Climate Resilient Development and Disasters
Trend Analysis of Policy Change after Milestone events in the period 2000 – 2020

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Title
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Abstract
There is a debate within the field of policy studies whether disasters are drivers of policy reforms, as encapsulated by the disaster-reform hypothesis. Since the disaster rate for extreme weather events are increasing in frequency and severity due to climate change, it is of high relevance to study if these disasters have any effect on climate policies. The aim of this thesis is therefore to empirically explore if there are any discernible global trends of disasters preceding a subsequent increase in Climate resilient development (CRD) policies and to show the variation of “effect lag” between income groups and regions. The research design operationalises the most severe disasters through “milestone events” and creates a CRD index by the arithmetical mean of sustainable development, climate adaptation, and climate mitigation. The results show a proportional share of countries experienced an effect lag of 1-3 years after their milestone events, while a large incidence of HIC and LMIC countries had a lag of 4-6 years. This explorative thesis has provided a research design and results on CRD, previously undescribed, that suggests several pathways for future studies such as interesting samples for case studies and alternative designs to the operationalisation of concepts.

Key words:
Climate resilient development, disaster-reform hypothesis, milestone events, effect lag, trend analysis
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<tr>
<td>CRD</td>
<td>Climate Resilient Development</td>
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<td>DRR</td>
<td>Disaster Risk Reduction</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<td>HIC</td>
<td>High Income Countries</td>
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1. Introduction

While the concern for the environment and the negative impact of human activity has increased as a public and political concern since the 1960s, the degradation of the environment and emission of greenhouse gases (GHG) have continued to increase and accelerate climate change (Okereke & Massaquoi, 2021; IPCC 2021). In the latest IPCC Assessment report (2021), unequivocal scientific evidence confirms that human activities have warmed the earth’s climate with widespread and rapid changes in the atmosphere, oceans and lands, causing increased frequency and severity of extreme weather events (IPCC, 2021).

These “extreme weather events” have often been called “natural disasters” but “(d)isasters are not natural. If the same powerful cyclone were to hit two different regions in the world, the results would look very different. It is actually the decisions we make that create a disaster.” (Shelterbox, 2021). The message is that extreme weather events constitute natural hazards and are inevitable to occur, but whether these events cause any damage to human lives or livelihood depends on societies’ ability to withstand, adapt, and mitigate the risks.

While the UN names climate change as the biggest threat to development (Okereke & Massaquoi, 2021: 325), several paradoxes and problems surround climate change and development. Even though sustainable development is the dominant approach today, it includes economic development which is an outright goal for countries and needed to relieve billions of peoples out of abject poverty. Yet, the development approach used thus far incorporate use of cheap fossil-fuelled technologies that exacerbate the problem by increased GHG emissions (ibid). Consequently, disasters threatening to disrupt the development process are increasing in severity and frequency (IPCC, 2021). To secure a sustainable future, simultaneous and often separate national efforts are underway: mitigating greenhouse gas (GHG) emissions, adapting to the environmental changes brought on by climate change, with strategies and approaches varying between countries and regions (UNEP, 2022).
To remedy the paradoxes and ensure that development procures a climate-friendly path, the IPCC have suggested a framework for action called Climate resilient development (CRD) which places sustainable development, climate change adaptation, and climate change mitigation policy actions as equally important and interdependent on each other (Schipper et al, 2022). Although, overall progress in individual dimensions such as climate change adaptation policy has increased in the last years, it has done so at a slower rate than climate risks, with some countries faring better than others (Schipper et al, 2022).

In the field of policy research, disasters as drivers for policy change have been attributed to some of the variation between countries over time and has been studied by many (see Kingdon, 1984; Baumgartner & Jones, 1993; Birkland, 1997; Pelling & Dill, 2010; McSweeney & Coomes, 2011). Often mentioned to have these reforming effects are the most severe disasters who are regarded as “catalysing conditions” (New et al, 2022), “focus events” (Kingdon, 1984; Birkland, 1997), or creators of “windows of opportunity” (Solecki & Michaels, 1994; Abunnasr, Hamin, Brabec, 2015; Friedman et al, 2019; McSweeney & Coomes, 2011). In every country there will always be one disaster that is more severe than the rest and is referred to here as the “milestone event.”

However, theoretical and empirical evidence exists on disasters producing both positive and negative policy outcomes, thus dividing the research field. Several studies have shown that disasters have had an increasing effect on policy reforms in general (Keeler, 1993; Zahran et al, 2008; Friedman et al, 2019; McSweeney & Coomes, 2011), as well as on local levels (Michaels et al, 2006; Dilling et al, 2017). Others argue that disasters have no or little effect (Boin & ‘T Hart, 2003; Dekker & Hansén, 2004; Boin et al, 2008; Zhang & Maroulis, 2021), or that the reforming potential is “overemphasized” (James & Jorgensen, 2009). In an effort to present an overview of when and where disasters lead to policy reform, Nohrstedt (2022) sketched four simplified theoretical scenarios of which one is particularly relevant. In what Nohrstedt (2022) calls scenarios of “lagged effects”, transformational policy changes necessitate long time to formulate, initiate, and implement following a disaster, unlike the immediate “bouncing forward” scenario (ibid: 429-32). This
delay in disaster and reform effect is interesting because several points of disagreements in the research debate concerns such spatiotemporal issues. Therefore, to explore the extent of disasters have an effect and mapping the variations in time lag would be of high relevance to the research field.

It is to this ongoing policy relevant debate on the links between disasters and policy reforms which this thesis contributes.

1.1 Aim and research question

With the situation described above, this thesis will explore the concept of policy framework of climate resilient development (CRD) and apply it on the disaster-reform hypothesis. The research design will incorporate a quantitative research method of trend analysis to be able to discern any observable trends in countries’ CRD policy progress in connection with recording a disaster. Due to the lack of previous studies on CRD, this thesis will develop an index measuring CRD whereby contributing with novel results. I argue that this thesis is interesting from a policy research perspective since it explores a new approach to testing the disaster-reform hypothesis, as well as exploring and describing whether disasters have a broad policy reforming effect. This broad policy perspective is encapsulated in understanding of CRD as what previously been regarded as separate policy sectors should instead be thought of as interlinked and interdependent. The research question is as follows:

Q. To what extent do milestone disasters precede a subsequent increase in climate resilient development related policy outcomes?

To answer this question, I will also be able to show lagged effects after milestone disasters. This makes the aim to empirically explore if there are any discernible global trends of disasters preceding a subsequent increase in CRD policies. This is of relevance to policy research because the results could provide a previously unrevealed description of number and share of countries where this trend is possible, thus providing interesting cases to test the disaster-reform hypothesis on CRD more thoroughly in the future. The study will draw upon data on 6780 disaster events in 113 countries.
1.2 Outline

After this introduction, previous research and relevant theoretical debates concerning CRD, disasters, and the disaster-reform hypothesis, are presented. Thereafter, the methodology underpinning the analysis, describing available alternatives of method and sources, and equally important, discuss the inherent limitations in the methodology. With theory and method in place, results from the trend analyses are given, including a description on the sample population. These results are then discussed and related to results found in previous research. Equally important in this section is the problematization of the method and results and with insights stemming from it and the results, this thesis will produce a number of interesting aspects worth exploring in future studies. Lastly, a conclusion summarizing the contents will finish this thesis.
2. Previous research

In this section, I present the relevant theoretical discussions and empirical results to this thesis. This section begins with a brief description of what constitutes a disaster according to different actors, with this dependency providing aspects of disasters worth mentioning. Thereafter the focus moves onto the disaster-reform hypothesis, iterating the arguments for its relevance to the policy research field. Subsequently, a description of the different theoretical opinions and empirical findings and past research methods that have been applied. Next, a description of the framework of Climate resilient development and its three dimensions, sustainable development, climate adaptation, and climate mitigation, with relevant research and discussions surrounding it.

2.1 Disasters & Milestone events

To begin with, “natural disasters” is a term of the past. A consensus within the academia and organisations working with disaster relief, is that natural hazards, such as extreme weather events like hurricanes, floods, droughts, are inevitable and part of the climate but disasters are man-made (Shelterbox, 2021).

Why studying disasters from a development and government studies perspective is highlighted by the humanitarian, economic and societal impacts disasters have. The policy study relevance is further underlined when climate change will induce higher frequency and larger impacts of extreme weather events (IPCC 2021). In disaster risk reduction (DRR) and climate adaptation policies, an important philosophy is to “build back better” which means to enhance preparedness for effective response and strengthening the resilience of systems (UNDRR, 2015).

In a hypothetical case, country A experiences a natural hazard such as a flood. It only becomes a disaster if the system and infrastructure affected is not resilient enough to withstand it, resulting in hundreds of fatalities and millions of dollars in damage. Within the framework of DRR, CRD and the narrative of this thesis, a
possible and desired outcome of this event is the induction of active policy imple-
mentation in country A, targeting disaster recovery and to “build back better”, i.e.
disaster adaptation and mitigation strategies. And in this perfect world, Country A
may experience other hazards but due to the incredibly successful reforms in poli-
cies events do not mutate into disasters.

Disasters can be defined as “a serious disruption of the functioning of a com-

munity or a society at any scale due to hazardous events interacting with conditions
of exposure, vulnerability and capacity, leading to one or more of the following:
human, material, economic and environmental losses and impacts” (UNGA, 2016).
Additionally, the Emergency Event Database (EM-DAT), produced by the Centre
for Research on the Epidemiology of Disasters (CRED) at the University of Lou-
vain, classifies disasters into two groups: natural and technological. “Natural disas-
ters” are events that have natural causes and have the following subgroups: geo-
physical, meteorological, hydrological, climatological, biological, and extra-terres-
trial. Technological disasters are caused either by human error in operation of tech-
ology or malfunction of technological systems (CRED, 2023a). Technological dis-
asters will not be included in the analysis. Furthermore, “natural disasters” and “dis-
asters” will here on be used interchangeably.

This study is on policy change with specific focus on trends in CRD, it is rele-
vant to only analyse the disaster types most closely associated and mentioned with
the effect of climate change. These are climatological (e.g. wildfires, droughts),
meteorological (storms, extreme temperatures), and hydrological (floods, land-
slides) disaster events (IPCC, 2021). Geophysical events, such as volcanic activity
and earthquakes, together with biological and extra-terrestrial disaster types are ex-
cluded from the analysis and discussion since no strong or confident results link
these with climate change (Buis, 2019).

Still, the disasters included pose a vast array of threats to societies and human
livelihood through associated damage and impacts. Disaster damage is the damage
occurring during or immediately after the event and is by default negative, disaster
impact is the total effect of the event, including negative and positive effects in the
long term (UNGA, 2016). In the framing of this thesis, policy change leading to
CRD is one aspect of positive disaster impact. How this is theorized to be, is explained by the disaster-reform hypothesis (Nohrstedt et al, 2021) which draws on several theoretical and empirical proofs (see Disaster-reform hypothesis).

2.1.1 Disaster-reform hypothesis

As mentioned in the introduction, Nohrstedt (2022) described four scenarios to illustrate how disaster can produce different policy outcomes, based on the “issue-attention cycle” where issues increase in their attention but depending on other factors, the attention dwindles and other issues rise on the agenda (Downs, 1972, see Nohrstedt et al, 2022: 430). The first scenario, “bouncing forward” is where a disaster creates public pressure on government great enough to induce immediate policy responses that generates long-term policy transformation (ibid: 429). “Interest decline” however, is where the attention on the underlying problems from to the disasters is somehow disrupted and policy activity decelerates and reaches no real transformation (ibid: 430). Another scenario of no transformation in policies is called “tyranny of the urgent” where the recovery and learning process following a disaster is repeatedly interrupted by other disasters, which forces government and policy actors to focus on short-term needs instead of long-term disaster adaptation (ibid: 431). The last scenario is “lagged effects” where transformational policy changes take long time to formulate, initiate and implement, unlike the immediate “bouncing forward” scenario (ibid: 432).

To these scenarios of issue-attention cycles the concept of “framing contest” can be applied (Boin et al, 2009). When a disaster strike, it creates a situation in which policy actors with control over the agenda decides how to frame the disaster, with commonly three options: no crisis and the situation is “business as usual”; crisis as threat and actors diffuse blame and defend the status quo; or crisis as opportunity where actors focus blame and challenge the status quo (Boin et al, 2009: 83-85). This thesis argues that a disaster severe enough, as in a milestone event, have the likelihood of inducing policy reform to an extent which might be visible (see Method 3.1)

Several studies have shown that disasters have had beneficial effects on policy reforms on country levels (Keeler, 1993; Zahran et al, 2008; Friedman et al, 2019;
Others have empirical evidence on disasters inducing policy change on local levels, resulting in intrastate differences (Michaels et al, 2006; Dilling et al, 2017; Friedman et al, 2019; McSweeney & Coomes, 2011; Abunnasr, Hamin and Brabec 2015; Nohrstedt et al, 2022). Baccini & Leeman (2021) found robust results that exposure to disasters changed Swiss citizens voting behaviour to become more pro-climate between 1995-2010.

However, the findings on disasters affecting policy reform on different levels have not yet given the debate any consensus. On the discussion of which state contexts matter, there is a debate on contexts such as country income settings (Burton, 2008; Fankhauser and McDermott 2014; Drury & Olson, 1998). Peterson (2021) found only empirical evidence on local levels in high income countries (HIC) while Wanner (2022) contrastingly found strong results on local settings in low- and middle income countries (LIC, MIC) with low democracy. McSweeney and Coomes (2011) analysed the impact of Hurricane Mitch on rural poor and indigenous communities in Honduras and concluded that albeit depending on the individual circumstances, climate adaptation and sustainable development is not contingent on central or external assistance and successful adaptation can be found within communities and areas deemed most vulnerable (McSweeney & Coomes, 2011: 5206).

Others argue that disasters have no or little effect (Boin & ‘T Hart, 2003; Dekker & Hansén, 2004; Boin et al, 2008; Zhang & Maroulis, 2021), that the reforming potential is “overemphasized” (James & Jorgensen, 2009) and disasters might cause negative policy outcomes by the “tyranny of the urgent” (Koivisto & Nohrstedt, 2016; Nohrstedt et al, 2021). This urgency is induced when the political need for a quick return outweighs the advantages of policy learning instead (Dekker & Hansén, 2004).

Additionally, there is a debate on if it is the frequency or severity of disasters that determine their policy reforming effect. Some argues that lower frequency of disasters is favourable (Birkland & Schwaeble, 2019; O’Donovan, 2017; Brody, 2003) and is supported by contestants of high severity disasters as well (O’Donovan, 2017; Birkmann et al, 2010).

Due to the difficulty in comparing cases of disaster-reform settings as illustrated by the varying empirical evidence described above, past research has mostly
been case studies or small comparative analyses such as Abunnasr, Hamin and Brabec (2015) on different adaptation strategies of Copenhagen, Denmark and Clarence, Australia, and Friedman et al (2019) on Hurricane Sandy’s impact on New York City’s and Boston’s disaster policy transitions to climate adaptation.

Nonetheless, quantitative analyses have also been conducted with different aims. To name a few, Fankhauser and McDermott (2014) analysed the links between income and adaptation to disasters. Baccini and Leeman (2021) studied disasters and voting behaviour in Switzerland, finding strong links. Lastly, Nohrstedt et al (2021) analysed how exposure to natural hazards affected disaster reform policies in 85 countries between 2007-2015. While they found no significant relationship between frequency and severity of disasters and improved DRR policy change, they found to variations in policy progress in countries with similar income and policy levels (Nohrstedt et al, 2021). It is to this body that this quantitative study wishes to add.

2.2 Climate Resilient Development
Climate Resilient Development (CRD) is a framework of “implementing mitigation and adaptation options to support sustainable development for all” and where “climate action and sustainable development are interdependent processes and climate resilient development is possible when this interdependence is leveraged” (Schipper et al, 2022: 2657). CRD is divided into three interdependent concepts: sustainable development, climate adaptation, and climate mitigation. These are developed further upon in the ensuing subsections.

CRD stems from the IPCC, whose Working Group II have in every IPCC Assessment Report (AR) since AR3 studied the links between climate change and development (Schipper et al, 2022). While these links have been framed within the concept of sustainable development since the Brundtland report in 1987, the framing of “climate-resilient pathways” was introduced with the release of the AR5 in 2014 (Denton et al, 2014). Climate-resilient pathways presented a move away from the broad links between climate change and sustainable development and instead
focused the discussion on the specific contributions of climate adaptation and climate mitigation to sustainable development (Schipper et al, 2022: 2660). Since then, research has expanded and chapter 18 of AR6 (Schipper et al, 2022), gives a current state of the art on the research of CRD which builds on the concept of “climate-resilient pathways”.

Critique against the CRD approach and the concept of resilience exists and comes from various fields of science, including political ecology, geography, and human environmentalism (Mikulewicz, 2019; Vardy & Smith, 2017). Key argument commonly found is how the IPCC take a “systemic approach to adaptation” and consequently resilience, thus “effectively decouples human-nature relations” (Mikulewics, 2019: 268). Eriksen et al., argues that adaptation and resilience as defined by IPCC, wrongly neglects the “political mechanisms of social change and the processes that serve to reproduce vulnerability over time and space” (2015: 523).

The policy relevance of studying CRD is obvious when put in light of the existential threat that climate change poses to human and natural systems. Past emissions, development pathways and climate change have not advanced countries’ climate resilient development (IPCC, 2022b: 33). Widespread non-climate challenges to societies such as poverty, water insecurity, degraded ecosystems and rural environments are found to be inhibiting CRD which consequently are exacerbated by climate change (ibid). IPCC finds with high confidence within the scientific community that prospects for achieving CRD are limited if GHG emissions do not rapidly decline (ibid).

Because CRD was conceived as a framework in the AR5 in 2014, IPCC regards it as a relatively new challenge and calls for more research to be done to advance the understanding of CRD as well as mechanisms and trends between climate change mitigation, adaptation, and sustainable development (Schipper et al, 2022: 2732). An aspect of CRD that needs to be further understood is what catalyses system transitions and transformation, including catalysing factors themselves. Another is identifying scenarios of maladaptation, what precede failed or successful efforts in CRD. That is why performing an operationalisation and trend analysis of CRD here is appropriate to describe the recent progress of countries and regions.
The results could help identifying the next course of action in researching CRD and catalysing factors.

2.2.1 Sustainable development
In 1987, the World Commission on Environment and Development (WCED) published *Our Common Future*, also known as the “Brundtland Report”, recaptured the ongoing debate on political economic development and environmental concerns by introducing the concept of sustainable development onto the global agenda (Springett & Redclift, 2015). The report defines sustainable development as “[meeting] the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 8). The report emphasized the “inseparability of environmental and developmental issues and the link between poverty and environment” (Springett & Redclift, 2015: 8). This environmental aspect has been at the core of sustainable development since then and within the UN’s organizations such as UNFCCC, the environmental issues arising from human actions in general and climate change in particular have been at the fore. The UNFCCC works toward establishing international frameworks for policy implementations on mitigating climate change, with annual meetings, so called conferences of the parties (COPs) (UNFCCC, n.d.). From the COPs, several international treaties and protocols on the environment and development have been drafted and entered into force (ibid).

In the years following the Brundtland report, several climate treaties and sustainable development frameworks from the UN sphere of action have been drafted and implemented. 2015 marked a significant year with the Agenda 2030, the Sustainable Development Goals (SDGs), the Paris Agreement, and the Sendai Framework (UNDP, 2023). Within the concept of CRD, sustainable development builds upon the Brundtland definition, which is encapsulated in the SDGs (UN, 2015).

2.2.2 Climate adaptation
Within social systems, adaptation is “the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities” (IPCC, 2022c: 2898). In terms of facing human-induced climate change, ad-
Adaptation can take different forms, ranging from incremental to transformational, anticipatory to reactive adaptation (Kates et al., 2012; IPCC, 2022b). The need for climate adaptation is therefore context-specific for countries and adaptation efforts consequently varies when comparing two separate countries. Beside the climatological factor in countries’ adaptation efforts, another is whether countries have the capacity and ability to adapt to climate change. IPCC (2022b: 12) finds that high development constraints for countries is very likely to induce high vulnerability to climatic hazards. For example, due to their exposed geography, Small Island Developing States (SIDS) are among the countries assumed to be the countries most affected by climate change (IPCC, 2022b: 11).

In addition, IPCC finds there are limits to adaptation, where some have already been reached to this date, and options may only be made available if political, financial and governance constraints are addressed and remedied. Maladaptation is most often an unintended consequence of human action and refers to actions that increase the risk of vulnerability to climate change or increased GHG emissions (IPCC, 2022b: 26-27).

Climate adaptation is no easy feat. Challenges include adaptation deficits and maladaptation. Adaptation deficit is the lack of financial, institutional, soft, and technological capacities that would enable a country to adapt effectively to disasters and climate change (Schipper et al., 2022: 2679). Fankhauser and McDermott (2015) analysed the links between income levels and adaptation to climate events. They found strong evidence through linear regression models of adaptation capacity increasing with country income (ibid: 17). Lastly, they iterate the lesson of climate change’s disproportionate impact on the poorer regions of the world where the deficit is the largest, and how rich countries with the largest GHG emissions could help by reducing their footprint (ibid: 17). This aligns with the message of CRD.

2.2.3 Climate mitigation
Mitigation of climate change is to reduce the human impact on the climate through reduction of GHG emissions or enhancement of carbon sinks (IPCC, 2022a). Climate mitigation of GHG emission is a global issue and therefore “it does not matter where GHG emissions come from, as they are all equal in their effect” (Peterson,
which problematizes policy and public reactions to it because country emission levels vary greatly between countries, regions, development stages, and income groups. According to the IPCC (2022c), emission per capita between countries is so disproportionate that the top 10% of households with the highest per capita emissions represents a 34-45% of the global consumption-based emissions. Yet, reaching a global consensus on mitigation action have proven to be a complicated issue (IPCC, 2022c; Alayza et al, 2022).

Every country contributes to emission levels and climate change, but the negative consequences of climate change in disasters are disproportionately felt by a small share of global population (McCraine & Surminski, 2019). However, extreme weather events have shown to increase support for mitigation (and adaptation) responses in and outside of affected countries (Demski et al, 2017). While mitigation actions are vital, mitigation options risk to increase competition for scarce resources and consequently, reduce adaptive capacity, especially if deployed at larger scale and with high expansion rates thus exacerbating existing risks. This makes the trade-off and “competition” between climate adaptation and mitigation actions important to understand and the IPCC urges coordinating policies to maximize synergies (IPCC, 2022c). Examples include large-scale or poorly planned deployment of bioenergy, biochar, and afforestation of unforested land (IPCC, 2022c).

In line with its definition, the goal of mitigation is the reduction of GHG emissions. Herein lies another debate between methods of measurement. There are two main approaches of measuring emissions: production-based and consumption-based. Production-based (a.k.a. “territorial-based”) emission data is the most widespread method of measurement and assigns emission data to the country in which they physically occur (Peters, 2008). This measurement is criticized for excluding the emissions embodied in international trade (Peters & Hertwich, 2008). This flow of GHG is instead captured by consumption-based emission data which focuses on where the consumption of products takes place regardless of where production of said goods were produced, whereby including the emissions of international trade flows (Peters, 2008). This allows consumption-based emission data to better illustrate the global differences in the globalized producer-consumer relations and highlighting “mitigation options and naturally encouraging cleaner production” (Peters, 2008).
Consumption-based measurements is however criticized for its measurement complexity and need for new international frameworks as to ensure equal accounting between countries (for discussion on this, see Peters, 2008: 14-17).

2.3 Theoretical summary

As illustrated in this section, there are numerous ongoing debates on every theoretical aspect. Within the realm of disaster-reform hypothesis, there are indications that disasters have had an effect on policy reforms while others argue the contrary. There seem to be a discrepancy between those that have notions of inferring statistically robust proof from sample to population, and those with several case studies that argue the impossibility of this. Moreover, there are questions on the “competing interests” between dimensions of CRD and critique against it. All these contradictions and assumptions lay an interesting base for this study to add onto.
3. Methodology

This chapter will explain the methodological aspects of this thesis, covering the two variables: milestone events and Climate resilient development. Each variable has an individual subsection explaining operationalisation of concepts, data availability of indicators and limitation of data, and limitations of the method chosen. After explaining the different approaches to the variables, a methodological summary will explain the logic applied in computation of variables and through the analysis.

All datasets are available upon request from the author.

3.1 Milestone events

Given the theoretical background, disasters have been quantified and operationalized by a variety of dimensions, depending on the approaches used and the research question of the study. For example, one could analyse individual disasters’ magnitude or damage as in a case study (e.g Abunnasr, Hamin and Brabec 2015), or one could compare the frequency, intensity, and spatiotemporal distribution of disasters over a certain period (e.g. Baccini & Leeman, 2021). In this study, I argue from a theoretical perspective that disasters significant enough to spark policy changes should be disasters with high magnitude. These potentially policy-transformative disasters are here called milestone events.

The database EM-DAT provides updated, open-access disaster data with over 22000 events recorded from 1900. To be included, a disaster must meet one of following criteria: 10 or more people deaths, 100 or more people affected, injured or homeless, a declaration of state of emergency by the country or an appeal for international assistance (CRED, 2023b). The data for disasters was accessed from the EM-DAT on May 8, 2023, and included only the climate change-related categories climatological, meteorological, and hydrological (see 2.1).

What constitutes a milestone event is context based, i.e. depends on the country’s capacity to withstand, mitigate, and reduce the damage. Consequently, and
important for the operationalization, setting a fixed limit of what constitutes a milestone event would be flawed since there is great disparity between country income groups. In a review study by CRED (2015), during the period of 1994-2013, there was an almost even distribution of disaster frequency between high, upper middle, lower middle and low income countries (HIC, UMIC, LMIC, LIC), but LICs and LMIC accounted for a third of the number of deaths respectively, or in sum 68%, compared to UMIC having 19% and HIC 13% (CRED, 2015: 28-29). Contrarily, when comparing the economic cost of disasters, cost decreases with lower income: HIC stand for 64% of the global total cost compared to 3% for LIC. However, if controlling for cost in percentage of GDP, the situation is reversed with damage for HIC being 0,3% of GDP and 5,1% for LIC (CRED, 2015: 38-40).

Thus, the method of defining milestone events should exclude comparisons between countries and be based on each country’s experience. For milestone events, this thesis uses disaster fatalities as the indicator and is defined as the first event that belongs to the 99th percentile in terms of total deaths and within the period of 1995-2020. With this operationalisation there are as anticipated limitations which will be discussed in the methodological summary.

3.2 Climate Resilient Development index
To be able to study the potential prevalence of patterns amongst countries experiencing disasters and achieving higher CRD in a quantitative frame, CRD must be translated into a measurable and comparable dimension. To the extent of my knowledge, no index or measurement data is available of CRD to this date, hence a Climate Resilient Development index (CRD index) will be created to this purpose. I argue that for the purpose of this trend analysis, creating and using an index is a suitable method of showing development trends between countries. Fully aware of the validation concern inherent in any quantified index, I emphasize that creating and using indices are a common procedure in social science and an appropriate method. While index results should be scrutinized and critically challenged in any research, they have the benefit of producing understandable and comparable scores and trends which suits the aim of this thesis.
As mentioned in the previous section, CRD covers three interdependent concepts: sustainable development, adaptation, and mitigation. In a CRD index, these concepts will be operationalised into three dimensions. Because these concepts are regarded as equally important and interdependent within the policy discussions of CRD, they will be weighted equally. Thus the index will be computed through the arithmetical mean of these dimensions and produce a score between 0 and 1 by:

\[
CRDi = \frac{1}{3} (I_{\text{Sustainable Development}} + I_{\text{Adaptation}} + I_{\text{Mitigation}})
\]

Operationalisations and data sources for each indicator will be explained and detailed below.

3.2.1 Sustainable Development indicator
As mentioned in section 2.2.1, sustainable development may be debated, but in this thesis, the SDGs will be used as operational indicators for sustainable development. I argue, discourse aside, because this thesis moves within the scope of the network of organisations working within or closely with the UN, the usage of the global standard of the 17 SDGs is warranted.

For this indicator, this thesis will use the SDG index produced by UN’s Sustainable Development Network Solutions (SDSN; Sachs et al, 2022). The SDG index was developed to assist countries and policy authors in assessing performance and progress in the goals, supporting them in prioritization and formulation of implementation strategies, and to establish the SDGs as a useful, operational tool for policy action (Lafortune, 2018: 5). The SDG index analyses data for individual countries’ progress and score for each goal through measurement of the respective indicators. While the SDGs themselves were launched by the UN in 2015, the data and observations for the indicators are also available for the period 2000-2014 which allows users to observe backdated scores and trends from before 2015. In cases of missing data, SDSN would not impute or model any missing data with a few exceptions depending on the degree of availability from other organisations such as the UNICEF, FAO etc (Lafortune, 2018: 17-18).

The SDG index weighs each of the 17 goals equally important, thus they have the same weight as well in the calculation of the index. Each individual score on
the goals is aggregated and the by calculating the geometrical mean with equal weighting gives a country’s score between 0 and 1 (for more detailed information on methodology and statistical soundness, see Lafortune, 2018).

3.2.2 Climate Adaptation indicator
Adaptation is defined as “[the] process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects” (IPCC, 2022a). Measuring and operationalising climate adaptation policies has proven to be complicated and different approaches have been used (see Kates et al, 2012; Fankhauser & McDermott, 2015). This thesis had an early research design that analysed quantity and frequency of climate law and policy implementations from databases, such as Climate Change Laws of the World (2022) and the Climate Policy database (Nascimento, 2023). This created problems identical to those of approximating mitigation policies: time constraints and validity concerns, which will be discussed in 3.2.3.

Instead, this research design will approximate climate adaptation through a vulnerability index as provided by the World Risk Report, produced by the German development organisation alliance Bündnis Entwicklung Hilft. It describes the risk of countries to experiencing disasters and vulnerability to natural hazards by analysing their dimensions of exposure and vulnerability. The report produces a World Risk Index (WRI), derived from the geometrical mean of exposure and vulnerability. Exposure is the amount and share of population being exposed to frequency and intensity of natural hazards. Vulnerability is defined as a composition of “economic, political, social and environmental factors … that maps the capacities and dispositions of societies and to what degree they can be destabilized, damaged, or even destroyed by extreme events” (World Risk Report, 2022: 40). In the WRI, the vulnerability dimension thus describes the degree to which populations are to be vulnerable to damage from natural hazards, composed of the three dimensions susceptibility, lack of coping capacities and lack of adaptive capacities (World Risk Report, 2022).
Since this thesis studies CRD and disasters, thus disaster (through exposure) is found in both the main hypothesis, therefore the vulnerability variable in the WRI is extracted to avoid the confounding factor of disasters affecting both dimensions. What remains is a measure of a country’s vulnerability through the dimensions mentioned above. While vulnerability is not a dimension of CRD, it can be understood as the situation from which adaptation policies are designed to remedy. Thereof, measures of vulnerability can be approximated as levels of adaptation progress.

The vulnerability variable in the WRI assumes values between 0 and 1, where low values indicate low vulnerability and high values indicate high vulnerability. Since the adaptation indicator is intended to give countries of low adaption values near zero, the vulnerability index need to be reversed which is done through:

\[ I_{Adaptation} = 1 - WRI_{Vulnerability} \]

This simple equation renders adaptation scores between 0 and 1 where higher values represent more successful climate adaptation than lower values.

3.2.3 Climate Mitigation indicator

Past research on climate mitigation policies often chooses one of the following two proxies: mitigation policies or GHG emissions. Mitigation policy content could be studied like Peterson (2021) did, or one could measure policy activity as Petersen (2022) did. Petersen approximated mitigation policy change with policy activity change after disaster events, where an increase in frequency would indicate change in mitigation policies (Petersen, 2022: 7). In discussing the limitations of her method, Petersen did the assumption of change in policy activity indicated change in content, which is not necessarily true, and noted that while most mitigation policies are positive from a climate change mitigation perspective, policies may be negative, by lowering ambitions or increasing emission allowance (Petersen, 2022: 25-26). Comparing Petersen’s method with content analysis of policies, the latter would give greater conditions for ensuring validity. Since this study’s aim is to explore global trends over twenty years, performing content analysis on each policy and country would not be feasible. That is why country emission will be used as the
indicator for climate mitigation change since the concept itself concerns reducing GHG emissions (see 2.2.3).

As explained earlier, there are two main alternatives to measuring emission levels. This thesis will use the consumption-based emissions method since its inclusion of international trade illustrates the global differences in producer-consumer relations and highlighting “mitigation options and naturally encouraging cleaner production” (Peters, 2008). Global country emission data was available from the Global Carbon Atlas, provided by the Global Carbon Project (Andrew & Peters, 2022). There, emission data is available for both territorial- (i.e. production-based) and consumption-based. The dataset on consumption-based emissions was acquired on April 19, 2023, and I opted for data to be shown as tonnes CO$_2$ (tCO$_2$) per capita for the period 2000-2020.

The mitigation indicator values need to have the range of 0 to 1 for the indicator to be a compatible dimension score for our CRD index, and the value should reflect the relative differences in emission per capita between countries. There are validation concerns with comparing absolute emission levels since they vary greatly, and these values do not completely translate into “values” of actual climate mitigation. These problems are analogous to the “quality of life” dimension in the Human Development Index (HDI) where it is approximated in income and measured as Gross National Income per capita, but as Anand and Sen (2000: 84) highlights, quality of life can vary greatly between countries of the same income level. To mitigate this concern, the following steps were applied to the dataset.

First, country emission data per capita was arranged by country and year. Second, I applied the following equation:

\[
I_{Mitigation} = 1 - \frac{\ln(\text{actual}) - \ln(\text{min})}{\ln(\text{max}) - \ln(\text{min})}
\]

where (max) was the maximum value of emission per capita found in the dataset, (min) the minimum value, and (actual) the respective country’s emission per capita that year. But to use the function of natural logarithm, no negative values or value of zero can be inserted since the natural logarithm of negative values and zero are undefined. This produced a problem for our data because by using consumption-based data, countries could in theory (and reality) have negative values by exporting
more than they import. This occurred 8 times between 2000-2020: Panama in 2003-06 and 2011-2013 and Venezuela in 2018. All other countries had positive values larger than zero. To avoid this issue, all values in the dataset had the minimum value (Venezuela, 2018: -1,087 tCO₂) and 1 added to it which thus increased every value with +2,087 tCO₂. This gave us a minimum value of 1 to be used in Eq. 3. The maximum sample was in Singapore in 2013 with 47,781 which gave us a maximum value of 47,781 + 2,087 = 49,868 tCO₂.

Lastly, the indicator score is the difference between 1 and the quotient. This renders countries with small per capita emissions to receive higher scores than large emitters. These adjustments guarantee the score to fall within 0 and 1 while maintaining the relative differences between countries.

3.3 Methodological summary

With a CRD index measuring each country’s annual score and a list of the milestone events for the sample, we can find whether there occurred an increase (positive) or decrease (negative) in CRD following a milestone event. This is performed in the following steps.

First, we find each sample country’s milestone event using the data from EM-DAT. All events in the dataset are per definition disasters and this study focuses on the worst disasters in terms of fatalities.

Second, each country’s CRD index score provides the development over time (2000-2020). To be able to find trends in milestone events having any effect on policy reform in terms of CRD, this trend analysis searches for so called “spikes’, i.e. the largest difference between two following years. Each country index will have two spikes per indicator: one positive and one negative. To deepen the analysis, this will be performed on the subindicators as well.

Third, by assembling each country’s respective indicator spike with its milestone event allows us to find where the milestone event occurred before the spike, i.e. a possible relation of CRD policy implementation is found. The following logic applies:

\[
\text{Eq. 4} \quad \text{Effect lag} = \text{Year}_{\text{Spike}} - \text{Year}_{\text{Milestone event}}
\]
If the milestone event occurred *after* the spike, no relationship between our milestone event and the spike is possible. However, this does not exclude the possibility of other events than the milestone one affecting policy change (see 4.2 Discussion for further elaboration).

Fourth, countries are arranged by their respective lag, i.e. difference of years between milestone event and spike, and sorted arbitrarily into groups of 1-3, 4-6, 7-10, 11-15, 16-20, and 21-25 years. Each indicator is arranged after this with frequency and percentage of sample total represented for each group.

This research design brings limitations that consequently affect the results. First, the chosen time window for disasters (1995-2020) begins five years ahead of the CRD index range. These five years were added onto the milestone dataset to account for the possibility of milestone events before 2000 could have any effect on CRD spikes occurring in 2000-2001. This addition was made without substantial backing beside intuition and the lack of empirical evidence on how long any disaster can have on policy reforms. Five years was deemed as appropriate. Second, only one milestone event per country is accounted for, yet there are countries with more than one disaster that belong to the 99th percentile during the period. Thus, the longer effect lag any of these countries record, the greater the risk that external independent variables, such as later milestone events, could be potentially more influential in causing the CRD spike.
4. Results

4.1 Findings

Table 1 describes the sample size (CRD column) with the number of countries available in each indicator dataset, assorted by income groups, Small Island Developing States (SIDS), and respective region as defined by the World Bank (World Bank, 2023). In total, 6780 disaster events from EM-DAT belonged to the final 113 countries in the CRD index.

Table 1. Description of sample with number of countries arranged after indicator datasets, period 1995-2020

<table>
<thead>
<tr>
<th>Indicator</th>
<th>EM-DAT</th>
<th>SDG index</th>
<th>WRI</th>
<th>GCP</th>
<th>CRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countries(^1)</td>
<td>180</td>
<td>163</td>
<td>193</td>
<td>117</td>
<td>113</td>
</tr>
<tr>
<td>HIC</td>
<td>49</td>
<td>50</td>
<td>59</td>
<td>47</td>
<td>43</td>
</tr>
<tr>
<td>UMIC</td>
<td>50</td>
<td>42</td>
<td>52</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>LMIC</td>
<td>52</td>
<td>45</td>
<td>53</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>LIC</td>
<td>28</td>
<td>25</td>
<td>28</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>SIDS</td>
<td>34</td>
<td>15</td>
<td>37</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>27</td>
<td>18</td>
<td>30</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>46</td>
<td>48</td>
<td>52</td>
<td>39</td>
<td>37</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>33</td>
<td>26</td>
<td>33</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>North America</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>South Asia</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>46</td>
<td>42</td>
<td>48</td>
<td>23</td>
<td>23</td>
</tr>
</tbody>
</table>


\(^1\) Venezuela is temporarily unclassified since 2021
From table 1 it is apparent that the dataset for the mitigation indicator is the most constraining factor to the CRD index. Particularly, there is a significant loss of SIDS with only 4 being included in the CRD, which represents 11% of the total number of SIDS. This is detrimental to this thesis’ contribution because of SIDS’s real exposure to climate change (IPCC, 2022b: 11), therefore analysing the relationship between disasters and CRD would be of high policy relevance.

With each country’s CRD indicator and subindicators, they can be arranged according to their effect lag. Table 2 shows the distribution in the results arranged after years between milestone event and a positive spike in indicator score. On the rows with indicator name, the number represents the frequency, while the rows in between show its percentage of the sample population. E.g. countries with a spike in CRD score in one to three years after its event equals to 15 countries or a 13,3 % share of the total 113 countries. The last column on the right shows the total frequency of countries who fulfilled this thesis’ criteria of cause (milestone event) preceding effect (CRD change). While there is no robust evidence on for how long time a milestone event may have policy reforming effects, I argue that hypothetically the likelihood decreases after 10 years.

<table>
<thead>
<tr>
<th>Lag</th>
<th>1-3</th>
<th>4-6</th>
<th>7-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>Tot</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRD</td>
<td>15</td>
<td>20</td>
<td>10</td>
<td>22</td>
<td>10</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>(%)</td>
<td>13,3</td>
<td>17,7</td>
<td>8,8</td>
<td>19,5</td>
<td>8,8</td>
<td>2,7</td>
<td>70,8</td>
</tr>
<tr>
<td>S</td>
<td>16</td>
<td>19</td>
<td>8</td>
<td>23</td>
<td>10</td>
<td>3</td>
<td>79</td>
</tr>
<tr>
<td>(%)</td>
<td>14,2</td>
<td>16,8</td>
<td>7,1</td>
<td>20,4</td>
<td>8,8</td>
<td>2,7</td>
<td>69,9</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>15</td>
<td>19</td>
<td>21</td>
<td>17</td>
<td>4</td>
<td>82</td>
</tr>
<tr>
<td>(%)</td>
<td>5,3</td>
<td>13,3</td>
<td>16,8</td>
<td>18,6</td>
<td>15</td>
<td>3,5</td>
<td>72,6</td>
</tr>
<tr>
<td>M</td>
<td>7</td>
<td>23</td>
<td>15</td>
<td>19</td>
<td>10</td>
<td>10</td>
<td>79</td>
</tr>
<tr>
<td>(%)</td>
<td>6,2</td>
<td>20,4</td>
<td>13,3</td>
<td>16,8</td>
<td>8,8</td>
<td>8,8</td>
<td>69</td>
</tr>
</tbody>
</table>

The results show that 70.8% of the countries have the sequence of disaster preceding a spike in CRD, signifying that the remaining 29.2% recorded their milestone event after their spike. Furthermore it shows a variation among the lag intervals, with the most countries experiencing a time lag of 11-15 years before a positive spike in development in all indicators except for mitigation who instead recorded most in between 4-6 years. In the main index of CRD the largest incidence is found in the 11-15 interval. However, 20 countries (17.7%) experienced a spike 4-6 years after a milestone event and 15 (13.3%) did so 1-3 years following.

More in line with the research question and aim are the findings presented in table 3. Here, the focus is on the CRD columns.

<table>
<thead>
<tr>
<th>Lag</th>
<th>1-3</th>
<th>4-6</th>
<th>7-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>CRD</td>
<td>S</td>
<td>A</td>
</tr>
<tr>
<td>HIC</td>
<td>6</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>UMIC</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>LMIC</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>LIC</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>SIDS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>6</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>North America</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>South Asia</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Group 1-3 show a distribution of countries by income groups, almost representative to their share of the sample population (table 1) with HIC having the most (6) and in descending order to LIC (2). This is not found in group 4-6, instead there is a large representation of HIC (12) and LMIC (7), whereas no UMIC and only a single LIC is placed here. Group 7-10 return to a distribution more similar to the former. This result indicates that in HIC and LMIC, climate-related disaster events can have the largest policy reforming effect not directly following the event but rather 4 to 6 years after. Case studies both could and should validate this result but also to test theoretical explanations (see 4.2 Discussion)

Regarding SIDS, two cases were recorded with an effect lag between 7 to 10 years. While this represents half of the sample population (4), SIDS are heavily underrepresented compared to the general population (37) due to lack of mitigation data (see table 1), thus drawing any conclusions on trends of disaster-reform among SIDS would be quite unrealistic.

By breaking down the lag groups, patterns arise which possibly indicates an effect lag trend in regions and income groups. Here, the regions East Asia & Pacific and Europe & Central Asia follow the trend of HIC and LMIC with 6 cases in 1-3, which becomes 15 added together in 4-6, then decreasing in proportion to 4 cases in group 7-10. In the last group, Latin America & Caribbean have the most cases with 4. Sub-Saharan Africa interestingly have 5 cases recorded 1-3 years after disaster and 2 each in 4-6 and 7-10 periods. Below, figure 1 illustrate the results from table 3.

In these graphs, there are some noteworthy trends to discuss below. First, in the top-left graph depicting HICs, most milestone events (triangles) occur before 2010 with many happening in 2003 and several CRD spikes (circles) coalesce in 2009. Additionally, the many CRD values (lines) among HICs are closely matched except a few cases with lower scores. Two cases even receive 2020 scores below 0,7, which is lower than many cases in the three remaining groups, showing that high income do not universally correspond with high CRD. Second, UMICs contrastingly show more of either immediate progress within 1-3 years or more delayed
after 7 to 10 years. Third, HICs and UMICs seem to show more of coherent incremental increase in CRD scores, whereas the CRD progression for LMICs are very mixed.

Figure 1. CRD progress for countries (lines) assorted after income groups over period 2000-2020

Note. All countries from table 3. Triangles indicate Milestone event; circles indicate year following the CRD spike; horizontal distance along x-axis visualize lag effect. Sources: World Bank (2023), CRED (2023c), Sachs et al (2022), World Risk Report (2022), Andrew & Peters (2022). Author’s modification

4.2 Discussion

This thesis is explorative and descriptive. The trend analysis results provide cases for validation studies and should be seen as a first step in developing and research-
ing the concept of CRD. The next steps should preferably conduct regression analyses to ascertain the robustness of these results as well as validation case studies, but they can also test them in conjuncture with explanatory theories. This study excluded regression models partly because of constraints in time and scope of a bachelor thesis, but more importantly for fundamental limitations in the material and variables. Similar quantitative studies on disasters and policies, such as Baccini & Leeman (2021), Nohrstedt et al (2021), Fankhauser & McDermott (2014), have used regression analyses to estimate the causal relationship between variables but their method included more variables than this design, provided better guarantee of isolation, possessed a larger sample as well. The method employed in here suffer from deficits in the fundamental assumptions underlaying regression analysis (Teorell & Svensson, 2007: 64-68).

First, regression assumes that the dependent variable does not influence the independent or that the independent precede the independent in time. While this method uses the sequence of the disaster-reform hypothesis (i.e. disasters causing reform), it could also be that policy reforms carry unforeseen negative outcomes that transforms natural hazards to disasters. This could be scenarios of maladaptation or “tyranny of the urgent” (Nohrstedt, 2022).

Second, the relationship between disasters and policy reform cannot be isolated from external variables nor are disasters the sole determinant for policy reform. For example, the global recession of 2008-09 resulted in sharp decrease in economic activity and energy demand in especially HIC, European countries, which consequently decreased their GHG emissions (EEA, 2016). This could explain the large incidence of CRD spikes coinciding in 2009 for HICs (figure 1) since an abnormal reduction in emission would inversely cause an increase in the mitigation indicator.

Furthermore, worth discussing is the operationalisation of disasters with milestone events as defined by number of fatalities. While disaster severity is deemed by many as an important factor behind policy reform (see 2.1), there are strong arguments for frequency being equally important to consider with higher frequency found to slow policy progress (Birkland & Schwaeble, 2019: 6). Due to the indefinite proof of what aspect of disasters that matter but to simultaneously consider the
contextual aspects of disaster-reform, this method operationalized the most severe disasters relative to each country as milestone events (see 3.1).

This arbitrary decision was made to construct a feasible and transparent model, accommodating to the explorative purpose of this thesis. This compromise brings weaknesses to the results, with regards to the divided opinions on disaster severity and frequency. In the disaster dataset, there are large differences in disaster frequency and severity, as discussed in 3.1. Out of the 6780 events recorded in 1995-2020, USA recorded 601 events, China 563, and India 373, while Finland only experienced 1. Since EM-DAT only insert events that are disasters per their definition (see 3.1), these numbers do not reflect the ratio of extreme weather events impacting a country without causing damage and thus be recorded as disasters. While climate adaptation revolves around strengthening societies to withstand extreme events, ipso facto avoiding disasters, a low number of disasters recorded do not automatically translate into higher levels of climate adaptation. It is as likely that the numbers reflect exposure to extreme weather events of countries.

An intriguing question that future studies could revolve around is if there is any difference in CRD trends before and after 2015. This year is very significant to the dimensions of CRD because several important frameworks and agreements on these came to existence: Agenda 2030, the Paris Agreement, Sendai Framework for DRR among the most influential (see 2.2.1). While the concepts of sustainable development, climate adaptation and mitigation were already known and implemented in policies, they undeniably gained higher notoriety and importance in policy action. Countries could of course have been underway on positive development paths, yet the attention the frameworks gave to the climate change issues, comparing the two periods could potentially show how international frameworks and agreements affect policy reforms and illustrate the primacy of them on individual countries performance.

This however do not disprove the disaster-reform hypothesis, it rather accentuates that disasters play a role of catalysation for change and focusing attention on systemic issues. But as this thesis began: there is nothing natural about disasters, they come to existence due to the agents that inhabit the systems. Disasters lead to reform if the agents and stakeholders actively pursue it.
5. Conclusion

The purpose of this thesis was to apply the disaster-reform hypothesis onto the unexplored policy framework of CRD. This shaped its aim to empirically explore if there are any discernible global trends in CRD development after climate change-related disaster, which rendered the following research question:

\[ Q. \text{ To what extent do milestone disasters precede a subsequent increase in climate resilient development related policies?} \]

To answer this question, trend analysis was appropriate and included the operationalisation of CRD as an index which had not been conducted previously. The methodology produced as a result 113 countries with a total of 6780 disasters. 80 countries (70.8\%) had recorded a milestone event preceding a spike in CRD index score (table 2). Of these, the lag interval with the highest incidence was 11-15 years (22 countries) followed by 4-6 (20), 1-3 (15) (table 3). The intervals spanning years 1-10 were disaggregated by indicator, income group and region which showed how the 20 countries with 4-6 years lag had large incidences of HICs and LMICs (table 3). Graphed over time in figure 1, results indicated trends among HICs, with several countries having milestone events and spikes coincide.

The results of this thesis can provide new testbeds for previous studies. To begin with there are several hypothetical explanations to the different effect lags. For example, the countries with CRD spike after 1-3 years could be cases of “tyranny of the urgent” (Nohrstedt, 2022) where this theory would also suggest a long-term decrease or stabilization; or the short lag could be also symptomatic of high adaptive capacity as argued by Fankhauser & McDermott (2014).

Baccini and Leeman (2021) showed that floods in Switzerland had a strong positive effect on voting behaviour, leading citizens to greener, pro-climate politics. Since their study included only one country, although comprehensively, the results from this study could provide interesting cases where their model can be applied. I suggest that interesting countries would be those with a lag of 1-6 years to ensure the disaster could be included within a usual electoral cycle.
Having an explorative aim, these results should be appreciated in their identification of cases to which theoretical and empirical evidence found in previous research can be tested. This is descriptive emphasis is the main contribution of this thesis to the policy research field on disasters and reform.

The operationalisation of CRD into an index had not been conducted previously, whereby this thesis has added new insights onto the growing literature on CRD and rendered new possibilities and issues on measuring CRD for further purposes. Also of value is this thesis contribution to the discussion on mitigation measurement. This thesis chose consumption-based over production-based calculations and have highlighted its CRD-relevant advantages such as its framing of consumption-production flows while pointing to its disadvantage of smaller data coverage than the global covering production-based (Peters, 2008; Peters & Hertwich, 2008).

Whereas others who have previously studied climate adaptation and mitigation have often analysed policy content (Peterson, 2021) or policy activity (Petersen, 2022), this method of an CRD index showcased the possibility of using vulnerability and consumption-based CO₂ emissions respectively as proxies.

Furthermore, this thesis’ use of trend analysis has presented its advantages and possibilities for policy studies while also pointing to its limitations. Future studies undertaking trend analysis of disaster-reform would benefit from including disaster frequency or economic costs onto the disaster variable and include validation studies to test the robustness of the results.

Beside these limitations, this thesis provides noteworthy results to contemplate into designing future studies within this theme. First, it has highlighted interesting cases for both quantitative and qualitative studies on particularly the variations in “effect lag” between income groups and regions.

Second, future studies should conceive of methods to procure a larger representation of SIDS into their studies, because understanding trends and development pathways among them is highly relevant due to their high exposure and vulnerability to climate change-related disasters (IPCC, 2022b: 11).

Third, the method and data herein can be used to answer other questions as well. If a study concerns disasters and maladaptation, I suggest that one could either study the prevalence of negative CRD spikes (as opposed to the positive spikes
studied here) both preceding and succeeding milestone events. In section 7. Appendix, table 4 shows the frequency, share and time lag of negative spikes after milestone events. As mentioned earlier, climate adaptation is an important part of the CRD framework and general climate policies, and the causes of maladaptation are important to understand to be able to avoid them in the future (Schipper et al, 2022: 2732-33).
6. References


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7. Appendix

Table 4. Number and share of sample experiencing negative spike, arranged according to lag in years from milestone event, within period 2000-2020

<table>
<thead>
<tr>
<th>Gap</th>
<th>1-3</th>
<th>4-6</th>
<th>7-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>Tot</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRD</td>
<td>13</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>8</td>
<td>8</td>
<td>73</td>
</tr>
<tr>
<td>(%)</td>
<td>11,5</td>
<td>11,5</td>
<td>13,3</td>
<td>14,2</td>
<td>7,1</td>
<td>7,1</td>
<td>64,6</td>
</tr>
<tr>
<td>S</td>
<td>11</td>
<td>11</td>
<td>18</td>
<td>14</td>
<td>14</td>
<td>8</td>
<td>76</td>
</tr>
<tr>
<td>(%)</td>
<td>9,7</td>
<td>9,7</td>
<td>15,9</td>
<td>12,4</td>
<td>12,4</td>
<td>7,1</td>
<td>67,3</td>
</tr>
<tr>
<td>A</td>
<td>14</td>
<td>11</td>
<td>16</td>
<td>13</td>
<td>11</td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>(%)</td>
<td>12,4</td>
<td>9,7</td>
<td>14,2</td>
<td>11,5</td>
<td>9,7</td>
<td>13,3</td>
<td>70,8</td>
</tr>
<tr>
<td>M</td>
<td>10</td>
<td>17</td>
<td>14</td>
<td>20</td>
<td>8</td>
<td>2</td>
<td>71</td>
</tr>
<tr>
<td>(%)</td>
<td>8,8</td>
<td>15,0</td>
<td>12,4</td>
<td>17,7</td>
<td>7,1</td>
<td>1,8</td>
<td>62,8</td>
</tr>
</tbody>
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