org/10.1016/j.enpol.2009.07.044>; M.A. Cole, A.J. Rayner, and J.M. Bates, 'The Environmental Kuznets Curve: An Empirical Analysis', *Environment and Development Economics*, 2.4 (1997), 401–16 <https://doi.org/10.1017/S1355770X97000211>.
[508] Kemp-Benedict and others https://calculator.climateequityreference.org/glossary.php#emiss_elast.
[509] Kemp-Benedict and others https://climateequityreference.org/calculator-information/the-climate-equity-reference-calculator-database/.

as a country's Gini coefficient that tells us how equal or unequal income is distributed in this country. Both of these inputs are readily and comprehensively available in high quality.

Finally, I think the CERF's suggestion for the level of the economic capability threshold is convincing and adopt the same level contained in the corresponding database[510]. Instead of using a measure of global extreme poverty (such as $1.9/day), the CERF works with the international poverty line (~16$/day, adjusted for purchasing power) and argues for an additional 25% to be added to it before emissions are considered in estimations of countries' climate responsibilities. The additional 25% are warranted to ensure that incomes directly above the poverty line are not directly penalised by being counted towards climate responsibility but that there is a relatively robust buffer between levels of income that count towards climate responsibility and poverty. Furthermore, it ensures that even if climate responsibility shares are borne by those slightly above the threshold, this burden would not push them below it again. We thus end up with an economic capability threshold of ~20$/day per person (rounded up to 7500$/year) only above which emissions start counting towards countries' climate responsibility shares[511]. GDP scores and Gini coefficients can then be used to find out which shares of countries' incomes and emissions fall below this line which are excluded from climate responsibility shares of the respective countries.

Combining all of these components, we end up with the following indicator of climate responsibility under the *Economic Activity Principle* (in words):

> *A country's climate responsibility is equal to the cumulative average of its income- and consumption-based emissions after 1990 (knowledge threshold) and above a purchasing power adjusted income of $7500 p.a., p.c. (economic capability threshold.*

[510] Kemp-Benedict and others.
[511] Kemp-Benedict and others https://calculator.climateequityreference.org/glossary.php#gloss_dev_threshold .

Mathematically, climate responsibility is thus given by:

$$\sum_{year=1990}^{year=now} (CBE + IBE)/2_{year} \times ATP_{year}$$

where CBE stands for consumption-based emissions, IBE stands for income-based emissions, and ATP represents the percentage share of emissions above the economic capability threshold of $7500 p.a., p.c. (purchasing power adjusted).[512] For individual countries, climate responsibility then results as their respective shares in the global total of climate responsibility. The following subsection briefly presents and even more briefly discusses some preliminary results from applying this indicator to China, the US, the EU28, India, Russia, and Japan. They are selected based on their high ranks in the current contribution to territorial emissions to contrast my findings with the current standard approach.

6.3.2. Results

Data and presentation format

The data used in this chapter come from several different but individually reliable sources. Data for territorial and consumption-based emissions are by now provided by a growing number of different databases and have reached high levels of reliability and availability[513]. Data on income-based emissions using the Ghosh-Model as opposed to the Leontief-Model are much less readily available and also more controversial both theoretically and empirically.[514] Despite its intuitive appeal, there are still only a handful of studies on this alternative indicator, although it has recently been regaining some prominence.[515] Beyond academic discourses, results of income-based accounts are typically unknown as opposed to the more widely known consumption-based accounts. The latter are by now underlying various "Carbon Footprints" one can calculate online, for example to offset emissions. The main source for the income-based emissions is thus a comparably rare dataset – from the Eora database – which includes territorial, consumption-, and income-

[512] This share can be found in the CERF dataset and is applied here to all emissions accounts. Kemp-Benedict and others.
[513] e.g. Wiedmann and others; Marcel P. Timmer and others, 'An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production', *Review of International Economics*, 23.3 (2015), 575–605 <https://doi.org/10.1111/roie.12178>; Ritchie and Roser.
[514] Ghosh; Dietzenbacher; Guerra and Sancho; Miller and Blair, chap. 12.1.
[515] Marques and others; Rodrigues, Marques, and Domingos; João Rodrigues and others; Liang and others.

based accounts[516]. Eora is one of the most sophisticated currently available databases for multi-regional, sectorally aggregated, high-resolution input-output models that includes environmental extensions[517]. It contains emissions data for 1970-2015, of which I employ the years 1990-2015. Prior years are excluded because of the knowledge threshold. For quality checks, I also used territorial and consumption-based emissions data mainly from the CERF (which in turn is based on data from the Potsdam Institute for Climate Impact Research's "PRIMAP hist" database) and OWID[518]. Data for the emissions share above the economic capability threshold also stem from the CERF database. According to the CERF, the underlying data for GDP and Gini coefficients stem from the World Bank Database[519].

Before proceeding to the results, please keep one formal point in mind: every result presented below is shown as a percentage share of the global total. Since the ultimate objective here is to reflect on which country should bear which portion of a prospective dimension of climate responsibility and associated costs, directly thinking and presenting results in shares helps. This way we can immediately ask and answer questions such as "What is country X's share in overall climate responsibility, if territorial emissions are used?". It not only tells us the country's share but directly relates it to other countries' and global emissions.

The following Figure 6-2 - Figure 6-7 contain information on China's, the USA's, the EU28's[520], India's, Russia's, and Japan's annual shares in territorial, as opposed to economic emissions (calculated as the average of consumption- and income-based emissions between 1990 and 2015. They also include the national prospective climate responsibility shares for the same time-period. Figure 6-2 shows these countries' annually weighted cumulative total for the whole time-period covered which is the main result of this dissertation.

[516] Special gratitude is owed to Daniel Moran, who – as representative of KGM & Associates which manage the Eora database – made the Income-Based Accounts used here available.
[517] Lenzen, Kanemoto, and others; Lenzen, Moran, and others.
[518] 'Our World in Data' Ritchie and Roser; Ritchie.
[519] Kemp-Benedict and others.
[520] The UK is still included here. However, one could argue that even though the dataset only reaches until 2015 – i.e., "pre Brexit" – the UK's share should be deducted because the UK takes its historical responsibility with it now that it has left the EU.

Thinking in shares: main results and takeaways

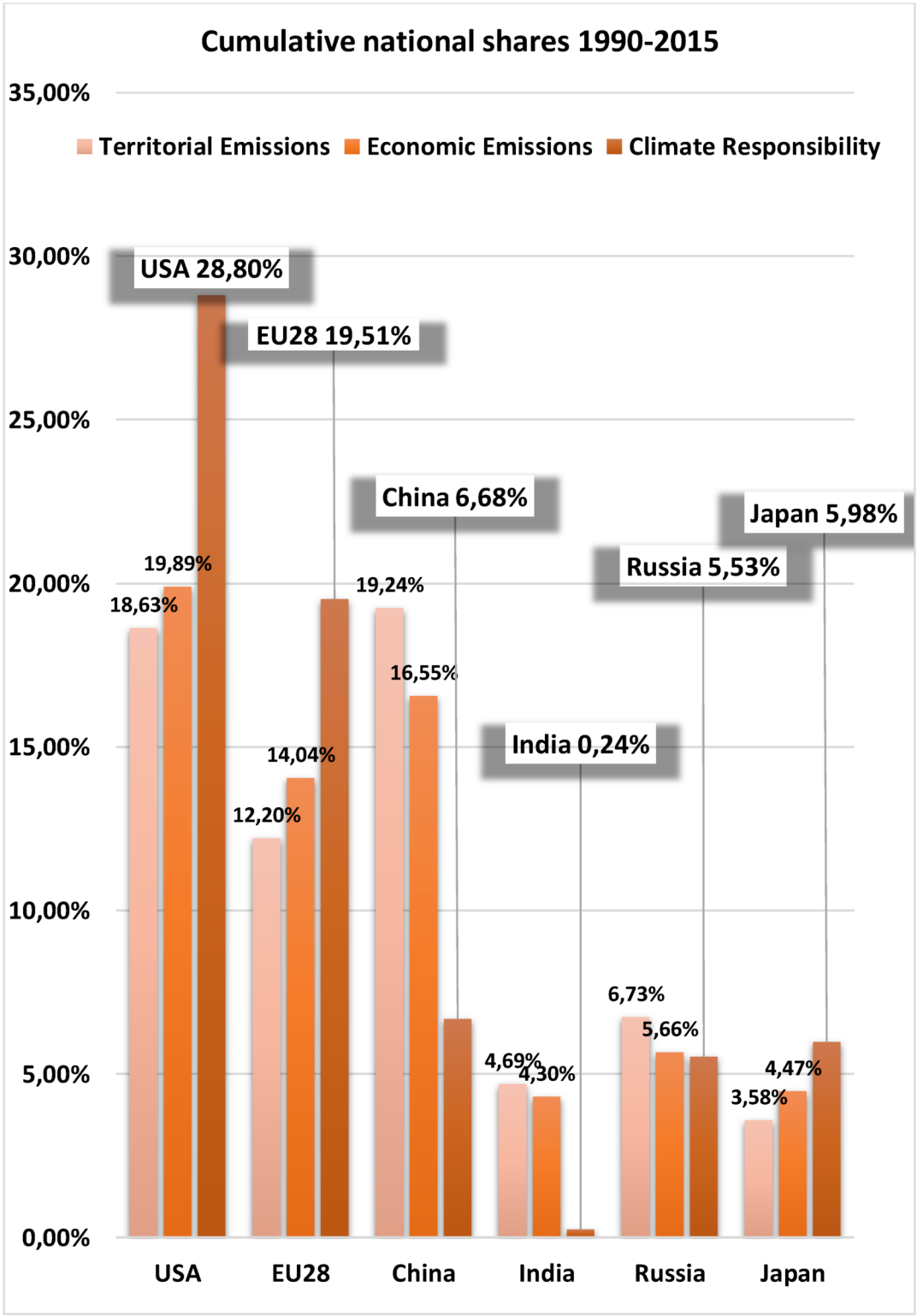

Figure 6-2: Global cumulative (1990-2015) shares for large emitters in Territorial Emissions, "Economic Emissions" (average of Consumption- and Income-Based Emissions), and Economic Responsibility (incl. Economic Capability Threshold).

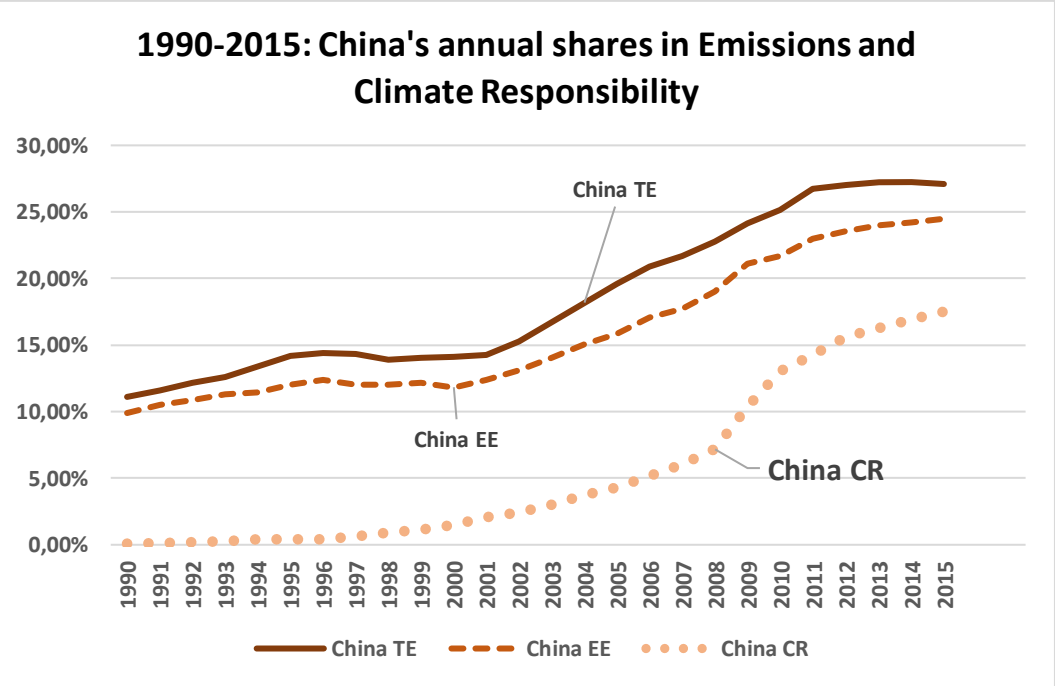

Figure 6-3: China's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE, measured as average of Consumption- and Income-Based Emissions) as well as annual Climate Responsibility (CR).

From Figure 6-2 and Figure 6-3 we see that China has not only overtaken the US as the largest annual emitter (consecutively on all emissions accounts) since 2005-2008, but that even its cumulative share in territorial emissions for 1990-2015 is (at 19.24%) now higher than that of the US (at 18.63%). This ranking is, however, due to the time-period covered and should not be confused with other accounts of historical responsibility: if years prior to 1990 were included, the US's share would rise as opposed to China's share. If years after 2015 were included, the opposite would hold. By contrast, China's cumulative economic emissions share is still somewhat smaller (at 16.55%) than that of the US (19.89%). This is due to the fact that Chinese emissions are still significantly higher on territorial as opposed to consumption- and income-based accounts. Overall, however, Chinese emissions are rising so rapidly (on all accounts) that without strong climate mitigation action by China, not breaching the temperature limits of the Paris Agreement appears impossible[521]. China alone can thus make or break effectiveness of the international response to climate change.

[521] Climate Action Tracker; Winkelmann and others; Burck and others.

Turning to climate responsibility, we see a considerable discrepancy between China's emissions and climate responsibility. The gap results from the inclusion of the economic capability threshold. We see that up until the time of the global financial crisis, China's share in emissions above the economic capability threshold was so small that its annual climate responsibility shares were far below its overall emissions levels (on any emissions account). Ever more noticeably since then, however, an increasing part of the Chinese population has risen out of poverty and above the economic capability threshold. Correspondingly, China's annual climate responsibility share has since risen more steeply than its emissions share. It has thus been beginning to close the gap to responsibility based purely on emissions.

On a global cumulative basis (see Figure 6-2), however, China's economic climate responsibility is at 6.68% of global responsibility and thus still substantially below its emissions share. While the distinction between territorial and economic emissions is thus highly relevant for China, the most significant influence on the level of its climate responsibility share is exerted by its level of emissions above the economic capability threshold. If the threshold is respected, almost all of China's emissions in the early 1990s are exempt from counting towards its climate responsibility.

This holds important information for future distributions of climate responsibility. If Chinese emissions continue to rise while it simultaneously continues to further eradicate poverty, its climate responsibility will continue to rise driven by both these inputs. Furthermore, we can see how substantially China would stand to gain from a switch from territorial emissions accounting to the *Economic Activity Principle* proposed in this dissertation. While its cumulative share in global territorial emissions for the 1990-2015 time-period amounts to a staggering 19.24%, its climate responsibility for the same period is only at 6.68% (Figure 6-2). Switching from a territorial accounting basis of climate responsibility to the *Economic Activity Principle* would thus mean that China's share in total costs would drop by almost two thirds. In other words, its territorial responsibility is almost three times as high as its climate responsibility under the *Economic Activity Principle*.

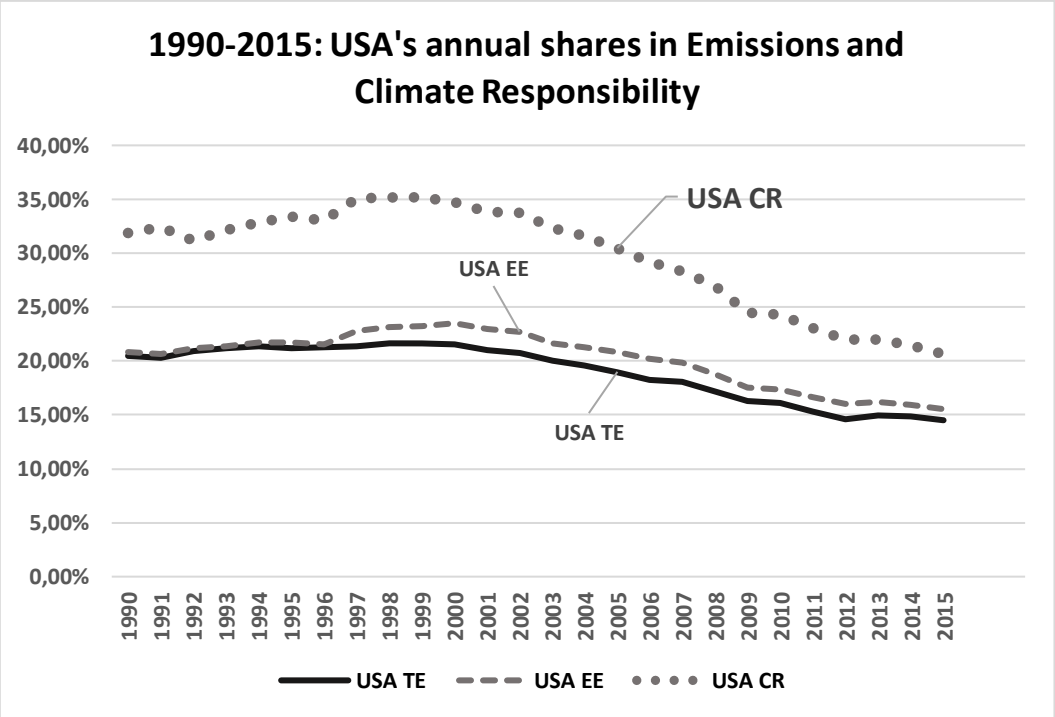

Figure 6-4: USA's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE measured as average of Consumption- and Income-Based Emissions) as well as annual Climate Responsibility (CR).

From Figure 6-2 and Figure 6-4 we see that the USA's annual share in global emissions and climate responsibility has remained rather stable until the early 2000s and since then started to decline in relative terms. This, however, should not be confused with an overall reduction in emissions. From the information presented here, we can only see that the annual *relative* importance of the USA as an emitter and responsibility bearer is declining. The underlying data shows that the USA's annual economic emissions are typically higher than its territorial emissions. This is a typical result for a wealthy economy exhibiting emissions embodied in imports exceeding those embodied in exports. The difference between territorial and economic emissions may appear small. But notice that a seemingly small *percentage point* difference between territorial and economic emissions in this chart can correspond to a large *percentage* difference in the USA's respective global shares. In 2000, for example, the USA's territorial emissions were at 21.57% while economic emissions were at 23.50% of the global total. The percentage point difference is only 1.93%. But it means that economic emissions in 2000 were thus almost 9% higher than territorial emissions. Which of these inputs is chosen to measure climate

responsibility thus matters greatly if climate responsibility in turn is the basis for distributing the overall costs of a response to climate change.

The USA's level of economic climate responsibility is significantly above its emissions levels throughout the whole time-period. This shows that a relatively large share of its emissions were emitted above the economic capability threshold compared to the rest of the world. Its overall share in cumulative prospective climate responsibility therefore ends up being the highest for any country in the world at 28.80% for the 1990-2015 time-period. If territorial emissions were directly translated into climate responsibility, by contrast, the USA would only be responsible for bearing 18.63% of the global costs of a response to climate change. This corresponds to a 55% increase in the share of costs the USA would have to cover if economic emissions above the economic capability threshold rather than territorial emissions were incorporated as basis of climate responsibility. It is not a stretch to assume that the USA would be heavily opposed to adopting the *Economic Activity Principle* as basis of burden-sharing in the climate regime.

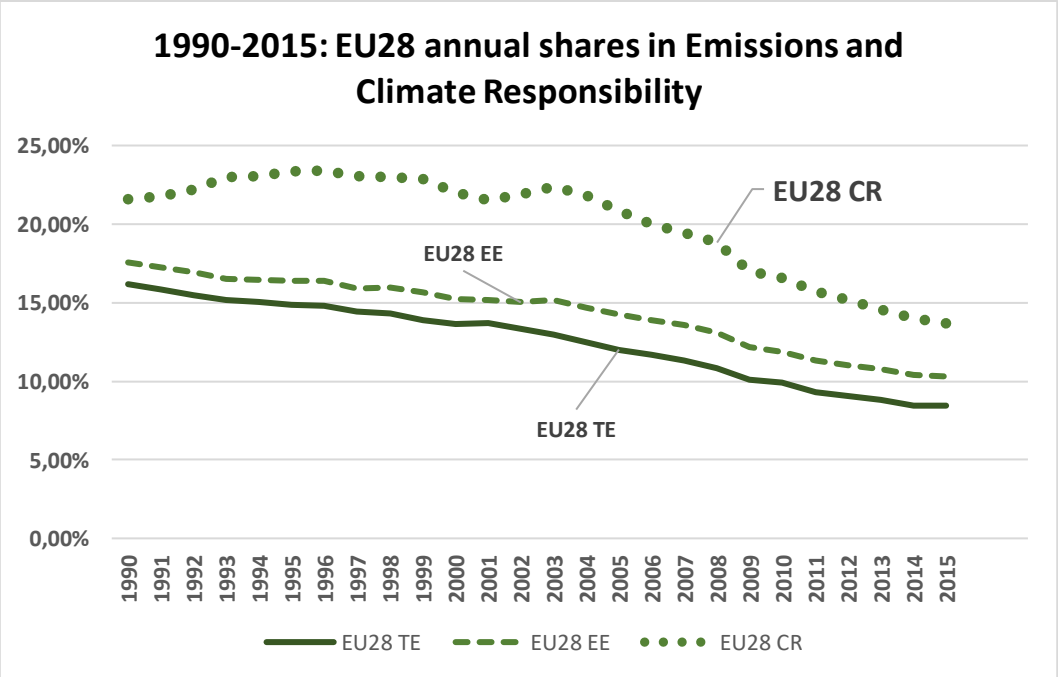

Figure 6-5: EU28's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE measured as average of Consumption- and Income-Based Emissions) as well as annual Economic Climate Responsibility (CR).

Figure 6-2 and Figure 6-5 illustrate that the EU28 exhibits a similar situation as the US with declining relative shares in emissions and at the same time a climate

responsibility share that is substantially above emissions levels due to high emission shares above the economic capability threshold. Cumulatively, the EU28 holds a climate responsibility share for the 1990-2015 time-period of 19.51% which is about three times that of China. Together with the USA, the EU28 can thus be viewed as climate responsible under the *Economic Activity Principle* for almost half of cumulative economic emissions above the economic capability threshold between 1990 and 2015.

If this result were to inform the EU28's and USA's pledges under the Paris Agreement, their respective ambitions would have to be ramped up substantially. If the EU28's cumulative share in territorial emissions between 1990 and 2015 were translated into its climate responsibility, it would amount to a share of 12.20% of the global total. Its share in cumulative prospective climate responsibility as calculated under the *Economic Activity Principle* would thus be almost 60% higher.

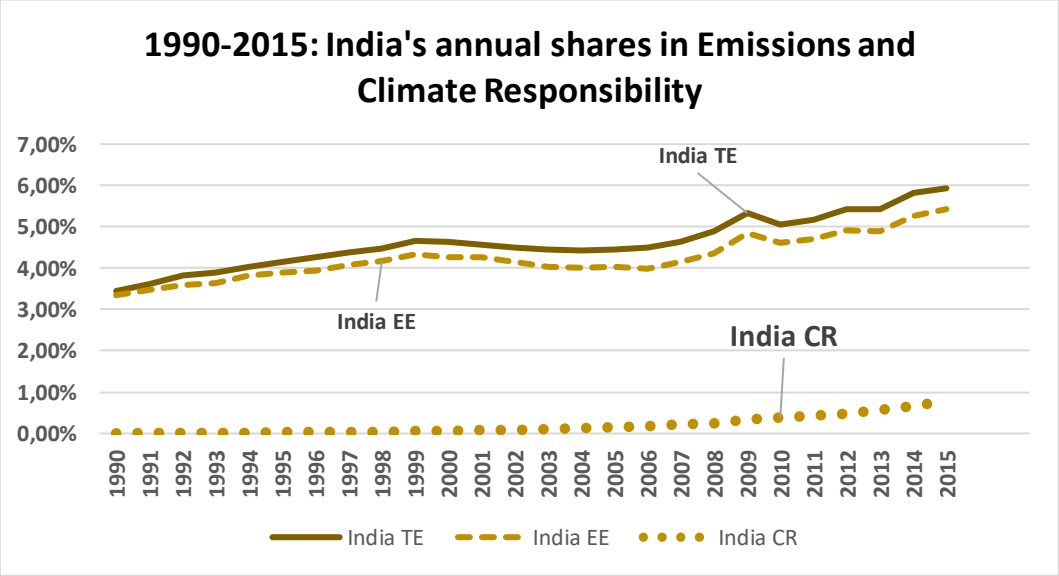

Figure 6-6: India's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE measured as average of Consumption- and Income-Based Emissions) as well as annual Economic Climate Responsibility (CR).

Figure 6-2 and Figure 6-6 demonstrate that India is one of the most interesting and special cases for a study on climate responsibility. While its annual emissions levels are far from negligible and have almost doubled in the time-period covered, they have always been and still are comparably small. Particularly on a per capita basis and considering the steeply increasing overall heft of the Indian economy, they are still nowhere near the level of industrialised countries.

What is even more singularly unique compared to the other countries covered here, however, are India's annual as well as cumulative shares in climate responsibility under the *Economic Activity Principle*. Even on an annual basis, they have only very recently approached the 1% mark. Cumulatively, and most strikingly, Indian climate responsibility remains at a minuscule 0.24% of the global total for the 1990-2015 time-period. Compare this to its population share in the global total which was almost 18% in 2015[522]. This, of course, is due to the immense share of the Indian population and related emissions that are exempt because they are below the economic capability threshold. For a discussion on international climate policies and their distributional impacts, it is one of the most important results presented here as India is often too narrowly presented as one of the largest emitters. While this view is true in absolute emissions terms, it is a complete misrepresentation of its climate responsibility for which India's emissions levels are set in relation to the economic capability threshold. Under the *Economic Activity Principle*, India's share in global cumulative climate responsibility would thus be only about 5% of its share under territorial emissions accounting. Conversely, its share in global cumulative territorial emissions for 1990-2015 is almost 20 times its share in climate responsibility under the *Economic Activity Principle*.

[522] World Bank, 'Population, Total - India', 2021 <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=IN>.

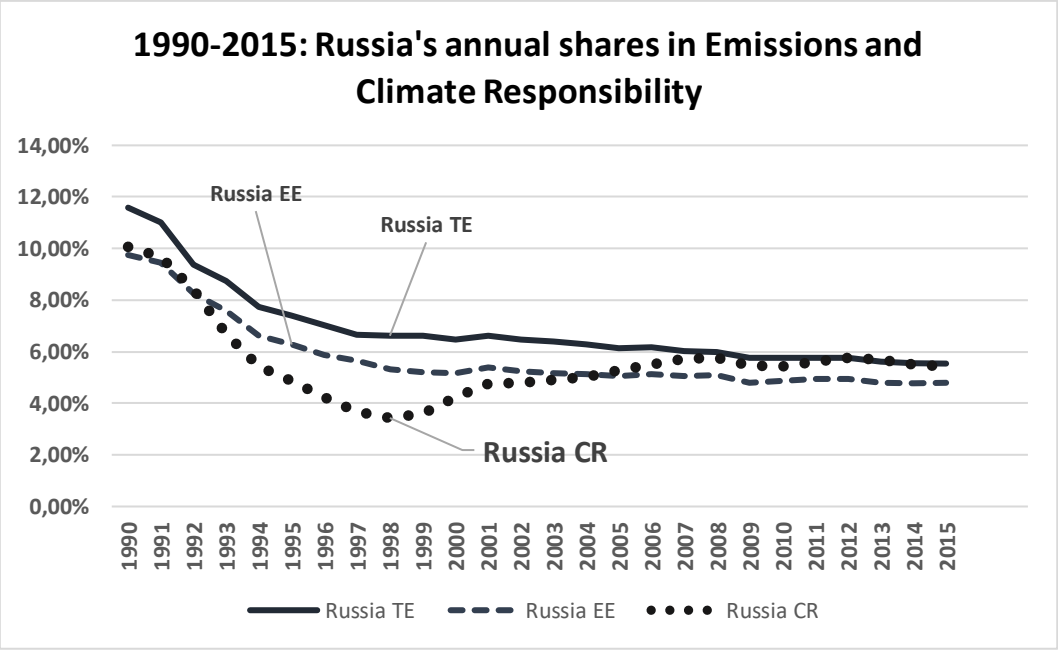

Figure 6-7: Russia's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE measured as average of Consumption- and Income-Based Emissions) as well as annual Economic Climate Responsibility (CR).

According to the results displayed in Figure 6-2 and Figure 6-7, Russia in the 1990s contributed relatively significantly to global emissions and had a high share in climate responsibility. Since then, however, its relative importance in these regards has declined substantially over the time-period covered. A unique feature of the Russian case when compared to the others discussed here, is that its level of annualised climate responsibility has crossed its emissions lines at several points in time. This indicates that its emission shares below the economic capability threshold were rising after the end of the Cold war (thus pulling down its responsibility) and have since stabilised at a relatively low level. Russia's annualised climate responsibility shares are now again at or above the level of its emissions shares. Cumulatively, Russia's climate responsibility for 1990-2015 makes up 5.53% of the global total. This is roughly in the area of its different emissions indicators meaning that Russia's emissions shares above and below the economic capability threshold were roughly proportional to the global average. It also means that Russia's responsibility share would not change as much as those of the previously discussed countries but still decrease by more than 20% if measured under the *Economic Activity Principle*, compared to territorial emissions.

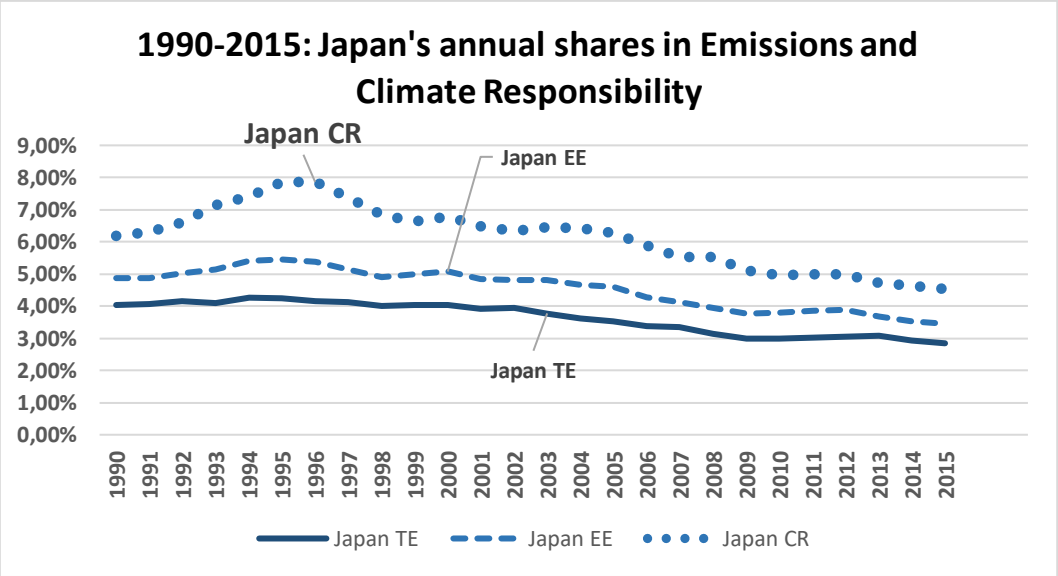

Figure 6-8: Japan's 1990-2015 annual % shares in Territorial (TE) and Economic Emissions (EE measured as average of Consumption- and Income-Based Emissions) as well as annual Economic Climate Responsibility (CR).

Lastly, Figure 6-2 and Figure 6-8 show Japan's situation as that of a relatively affluent economy with overall declining levels of relative emissions and relative annualised climate responsibility shares. The fact that Japan's annualised climate responsibility was consistently higher than its emissions levels points out that compared to the rest of the world, its emissions shares above the economic capability threshold have been relatively high. Cumulatively, Japan's climate responsibility was at 5.98% for 1990-2015, i.e., almost 60% above its cumulative emissions shares. Interestingly, despite the small size of both its population and emissions levels in comparison to those of China, Japan's cumulative climate responsibility under the *Economic Activity Principle* is not very far below that of China.

6.4. Conclusion

This chapter has shown that countries' greenhouse gas emissions differ substantially depending on whether they are measured on a territorial, consumption, or income basis. If these emissions accounting bases are respectively chosen as measuring prospective climate responsibilities, countries end up with substantially differing climate responsibility shares. If some such form of climate responsibility is in turn acknowledged as basis for differentiating countries' respective contributions to a response to climate change, we see that the choice of emissions basis has a profound effect on the resulting shares in the overall costs to be borne by countries

respectively. The differences between the results of the individual emissions accounting indicators are so substantial that it is surprising that the choice of and debates over emissions accounting bases are not front and centre in international climate negotiations. Major emitters like the ones discussed in this chapter stand to lose or gain massively depending on the chosen emissions indicator. The apparently widespread acceptance of territorial emissions accounting on the surface of the international climate regime is staggering.

If we go even further and include countries' respective economic capabilities into due consideration as the *Economic Activity Principle* suggests, the results become even more overwhelmingly different from territorial emissions accounting. Looking at the climate responsibility shares in Figure 6-2 alone, we probably could not tell which country is which anymore without the respective data labels. The comparison of India's climate responsibility based on the *Economic Activity Principle* versus its territorial emissions is most striking. Switching from the *Economic Activity Principle* to territorial emissions accounting as basis of climate responsibility implies an almost twenty-fold increase in the costs India would be viewed as prospectively responsible for. The view that China is the largest emitter, implying that it holds the greatest climate responsibility, since its territorial emissions surpassed those of the US in 2005/2006 is also widely accepted. Indeed, its current absolute emissions are higher than those of any other country and regardless of whether we measure them using territorial, consumption-, or income-based emissions accounting. The choice of emissions indicator on an annualised rather than cumulative basis would only marginally change the point in time at which China surpassed the US as largest annual emitter. Even its per capita emissions have now reached and begun to surpass those of some developed countries, for example, of the European Union's average. Also, and most importantly, even its cumulative emissions for the 1990-2015 time-period covered here are on the territorial emissions accounting basis already slightly higher than those of the United States (see Figure 1-3 and Figure 6-2). India, with a population almost as large as that of China, currently still emits much lower amuonts of greenhouse gases. But many fear that its emissions trajectory might follow the Chinese path of development which would imply substantially increased emissions on any emissions account and an at least

increasingly relevant climate responsibility share based on the *Economic Activity Principle*.[523]

The next chapter will now take a step back from this detailed analysis to more broadly reflect on and discuss in some more depth what to make of these results and the *Economic Activity Principle* that led to them.

[523] Compare the related discussion in Ritchie and Roser.

7. Conclusion

Reflection

It is time for a contemplation and reflection of what this dissertation has done considering where it started and what results its examinations, arguments, and analyses ultimately led to. At the beginning, there were several puzzles with which existing answers did not seem to fit right. Overarching all of them was the fundamental question why it is that science has produced ever more, ever more consistent, and ever more agreed-upon knowledge about dangerous climate change but the political, economic, and individual levels of agency have still not developed adequate policy and behavioural responses to prevent it. Why is it that broadly accepted and shared knowledge of the dangers of unmitigated climate change has not yet translated into our acceptance of correspondingly adequate climate responsibilities? Beginning the search for an answer seemed to quickly reveal that while there is at least sufficient and broad scientific agreement about the general causes and consequent effects of climate change, there is comparably little agreement about the potential prescriptions that follow the facts[524].

Going a little deeper, however, I found that this preliminary revelation was too blunt. Instead, a thorough and encompassing examination of the history of international climate governance has produced a different, more nuanced discovery. From its early beginnings in the 1972 "Stockholm Declaration" to the 2015 Paris Agreement and the subsequent attempts at its implementation, the international climate governance regime has produced a vast stock of agreements. Agreements about the science, overarching goals, and procedural goal characteristics needed in a response to and prevention of dangerous climate change reaches wide, far, and deep. There is agreement that we need to effectively prevent dangerous climate change. There also is agreement that such an effective response should simultaneously be equitable. Explicitly entailed in these agreements has since the early 1990s been the further agreement that the principle of *common but differentiated responsibilities and respective capabilities* should guide our response leading towards the goal of preventing dangerous climate change. So, we agree that CBDR-RC should guide how

[524] For a wide selections of disagreements about climate change, see Hulme.

we think about and act in accordance with climate responsibility. And we agree that the time for an effective and equitable response to climate change is running out.

But the original puzzle remained. With ever more agreement, it became even more perplexing. Although CBDR-RC was formulated and adopted as guiding principle three decades ago, an effective response to climate change is yet to be given. So, the search for an answer continued as formulating the question progressed. Rather than knowing to little or not generally agreeing about climate change and the required goal characteristics of a response, the problem appears to be that the agreements we have reached have not yet been translated into a normatively convincing, practically useful, and empirically measurable – and in this sense agreeably actionable – concept of climate responsibility. As I laid out in the introduction and motivating chapters of this dissertation, climate responsibility is currently used to mean too many inconsistent things. The concept of climate responsibility is accepted as immensely important on all levels, but it has not yet been systematically derived from and robustly related to the goals of the international climate regime. In this gap between agreed upon theory and lagging or even lacking practice, I found the corresponding question examined and answered in the present dissertation: what is a normatively defensible and practically useful concept of climate responsibility and how can and should it be measured empirically?

To answer it, I began where I had left off in my master's thesis on CBDR-RC. This involved, first, thoroughly and comprehensively engaging with the goals of the climate regime and the guiding principle of CBDR-RC. Climate responsibility needs a goal to which it can direct action and I found this goal to lie in simultaneous sustainability and equity. Second, from the goal of sustainability, I derived the subsequent climate responsibility building block of harm. Harm had to be conceptualised in turn such that its prevention did not contradict the goal of equity. Such a conceptualisation required the introduction and defence of capability thresholds that curtail demands on responsibility bearers such that they *can* indeed fulfil them. Having established these building blocks, I proceeded third, to their systematic and principled interrelation and the derivation of an actionable and measurable climate responsibility principle. Further searching, reasoning, and arguing, I eventually uncovered it in the *Economic Activity Principle*.

According to the *Economic Activity Principle*, climate responsibility should be conceptualised as agents' unsustainable economic emissions above an economic capability threshold and after a knowledge threshold. The fourth and last major step in this dissertation was then to measure the resulting conceptualisation of climate responsibility empirically. Doing this resulted in conceptualising and measuring agents' economic emissions as their average consumption- and income-based emissions above a capability threshold of US$ 7500 (adjusted for purchasing power per annum and per capita) and after 1990. I defended 1990 as meaningful knowledge threshold in the sense that it effectively excludes excusable ignorance.

This dissertation ultimately resulted in a thoroughly and comprehensively reconceptualised and measured, i.e., a fundamentally rethought concept of climate responsibility. It is based on the *Economic Activity Principle* which was in turn systematically derived from the agreed goals of the international climate regime and the principle of CBDR-RC. The results presented in chapter 6 are shockingly and intriguingly different from mainstream views of climate responsibility expressed in prevalent theory, discourse, and practice. The results show that the current implicit and often explicit equation of countries' climate responsibilities with their territorial emissions is directly contradicting the goal of representing countries' responsibilities and especially their respective capabilities. Responsibilities and capabilities, I argue, should instead be understood economically and such that the resulting distribution of burdens does not stand in the way of further development. Protecting current living standards and enabling further development are the ultimate reasons for responding to climate change after all. If the *Economic Activity Principle* is rigorously applied as basis of countries' climate responsibilities, the distribution of burdens differs profoundly from the one obtained if territorial emissions accounting is used as basis. In many cases, it differs so substantially, that the resulting prospective climate responsibility shares are unrecognisably different from the ones we arrive at under mainstream views of territorial climate responsibility.

The vast discrepancies between the current ways of thinking climate responsibility and the one prescribed by the *Economic Activity Principle* imply that rethinking climate responsibility in the way proposed would produce new winners and

losers. Many countries profit from the current ways of thinking climate responsibility while others would stand to gain a lot from rethinking it as proposed here. For the question of what to politically make of this principle, this is deeply disturbing. Some may try and immediately dismiss the *Economic Activity Principle* as perhaps an interesting thought experiment but not much more. But including respective capabilities in differentiating the burdens of the global climate regime is a crucial component of CBDR-RC. I have here derived the *Economic Activity Principle* directly from this cornerstone principle CBDR-RC and think their broad equivalence is defensible. Rash rejections of the *Economic Activity Principle* may thus also rip apart CBDR-RC and create new craters of disagreement which were closed by painfully obtained prior agreements. CBDR-RC is and will likely remain right at the heart of differential treatment in international climate governance. The *Economic Activity Principle* just shows – perhaps painfully so – what follows if we rigorously rethink climate responsibility in accordance with the already existing main goals and goal characteristics of international climate governance.

Outlook - quo vadis, *Economic Activity Principle*?

There are several options for how to proceed from the reconceptualisation and measurement of climate responsibility developed here. I will briefly discuss its political outlook as well as options for future research and some practical applications it could serve.

In its implications for the distribution of prospective climate responsibilities, the *Economic Activity Principle* bears some resemblance with the 1997 "Brazilian Proposal" and other historical responsibility proposals in the international climate regime[525]. Like these proposals, it would redistribute burdens from economically weaker countries who contributed relatively little to the phenomenon of climate change to those with high historical emissions responsibilities. Furthermore, it would increase the magnitude of such redistributions by taking countries' economic capabilities into explicit account instead of just historical emissions. Countries that stand to gain from a political implementation of the principle have been gaining ever greater power in the international climate regime. Their increased influence

[525] cf. e.g. Müller, Höhne, and Ellermann; Den Elzen, Schaeffer, and Lucas; Brazil.

can most essentially be attributed to the fact that without their support and active participation, the climate regime would lose all hope of formulating and implementing an effective response to climate change. Countries like China and India, which would have most to win from the *Economic Activity Principle*, could assume the role of supporters and attempt to introduce more or less ambitious versions of it into the international climate regime.

However, the history of prior attempts going in this direction is long and bleak. Like the Brazilian Proposal, no attempt at more explicitly and influentially introducing a formula approach into burden-sharing under the climate regime has ever enjoyed lasting effect. At the same time, policymakers, observers, the public, and – not to forget it – the environment are currently witnessing that the Paris Agreement's bottom-up approach of nationally determined contribution towards overarching ambitious goals is failing to reach a sufficient level of effectiveness. Sooner or later, a more systematically principled and at the same time measurable approach for bringing nationally determined contributions in line with the overall goals may have to be adopted[526]. Until this realisation has sunk in, however, there is little hope for an influential political endorsement of the *Economic Activity Principle*. In the meantime, the *Economic Activity Principle* can perhaps serve as valuable interpretation of the principle of CBDR-RC and an important equity gauge of countries' contributions to the bottom-up pledge and review system adopted under the Paris Agreement.

Regarding future research in the many and vast fields related to climate responsibility, there are still many stones left unturned. Most important would be improving the availability and quality of data on the lesser known and less widely established aspects of the *Economic Activity Principle*. This includes gathering better data on how emissions are distributed across levels of income as well as further developments in existing input-output databases and their environmental extensions. Recent and ongoing developments in the "Global Trade Analysis Project", "World Input-Output Database", and Eora[527] show a growing interest in other than territorial emissions. If this trend continues, we might soon see more readily

[526] Darrell Moellendorf, 'Responsibility for Increasing Mitigation Ambition in Light of the Right to Sustainable Development'; Callies and Moellendorf.
[527] Lenzen, Moran, and others; Lenzen, Kanemoto, and others.

available high-resolution databases and corresponding calculators which could incorporate measurements of the *Economic Activity Principle*. Being integrated into the Climate Equity Reference Framework and its online calculator would also be a promising outlook for the *Economic Activity Principle*. Perhaps more broadly visible and also interesting from a policy-perspective would be if the *Economic Activity Principle* or similar approaches were to find their way into future research at the university level or even official measurement guidelines developed or endorsed by the IPCC.

Beyond such political and research outlooks, the *Economic Activity Principle* might also find resonance in more practical applications. On the one hand, it would be very interesting to see legal scholars and practitioners investigating the principle from a legal perspective and perhaps even developing concrete legislative proposals on its basis. On the other hand, there is an increasing interest in environmental accounting at the corporate level. Many companies around the globe are beginning to develop an interest in their environmental effects and could apply the *Economic Activity Principle* to conceptualise and measure their climate responsibilities. Responding to this growing demand, accounting firms could incorporate measures of climate responsibilities based on the *Economic Activity Principle* into newly developing accounting standards.

Overall, my hope is that the *Economic Activity Principle* can serve as meaningful input into all these levels, even if it only serves as interesting, new, and thought-provoking contribution to the ways we think and exchange our thoughts about climate responsibility.

Appendix:
Additional info on data sources for measuring climate responsibility

CERF

All data used to estimate emissions shares above the economic capability threshold stem from the database of the CERF calculator[528] which is fully and freely available online at: https://calculator.climateequityreference.org/ and directly at:

https://calculator.climateequityreference.org/tables/download_tab-sep.php?db=fw-sql3--4nk6Wf.

Eora

All data used to estimate and report consumption-based, territorial, and global total emissions, as well as for population stem from the Eora input-output database[529] which is available online at: https://worldmrio.com/. Income-based emissions data were kindly made available by Dr. Daniel Moran as representative of KGM & Associates and the Eora database. For the full dataset, please do not hesitate to contact me.

[528] Kemp-Benedict and others.
[529] Lenzen, Moran, and others; Lenzen, Kanemoto, and others.

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CURRICULUM VITAE

Tim Simon Herr

Email: simon.herr@unisg.ch, Internet: http://globalnorms.unisg.ch

Ausbildung

09/2016 – 11/2021	**Universität St. Gallen, Schweiz** Ph.D. Programm in International Affairs and Political Economy (DIA) – **Gesamtnote: 5.10 (Gut)** „Rethinking Climate Responsibility – From Theory to Measurement to Practice“
03/2013 – 11/2015	**Universität St. Gallen, Schweiz** Master of Arts in Economics (MEcon) – **Gesamtnote: 5.0 (Gut)** Masterarbeit: „Reconceptualising Common but Differentiated Responsibilities in International Climate Negotiations“ – **Note: 5.5 (Sehr gut)**
10/2009 – 07/2012	**Lancaster University, Großbritannien** Bachelor of Arts (Hons) in Philosophy, Politics and Economics (PPE) – **Note: 1st Class Honours (Bestnote)**
08/1995 – 06/2008	**Rudolf Steiner Schule, Siegen** Allgemeine Hochschulreife – **Note: 1.9**

Relevante Arbeitserfahrung

07/2018 – 01/2022	**Wissenschaftlicher Mitarbeiter, Universität St. Gallen**
10/2012 – 03/2013	**Wissenschaftlicher Mitarbeiter, Fraunhofer IAO, Stuttgart** Internationales Projekt „Morgenstadt: City Insights“
01/2013 – 03/2013	**Wissenschaftlicher Mitarbeiter, Fraunhofer IAO, Stuttgart** EU-Projekt „Transportation Innovation Deployment in Europe“

Konferenzbeiträge und Publikationen

02/2022	„Conflicts over Climate Finance” – Buchkapitel Forschungsprojekt
12/2021	„Conflicts over the Institutional Landscape of Climate Finance” – Beitrag interner Projektworkshop
04/2021	„Rising Power Identities and Role Performance. Brazil and India in International Climate Governance“ (Franchini, Kumar, Herr) – Beitrag ISA Jahreskongress
02/2021	„The Changing Institutional Landscape of Climate Finance“ – Beitrag interner Projektworkshop mit externem Feedback, online
10/2020	„The Changing Institutional Landscape of Climate Finance“ – Beitrag interner Projektworkshop mit externem Feedback, online
06/2020	„Climate Finance Case Study“ – Beitrag interner Projektworkshop, online
03/2020	„Differential Treatment Dynamics in the Climate Regime: An Overview“ (Dingwerth & Herr) – Beitrag interner Projektworkshop, St. Gallen
12/2019	Teilnahme COP25 in Madrid
11/2019	„Rethinking climate responsibility“ – Beitrag internes Forschungskolloquium Uni Fribourg (Schweiz)
10/2019	„Differential treatment norms in the climate regime (1992 to 2018)“ (Dingwerth & Herr) – Beitrag interner Projektworkshop mit externem Feedback, St. Gallen
07/2019	„Reconceptualising climate responsibility – from theory to practice“ – Beitrag Environmental Justice Conference, East Anglia
05/2019	„Systematising climate responsibility“ – Beitrag Amsterdam Graduate Conference Political Theory
04/2019	„The Rise of Emerging Powers: A Challenge to Norms of Differential Treatment for Developing Countries?“ – interner Projektworkshop, Berlin
02/2019	„Varieties of Differential Treatment“ (Dingwerth, Eckl, Herr, Weinhardt) – Beitrag Dreiländertagung Zürich und internes Forschungskolloquium SEPS-UNISG
11/2015	„Rethinking climate responsibility“, Prof. Dr. Klaus Dingwerth & Simon Herr, veröffentlicht auf swissinfo, URL: http://www.swissinfo.ch/eng/opinions_rethinking-climate-responsibility/41805346
11/2015	„COP21 Paris climate summit: Climate responsibility will not come for free“, Prof. Dr. Klaus Dingwerth & Simon Herr veröffentlicht in „City A.M.“, URL: http://www.cityam.com/229781/cop-21-paris-climate-summit-climate-responsibility-will-not-come-for-free