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Border Carbon Adjustment and Inequality

Distributional Equity Concerns About the EU CBAM's Impacts in South Africa

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Abstract

Border carbon adjustment (BCA) policies are increasingly discussed as an instrument to avoid carbon leakage; however, their social implications are not well understood. Nevertheless, the EU introduced its CBAM, which will take effect in 2026. After showing that distributional impacts in exporting countries were not considered in the policy process, I examine the potential effects in South Africa, a country with sizable EU exports and already severe inequality and poverty levels. This thesis aims to explicate the underlying mechanisms through which regressive impacts could result from the policy and estimate their likelihood. By integrating theoretical knowledge and initial expert interviews, I identified two main routes to impact. First, export reductions could result in lay-offs in the targeted and associated industries. Second, regressive effects may follow from increases in the domestic carbon tax, motivated in part by the EU policy. Complemented by gathering empirical data, I mainly utilised interviews with various South African stakeholders (from government, industry, labour unions, and NGOs) to determine and investigate the links throughout the cause-and-effect chain between the CBAM implementation and higher inequalities. After examining the relevant conditions and moderating variables, I conclude that the policy as it was proposed by the EU Commission will likely exacerbate inequalities in South Africa. However, this is not easily transferable to other contexts. Considering relevant country-specific circumstances and the influence of policy design decisions, these impacts are neither universal nor unavoidable. Nonetheless, it is crucial that policymakers, both in the implementing and affected regions, are attentive to these mechanisms and potential outcomes. Targeted revenue recycling and redistribution to support low-income households and a just climate transition is likely able to avert adverse effects. Generally, future research should focus on equity implications of transnational climate policy to better understand the impacts on vulnerable communities and help resolve justice-environment trade-offs.

Keywords: *Border carbon adjustment, CBAM, Carbon pricing, Inequality, South Africa, Intervention theory*

Executive Summary

In this thesis, I examine the environmental policy instrument of border carbon adjustment (BCA) from a social equity and justice perspective. BCA raises a charge on emissions that are embodied in imports. It therefore targets production activities outside of the enacting entity's jurisdiction. Consequently, the focus lies on distributional implications for exporting countries. To operationalise this research, I use the case of the EU carbon border adjustment mechanism (CBAM) and its potential impacts in South Africa. The existing research on regressive effects of carbon pricing demonstrates a need to acknowledge and manage the risk of adverse distributional effects (Dorband et al., 2019). However, studies thus far have been mostly limited to burden-shifting and aggregate welfare losses for affected countries (Böhringer et al., 2017; Ghosh et al., 2012; Leturcq, 2021; Weitzel et al., 2012). Overall, the impact of BCA on inequalities within exporting countries is largely absent from the literature.

Aim and Research Questions

The general aim of this research is to help inform policymaking. More specifically, it should provide guidance for decisions on whether and how to implement BCA, incorporating a holistic social justice perspective that recognises distributional effects across and within affected countries. Instead of providing one definitive answer, the research aims to point out relevant nuances and contexts on which the outcome of these decisions may depend.

The concrete research objective is to increase our knowledge of equity impacts associated with the design and implementation of the EU CBAM as applied to South Africa.

RQ1: How is the risk of increased inequalities in exporting countries represented in the EU CBAM policy process?

RQ2: What are the likely effects of the CBAM on inequalities in South Africa?
RQ2.1: What are the mechanisms through which these effects can occur?
RQ2.2: How likely are these to occur?

RQ3: What context-specific factors determine the likelihood of the CBAM affecting inequalities in South Africa?
RQ3.1: What socioeconomic conditions in South Africa are relevant?
RQ3.2: Which aspects of the (CBAM's) policy design are relevant?

Conceptual Framework

I utilise a framework that mainly draws upon theory-driven policy evaluation and the literature on carbon price regressivity to identify where and how the CBAM might affect income inequality in South Africa. I construct an intervention theory to explicate the cause-and-effect chains and underlying mechanisms that regulate potential adverse effects. Within this framework, I examine two main routes to impact, which arose from the literature review. Combining the gained insights into the policy instrument and how it relates to distributional impacts, the identified paths to exacerbated inequalities are 1) through direct effects from decreased exports in the targeted sectors, and 2) indirectly through increased carbon prices, mainly by South Africa raising the domestic carbon tax in response to the CBAM.

Methods and Research Design

My research begins with an analysis of the EU policy process, which further motivates the research if the risk of adverse impacts is not considered and points out important mechanisms and policy design elements. The answers generated for RQ2 will inform the examination of context-specific factors under RQ3.

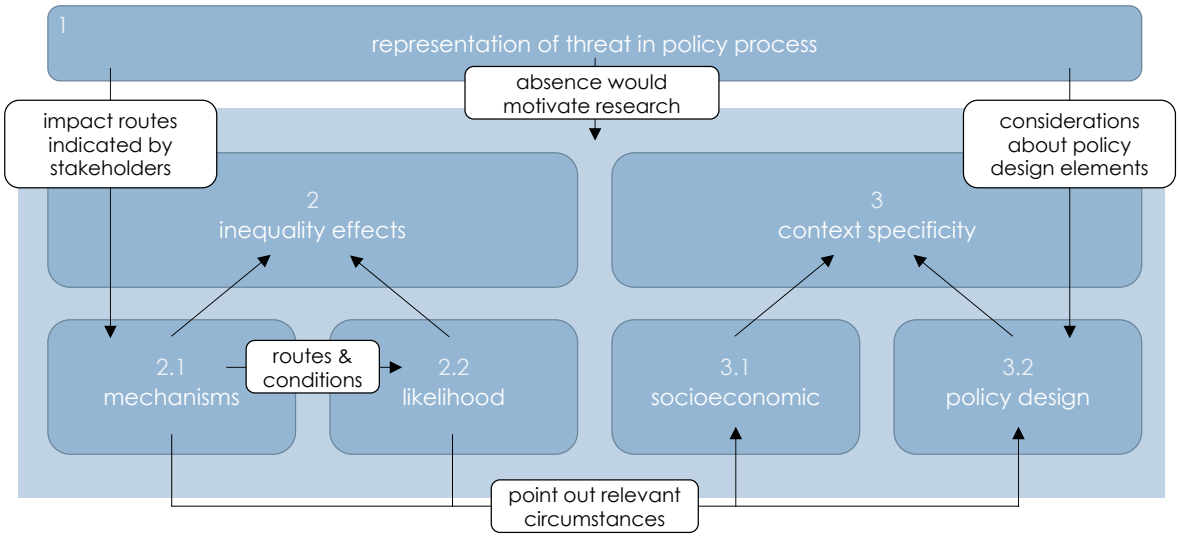

Figure A: Research design showing the relationships between the RQs

The collected data is differentiated by the research questions it is intended to help answer. For RQ1, I gathered documents representing the EU CBAM policy process. To answer RQs 2 and 3, I utilised different sources to construct the intervention theory and evaluate its links. This comprises mainly stakeholder interviews but is complemented by different empirical elements. For the analysis, I coded the data accordingly to match the constituent parts (underlying moderators and conditions) of the intervention theory.

Analysis

The answers to the research questions will be summarised in the next section. Here I briefly outline the impact routes and indicate the estimated likelihood of the underlying moderators and conditions contributing to higher inequalities. Where these moderators and conditions apply is represented by the numbers (termed *nodes*) in Figure B. For example, the aspects summarised under node 1 can be understood as the answer to the following question: "What has to be true, so that the introduction of the CBAM leads to reduced exports from South Africa to the EU, and what influences the degree or direction of that relationship?"

Adverse distributional effects resulting from export reductions in the South African aluminium and steel industries are likely to occur. However, the magnitude of these impacts may be limited. Most moderators governing the link between the CBAM and decreased EU exports strongly indicate that such a reduction would take place (node 1). Yet, the conditions that need to be fulfilled for this to translate into lay-offs are slightly more ambiguous (node 2). While it is likely that possible workforce reductions lead to higher unemployment (node 3) and then to exacerbated inequalities (node 4), these connections are characterised by modest uncertainties about the underlying moderators.

A negative impact on inequality through the route of increased carbon prices is likely. The CBAM will probably lead to higher carbon prices beyond the direct increase examined in chapter 5.3 (node 5). The conditions regulating the distributive channels through which negative effects can unfold are also fulfilled, though to varying degrees (node 6). Revenue recycling as an important countermeasure is unlikely to be utilised extensively (node 7) and modelling studies of carbon price regressivity in the South African context also suggest a high vulnerability (node 8).

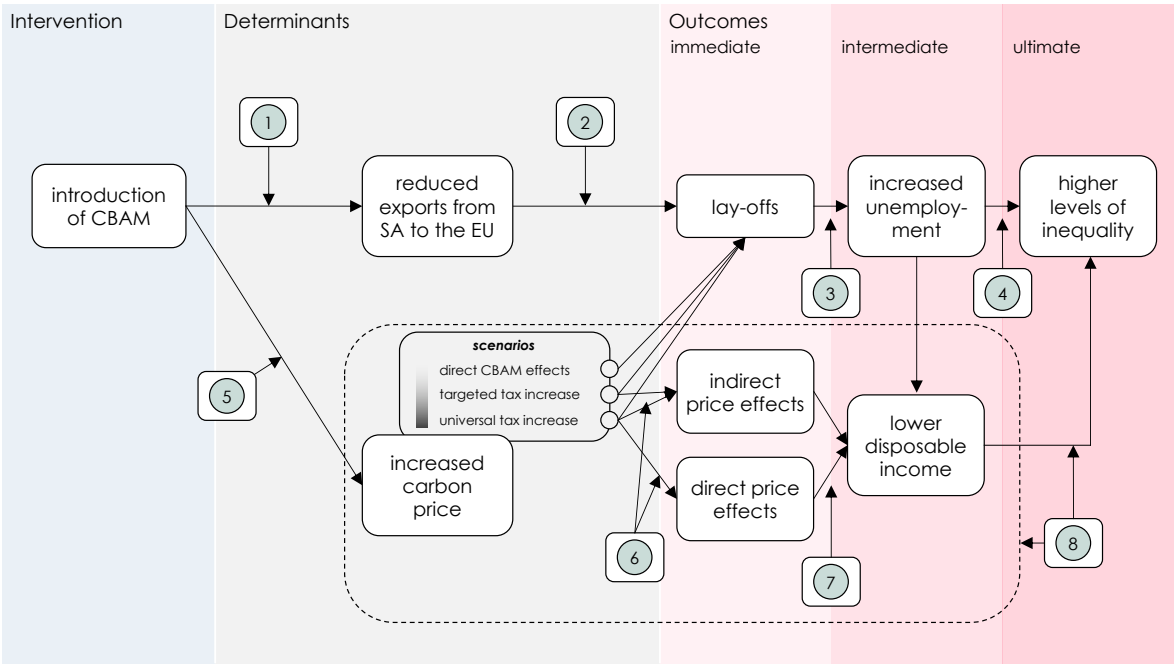

Figure B: Intervention theory outlining the impact routes and pointing out where moderators apply (nodes 1-8)

Conclusions and Recommendations

After studying how the EU CBAM could influence inequalities in South Africa, I conclude that negative impacts are likely to occur, warranting further investigation. I determined two routes through which adverse effects result: 1) by reducing exports in targeted sectors leading to lay-offs, and 2) by motivating higher domestic carbon prices which may be regressive. Either path is shown to be highly dependent on the policy design and the country-specific context. Consequently, BCA can have distributional implications. However, if policymakers are attentive to this risk, this can be mitigated or even avoided.

While ambitious climate policies and international approaches are needed, their application mandates coordination and thorough consideration of effects beyond the policymaker's jurisdiction. As the CBAM is not yet in effect and its design being finalised, lawmakers can still adjust the policy to address concerns about inequality impacts in exporting countries.

EU policymakers should aim to ensure equitable outcomes. One of the most effective means to avoid regressive effects is to re-channel the revenues to the exporting countries. This could help facilitate decarbonisation activities, provide funds to mitigate adverse distributional outcomes and lessen the incentive to raise (potentially detrimental) domestic carbon prices. Another way to strengthen the industry transition is to couple the policy with allocating additional technological or financial resources to build local capacity. Acknowledging the need to maintain WTO compliance, exemptions or differentiated price levels for lower-income countries could be considered and other ambitious non-price climate policies recognised. To preserve the policy's environmental integrity, export rebates should not be granted and free allowances phased out. However, as the latter can increase pressures on third countries, the additional revenues should be earmarked to mitigate this. Overall, increased attention to inequitable policy outcomes outside of the EU appears necessary.

South African policymakers, in addition to promoting the aforementioned CBAM design characteristics, can contribute to avoiding regressive impacts in multiple ways. To ameliorate the position of local industries to remain competitive in view of increasing global climate standards (and thereby avoid adverse impacts through route 1), the government should

accelerate decarbonisation activities. As future scope expansions are likely (and a comprehensive transformation necessary), this should not be limited to steel and aluminium industries but comprise the gradual removal of all trade-offs between economic and environmental concerns. To facilitate this, the policy mix should be diversified and an over-reliance on the carbon tax avoided. Given South Africa's susceptibility to regressive impacts from this instrument, any increase should be accompanied by targeted redistributive measures.

RQs *answered*	
1	How is the **risk** of increased inequalities in exporting countries **represented in the EU CBAM policy process**?
Official documents from EU institutions do not consider the threat of adverse distributional impacts in countries affected by the policy. While the Commission's impact assessment examines the risk of regressive outcomes, this is limited to EU member states and does not cover exporting regions. As part of the stakeholder consultation process, some contributors warned about these effects, but this was not incorporated by the policymakers.	
2	What are the **likely effects** of the EU CBAM **on inequalities** in South Africa?
It can be concluded that the CBAM (as it was proposed in July 2021) would be regressive in the South African context. However, this refers to the direction and does not imply very sizable effects on a national level. Direct impacts from lay-offs in targeted industries are likely to be locally concentrated, whereas effects from a carbon tax increase are more widely spread. Particularly vulnerable groups (across race, gender, and region) are assumed to be affected disproportionately, yet in absence of granular data, this is difficult to conclude with certainty.	
2.1	What are the **mechanisms** through which these effects can occur?
The CBAM's distributional impacts ensue via two different routes. First, export reductions result in employment effects in the targeted and associated industries. Second, employment and price effects follow from increases in the domestic carbon tax, motivated in part by the EU policy. The complex underlying mechanisms were explicated in form of an intervention theory.	
2.2	**How likely** are these to occur?
Along both identified routes, several moderators and conditions regulate the ultimate outcome. Their interconnection and residual uncertainty about individual links prevent a definitive assessment. However, based on the examination in this thesis, adverse effects seem likely. Direct impacts from reduced exports are probably limited, though strongly depending on the policy design. Effects from increased carbon taxes, however, are potentially larger and, arguably, have already started to occur resulting from the CBAM's announcement.	
3	What **context-specific factors** determine the likelihood of the CBAM affecting inequalities in South Africa?
The studied case is unique for many reasons. In other countries, the same policy can have vastly different impacts. Similarly, the way in which BCA is designed and implemented can be decisive for distributional implications in any region.	
3.1	What **socioeconomic conditions** in South Africa are relevant?
South Africa is particularly susceptible to carbon prices triggering regressive income effects. This is mainly attributed to energy consumption patterns. Additionally relevant to the route via export reductions, a historical lock-in to a carbon-based economy with a high emission intensity expands this vulnerability to the labour market. Elevated unemployment rates, vast differences in education levels, and a scarcity of semi-skilled jobs limit the capability to compensate further lay-offs. Finally, extreme and multi-dimensional inequalities, largely an apartheid legacy, aggravate the impacts of any additional regressive effect.	
3.2	Which aspects of the (CBAM's) **policy design** are relevant?
Decisions about revenue recycling and scope definition are central to the policy's distributional impacts. Whether and how the revenues are re-channelled influences both the competitiveness in exporting countries (route 1) and the incentive to raise domestic carbon prices (route 2). Applied purposefully, it can eliminate regressivity altogether. In contrast, expanding the scope to more products and indirect emissions potentially exacerbates impacts. Additionally, all decisions shaping the effective price levels are important, and a combination with technology transfers can alleviate adverse effects by supporting the (industrial) climate transition.	

My study provides a foundation for future research to expand on the generated findings. The thesis has two principal outputs. First, I provide evidence that the CBAM and like policies have the potential to adversely affect inequality outcomes in exporting countries. Second, I establish a framework in form of an intervention theory that explicates the underlying mechanisms. The main avenues for future research consist of either adapting the intervention theory and expanding the scope to other contexts (regions and/or policies) or narrowing in on sub-sections of the cause-and-effect chain and testing them in more detail.

Overall, the risk of adverse distributional effects from BCA was confirmed and should therefore be subjected to further investigation.

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Abbreviations

BCA	Border Carbon Adjustment
CBAM	Carbon Border Adjustment Mechanism
CBDR-RC	Common But Differentiated Responsibilities (and Respective Capabilities)
EC	European Commission
EITE	Emission-Intensive and Trade-Exposed
ETS	Emissions Trading System
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IPCC	International Panel on Climate Change
LDCs	Least Developed Countries
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organisation
R	Respondent (i.e., interviewee)
RQ(s)	Research Question
SA	South Africa
SDG(s)	Sustainable Development Goal(s)
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

As the most recent IPCC report stressed once more, anthropogenic climate change requires an urgent response (IPCC, 2022a). To avoid catastrophic impacts, rapidly curbing greenhouse gas (GHG) emissions is indispensable. Individual and country-level action is needed, but the nature of the problem ultimately demands concerted global action (Galán-Martín et al., 2018). One approach to expanding the range of unilateral climate policy is to include emissions that are associated with the domestic consumption of goods but occurred in third countries. Arguably, new policies are needed to facilitate a holistic transformation (Keohane & Victor, 2016; Nilsson et al., 2021). However, when they are introduced, it must be avoided that they hurt the already most vulnerable.

A pressing social problem, strongly associated with GHG emissions, is income inequality (Diffenbaugh & Burke, 2019; Teixidó-Figueras et al., 2016). While global levels are declining, more than half of an individual's income is still determined by their place of birth (Milanovic, 2016). In many instances correlated with extreme poverty, within-country inequality is rising and contributes more to overall inequality levels (68%) than differences between countries (Chancel & Piketty, 2021). Further exacerbated by the Covid-19 pandemic, inequalities and their reduction across gender, race and region are recognised to be "integral to achieving the Sustainable Development Goals" (SDGs) (United Nations, n.d.).

In my thesis, I examine the environmental policy instrument of border carbon adjustment (BCA) from a social equity and justice perspective. BCA raises a charge on emissions that are embodied in imports. It therefore targets production activities outside of the enacting entity's jurisdiction (Davidson Ladly, 2012). Consequently, the focus lies on distributional implications for exporting countries. I draw on existing research to embed the policy in a broader social and climate justice context. Specifically, I aim to find out if there are adverse effects on different forms of income inequality within countries affected by such a policy.

To operationalise this research, I use the case of the EU carbon border adjustment mechanism (CBAM) and its potential impacts in South Africa. The EU's plan has not taken effect yet. However, it constitutes the first internationally relevant policy of its kind and, as it complements the world's largest emissions trading system, is likely to have widespread consequences. By studying this concrete case, I hope to generate insights into which factors are relevant to adverse distributional effects of BCA and how to mitigate or avoid them.

A BCA essentially expands a domestic carbon price[1] to also include imports. The underlying rationale is from a competitiveness perspective to *level the playing field* (e.g., all steel sold in Sweden should be subject to the same carbon price regardless of where it was produced) and from an environmental perspective to avoid *carbon leakage* (e.g., if Swedish producers need to pay a carbon price while companies abroad do not, there is a risk of domestic production shifting to third countries where environmental standards could be lower). Within the EU's emissions trading system (ETS), carbon leakage for emission-intensive and trade-exposed (EITE) industries so far has been addressed by issuing free allocations (i.e., to largely exempt companies from paying for certificates) (EC, 2021). These free allocations will be phased out in conjunction with introducing the CBAM. The new mechanism is set to start with a transition period with

[1] A carbon price constitutes a market-based policy instrument that aims to address the negative externalities (environmental effects) of greenhouse gas emissions. It forces market actors to pay for every emitted tonne of carbon, incentivising the reduction thereof. It is generally implemented in form of a tax or an emissions trading system.

mandatory reporting requirements from 2023 and take full effect for certain EITE industry sectors from 2026.

1.1 Problem Definition

The research problem I identified concerns the justice implications of BCA. It is relevant from an academic perspective, as the social dimension of this policy option is not well-studied. Yet the research that does examine distributional and other fairness aspects suggests that adverse effects are likely. Therefore, an in-depth analysis of potential impacts on inequality will enable a more holistic policy assessment. The study also bears practical relevance. With the EU CBAM being implemented and discussions of adoptions in other places (Dybka, 2021), the policy is no longer only a theoretical construct. Furthermore, a first analysis of the EU's public consultation (see Appendix IV) suggests that justice concerns and the perspective of affected countries are underrepresented in the political process.

On a fundamental level, the research problem stems from potential trade-offs between ecological and socioeconomic ambitions (Spaiser et al., 2019). It therefore requires the integration of knowledge from multiple disciplines. As a BCA constitutes a partial shift towards accounting for consumed rather than produced GHG emissions, related equity implications need to be considered (Steininger et al., 2014). Because it also introduces a carbon price outside of the policymaker's jurisdiction, the literature on potential regressivity (Ohlendorf et al., 2021) and just price levels according to the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC) (Bauer et al., 2020) is also relevant. These insights from the academic discourse together with the examined stakeholder perspectives show that there is a need to acknowledge and manage the risk of adverse distributional effects. However, studies thus far have been mostly limited to burden-shifting and aggregate welfare losses for affected countries (Böhringer et al., 2017; Ghosh et al., 2012; Leturcq, 2021; Weitzel et al., 2012). While some authors point to the inclusion of historical emissions or try to incorporate contextual vulnerabilities (Bauer et al., 2020; Eicke et al., 2021), the impact of BCA on inequality within affected countries and more holistic forms of justice are largely absent from the literature. Given the relevance suggested by regressive carbon pricing and increased country-specific inequalities, this constitutes a research gap.

In practice, the equity and fairness concerns appear underrepresented in the political process. As part of the EU's public consultation, most submissions originated from companies or business associations and almost 95% were from actors within OECD countries (European Commission, 2021a). A pre-study found that both groups were very unlikely to reflect on justice-related aspects of the policy (Appendix IV). Following the consultation process, the commission's final proposal does not include either of the two main suggestions (raised by NGOs and academics) to exempt Least Developed Countries (LDCs) and to redistribute or earmark the revenues for international climate finance (EC, 2021). This could be interpreted as evidence that pointing out inequity concerns is not effective, yet this strikes me as a very cynical reading.

The identified research problem and the reason why the policy and its examination from a justice and equity perspective is necessary is fundamentally based on the issue of climate change. It requires rapid and comprehensive decarbonisation of all activities, including industrial production (Bataille et al., 2018). A carbon price is one tool to incentivise and steer this process. However, for an equitable transition, it is crucial to acknowledge the CBDR-RC principle (S. Banerjee, 2021). A uniform global carbon price would be economically efficient, yet, without complementing policies, severely defy this principle (Bauer et al., 2020). Following this rationale, adverse distributional effects are likely to occur. The question of whether these will be passed through to the (sub-)national level is unanswered. Further, the understanding of context-specific

factors and underlying mechanisms that would lead to exacerbated inequalities is limited (Weko et al., 2020). Adding to this body of knowledge is what motivates this research.

1.2 Aim and Research Questions

The general aim of this research is to help inform policymaking. More specifically, it should provide guidance for decisions on whether and how to implement BCA, incorporating a holistic social justice perspective that recognises distributional effects across and within affected countries. Instead of providing one definitive answer, the research aims to point out relevant nuances and contexts on which the outcome of these decisions may depend. Building on and integrating the findings of other scholars, this thesis strives to add the perspective of intra-country inequalities by studying a suitable example. In this way, the thesis addresses the detected research gap and contributes to solving the identified problem.

The concrete research objective is to increase our knowledge of equity impacts associated with the design and implementation of the EU CBAM as applied to South Africa. To guide and operationalise the analysis, I devised three research questions (RQs).

RQ1: How is the risk of increased inequalities in exporting countries represented in the EU CBAM policy process?

RQ2: What are the likely effects of the CBAM on inequalities in South Africa?
RQ2.1: What are the mechanisms through which these effects can occur?
RQ2.2: How likely are these to occur?

RQ3: What context-specific factors determine the likelihood of the CBAM affecting inequalities in South Africa?
RQ3.1: What socioeconomic conditions in South Africa are relevant?
RQ3.2: Which aspects of the (CBAM's) policy design are relevant?

Acknowledging the limited external validity, answering the RQs aims to provide some insights into the following broader questions: How does border carbon adjustment (BCA) relate to different forms of inequality within exporting countries? What are contextual factors influencing the distributional effects of BCA? What measures or policy design decisions can be taken to mediate adverse equity effects of BCA?

1.3 Scope and Delimitations

The study is scoped along multiple dimensions. The policy under examination is the EU CBAM proposal (EC, 2021). While there is one active BCA policy covering electricity imports in California, the regional and product-specific limitedness makes it unlikely to have relevant equity impacts (Fowlie et al., 2021). The CBAM, complementing the EU ETS, however, encompasses global trade flows worth more than $60 billion[2] and affects countries with widely different socioeconomic compositions (Chatham House, 2021).

The study is limited to impacts of the CBAM on South Africa. The reasons why South Africa is a suitable study object are multiple. First, a substantial portion of its aluminium and steel exports go to the EU countries (Chatham House, n.d.). Second, there is vast and multi-dimensional inequality within the country already today. Gender and racial inequality are prevalent and income inequality is the world's highest (Francis & Webster, 2019; Stolzenburg et

[2] Monetary values in this thesis are referred to as follows: $ - US Dollar; R - South African Rand; € - Euro

al., 2020). Third, English is among the official languages, which allows for a more comprehensive analysis and the inclusion of official documents. Finally, I have access to an extensive network in South Africa, was able to visit the country, speak to local individuals about my research, and conduct some interviews on-site.

The examination of industries will be limited to the South African aluminium and steel sector. While these are not the only goods covered by the policy, other exported commodities to the EU are negligible (see chapter 5.3.1). Assessing the policy's direct effect on these industries is essential. Additional considerations concern the South African carbon tax, as it could be raised in response to the EU policy and therefore result in indirect distributional effects.

While the policy instrument's focus and underlying rationale are environmental, this research only regards the social dimension of sustainability. Within that, the concept of distributive justice is central to the analysis. Definitions, alternative interpretations of *justice*, and the reasoning behind this delimitation are presented in chapter 3.2. While acknowledging historical emissions and injustices as an important factor in today's resource distribution, my analysis will centre around intra-generational equity. Inter-generational aspects are implicit to recognising the need for rapid decarbonisation for the continued habitability of our planet. Discussions about compatibility with trade law are acknowledged when evaluating relevant policy design decisions but otherwise largely out of scope.

Inequality as the central measure for distributive justice considerations is at the heart of the analysis. More precisely, I focus on changes in income inequality. While strongly correlated, poverty, unequal wealth distributions, and vastly different levels of GHG emissions are not separately considered. To provide a more nuanced examination of income inequality, I include the dimensions of race, gender and region. This disaggregation helps understand impacts on vulnerable groups, potentially exacerbating other forms of inequality.

1.4 Ethical Considerations

I do not see any threats to the integrity of my research. The study was not funded or in any way influenced by an external organisation. However, it was important to be mindful of vested interests of the interviewees. Participants could hold strong views on the policy which may not be related to expected effects on inequalities. Consequently, I ensured to remain objective and present the whole spectrum of findings. It was essential to avoid taking sides or disregarding unexpected results.

All participation was voluntary, and I took measures to avert any harm from participants. To ensure this, I made the purpose of my research transparent and explicit. Additionally, all interviewees were asked for consent to record the conversation for transcribing purposes. The respondents will not be referred to by their names as this does not provide an additional benefit. However, as it helps the reader to better apprehend the different viewpoints of the respective interviewee, I describe their position in a way that might allow inferences about their identity. As part of a general interview consent form (see Appendix II), I explicitly asked each participant to state the way I could refer to them and chose generic descriptions such as *South African policymaker* for anonymisation. Non-anonymised interview transcripts are stored on a password-protected storage medium and retained for at least five years according to common guidelines from the American Psychological Association (APA, 2010, 2020).

My study examines potential adverse effects on vulnerable groups. However, there is no reason to assume that the research itself will add to this in any way. On the contrary, my research aims to raise awareness of potential risks and help policymakers to take these into account. Yet, I made sure to avoid creating unrealistic expectations regarding the outcomes. Furthermore, any

results were aimed to be objectively presented and contextualised. The threat of my findings being politicised (in any direction) was addressed by diligently embedding them in the larger context of what previous research found.

1.5 Audience

The findings of this thesis may be of interest to a variety of stakeholders. However, the practical relevance is most pronounced for policymakers. Other intended audience members come from academia, NGOs, and the general public.

Policymakers can be seen as the central addressees of this research. Yet, it is important to differentiate between those who might introduce a BCA policy and those who are potentially affected as representatives of exporting nations. This dichotomy can be more generally framed as between high-income on the one, and low- and middle-income countries on the other hand. In the specific context of this thesis, these are represented by EU and South African policymakers. By assessing social equity implications, my research aims to support the decision-making process for whether and, if so, how to implement BCA. I provide information on inequality concerns to complement existing analyses of the environmental dimension. By examining aspects of the policy design and how that relates to social impacts, I intend to highlight relevant implementation details. As these specifics are still being debated and can be amended by the European Parliament and Council, the adopted version of the EU CBAM may still be influenced.

Takeaways for South African policymakers, on the other hand, revolve around the question of how to react to BCA policies to avoid negative distributional effects. I attempt to answer whether there is reason for concern and, if so, how potential impacts can come about. This, in turn, informs approaches to mitigate or sidestep these risks. By carefully analysing the context, I aim to provide insights into the generalisability and limitations of my findings. This is to support a broader set of countries and their policymakers with some, albeit less detailed, information on the potential consequences of BCA.

By closing or at least addressing the identified gap in the literature, this research also aspires to deepen the understanding of the distributional implications of BCA. I aim to support scholars by identifying relevant circumstances and contexts for such adverse effects. For NGOs and civil society groups, this research can point towards a necessity to engage (more) in the policymaking process for implementing BCA policies to achieve inclusive outcomes. To enable effective engagement, I highlight the most important elements and levers. Finally, this research has the potential to increase general awareness of the potential social justice implications of CBA. Considering the ongoing process, this can support the public discourse and thereby democratic legitimacy.

1.6 Disposition

This thesis comprises seven chapters that aim to guide the reader and facilitate the most effective apprehension of my findings about the distributional impacts of BCA. **Chapter 1** introduces the identified problem, this research's aim and the guiding questions it sets out to answer. It further discusses ethical implications and who can benefit from the generated knowledge. **Chapter 2** provides an overview of the existing research surrounding the topic. Additionally, it presents fairness principles to further justify the study's significance as well as the policies relevant for the investigation of impacts. In **chapter 3**, I narrow in on literature that is more directly applicable to my methodological approach. Gradually assembling the conceptual framework, the section starts by drawing upon the concept of theory-based policy evaluation for methodological grounding. After refining the interpretations of justice and inequality, the

theory and evidence on distributional effects of carbon pricing are examined to integrate its components into the final structure used for the analysis. **Chapter 4** shows how the research questions relate to each other and how they are approached. This includes both the collected data and the methods used to analyse it. In **chapter 5**, I present the results and analyse them in an integrated way. I use the research questions and, within that, the constructed intervention theory for orientation and structure, tracing the cause-and-effect chains under examination. **Chapter 6** reflects on the findings and further contextualises them. It relates the results back to the literature and discusses alternative research approaches. Finally, in **chapter 7**, I draw ultimate conclusions and summarise the answers to the research questions. The last considerations concern the practical implications of my research and potential future research avenues.

2 Background and Current Knowledge

This chapter synthesises the relatively scarce literature on fairness- and inequality-relevant considerations about BCA policies. Furthermore, I introduce principles that are pertinent to the analysis and its contextualisation. Finally, both the EU CBAM and the South African carbon tax are briefly outlined to prepare and enable a thorough examination of impacts.

2.1 BCA and Equity

In absence of a large body of research on social implications of BCA, this review draws on multiple related streams to contextualise the topic and present the current discourse. The general topic of BCA and, by extension, carbon pricing is mostly studied by economists. However, especially for the fairness and justice dimension, there are some contributions from political and interdisciplinary sustainability scientists (Brandi, 2021; Eicke et al., 2021). Overall, scholars approach the issue of fairness from multiple angles. Some evaluate it primarily based on the proportionality to countries' economic output (GDP) (Bauer et al., 2020), while other researchers focus on the potential risk of regressivity on different levels (Ohlendorf et al., 2021). Another approach is to study BCA policies as a partial shift towards consumption-based carbon accounting (Steininger et al., 2016). Some researchers argue that (particularly high-income) countries should be judged based on the emission reductions associated with consumption levels rather than domestic production (Hickel, 2020).

Researchers pointed out several surrounding issues that can inform overall justice assessments and the analysis of potential remedies for otherwise exacerbated inequalities. Close international collaboration is perceived as an essential part of overcoming the potential social limitations of BCA. Nurdiawati and Urban (2021) recognise a key role of partnerships for developing and transferring the required technologies for industry decarbonisation. According to Steininger et al. (2014), this technical assistance is central to preventing carbon leakage and burden-shifting. Cooperation is also required to ensure consistent measurement of embodied emissions (Jordan, 2021; Muslemani et al., 2021). From an equity perspective, this is important as lower-income countries are particularly vulnerable to administrative burdens resulting from reporting complexities (Eicke et al., 2021; Liu et al., 2016). Several authors consider the redistribution of revenues resulting from BCA (Leturcq, 2021; Steininger et al., 2014). These funds could be used to support exporting countries in building institutional capacities (e.g., for reporting), climate finance, or economic diversification to reduce vulnerabilities.

There are studies on distributional effects and welfare losses for lower-income countries for both carbon pricing in general and BCA in particular (Böhringer et al., 2012; Chepeliev et al., 2021; Eicke et al., 2021). However, the effects from BCA are considered only on an aggregated level, disregarding potential regressive effects within countries. Yet, the importance of disaggregating national impacts is increasingly recognised (Dorband et al., 2019; Pascale et al., 2020). Further, global inequality is strongly interlinked with GHG emissions and is increasingly fuelled by inequalities within (rather than between) countries (Chancel & Piketty, 2015). Other potential avenues of expanding the inequality considerations in this context consist of studying spatial and relational differences as well as embodied labour in conjunction with embodied emissions (Baker, 2018).

One of the main methods to assess distributional impacts of BCA is based on computable general equilibrium (CGE) modelling (Böhringer et al., 2017; Weitzel et al., 2012). However, the application of this approach is limited to economic welfare considerations and operates at regional or national levels. Eicke et al. (2021) build a specific conceptual framework for evaluating how much the EU CBAM will affect different countries. In their analysis, they distinguish between exposure and vulnerability to calculate and operationalise risk resulting

from the policy. For an analysis of inequality impacts within countries, these categories could be adapted and expanded to represent more granular (i.e., sub-national) data.

2.2 International Principles

Principles of international cooperation are central to facilitating a just climate transition (Anderson et al., 2020). Two of these appear essential for the assessment of fairness and help the contextualisation of this thesis' results: state sovereignty and common but differentiated responsibilities (and respective capabilities) (CBDR-RC). The first is potentially infringed upon by undermining the exporting countries' autonomy to adopt different approaches of climate mitigation policies than a carbon price (Leimbach & Giannousakis, 2019). The principle of CBDR-RC is a central part of the UNFCCC manifesting that different historical emissions and economic means should also be reflected in the contribution toward climate mitigation and adaptation (Brunnée & Streck, 2013; UN, 1992). It can be argued that low-income countries paying the same price per tonne of carbon as EU members is at odds with this principle (Bauer et al., 2020). The connection between BCA policies and the CBDR-RC principle was established by multiple scholars and bears particular relevance (S. Banerjee, 2021; Steininger et al., 2014; Van Heerden et al., 2016).

2.3 EU CBAM

The EU proposal to implement a BCA policy is highly relevant, as it is not only concrete and set to take effect soon but also covers a considerable volume of trade flows and emissions. As a part of the *European Green Deal* (European Comission, n.d.) and the *Fit for 55 Package* to implement it, the CBAM is introduced as an "essential element of the EU toolbox to meet the objective of a climate-neutral Union by 2050" (EC, 2021, p. 17) and clearly framed as an environmental rather than a trade policy.

The CBAM's central rationale and function are to address the issue of carbon leakage within emission-intensive and trade-exposed (EITE) industries (EC, 2021, p. 17). This is currently covered by free allocations under the EU ETS, which means that instead of having to purchase emission certificates, producers receive allowances for the carbon embodied in their products (based on industry benchmarks). The CBAM provisions are intended to gradually replace this instrument and prevent carbon leakage by ensuring that any good sold within the EU was subject to a comparable price on the emissions associated with its production. Another stated purpose of the policy is to "encourage the use of more GHG emissions-efficient technologies by producers from third countries" (EC, 2021, p. 17), which manifests the policymakers' general awareness of impacts outside their jurisdiction. The proposal declares the EU's readiness to support low- and middle-income countries with the policy implementation and their decarbonisation efforts (EC, 2021, p. 23), however, without elaborating on concrete measures.

As indicated above, the exact policy design plays an important role for possible adverse effects in exporting countries. I briefly outline how the Commission's proposal envisions the CBAM to be implemented. First, the price per tonne of embodied GHG emissions is based on weekly averages of the EU ETS rates[3] and is paid by the importer (EC, 2021, p. 18). It can be reduced by verifying that the emissions were already subject to an explicit carbon price in another jurisdiction (EC, 2021, p. 32). A further important determinant of the ultimate costs for exporters is the effective price paid by EU producers after taking into account free allocations, whose phase-out is not yet clearly defined (EC, 2021, p. 43). Unlike the EU ETS, the CBAM operates more like a carbon tax and does not impose any *cap* on the overall emissions to avoid restricting trade flows (EC, 2021, p. 18). During the proposed transition period between 2023

[3] As an indication, on May 16, 2022, the price per tonne of CO_2e was circa €90 (around $95) (Trading Economics, 2022).

and 2025, the CBAM does not include payments but requires quarterly reporting on embodied emissions (EC, 2021, p. 44).

At the end of this two-year period and before financial adjustment takes effect in 2026, the proposal sets out the intention to re-evaluate the policy design. The main focus of this lies in a possible scope expansion (EC, 2021, p. 23). Currently, it covers only direct emissions (scope 1) embedded in goods from the following sectors: cement, electricity, fertilisers, iron and steel, and aluminium (EC, 2021, Annex I). Extending this to indirect emissions and other goods is explicitly discussed as an option and would have far-reaching consequences for the impacts examined in this thesis. Another important aspect is the use of revenues generated from the policy. These are assumed to amount to roughly €2.1 billion per year by 2030 (EC, 2021, p. 48). However, the proposal does not envision the recycling of these revenues but states that "most revenues generated by CBAM will go to the EU budget" (EC, 2021, p. 11). Dedicating the funds to financing climate transition activities or re-channelling them to the exporting countries, instead, would likely influence the policy's distributional implications.

2.4 South African Carbon Tax

In 2019, the South African government announced and implemented a domestic carbon tax to incentivise the mitigation of GHG emissions (Republic of South Africa, 2019). As outlined in the previous chapter, the CBAM takes into account and allows the deduction of carbon prices that were already paid in the country of origin. Therefore, considering the characteristics of the South African tax is relevant to estimating the potential impacts of the EU policy. In this section, I briefly outline the most important features with a focus on factors determining the effective price levels for EITE industries.

The tax was introduced at a level of R120 (around $7.50) per tonne of emissions (Republic of South Africa, 2019, p. 12) and was increased to R144 in 2022 (National Treasury, 2022, p. 47). While the coverage of emissions is with 80% very comprehensive (World Bank, 2021), in the first phase of the tax, the policy provides free allowances ranging between 60% and 95%, resulting in effective rates between R7 and R58 (IEA, 2020). For industries, such as steel and aluminium, allowances for trade exposure and emissions from industrial processes lead to a very low tax burden of less than $0.5 per tonne (Republic of South Africa, 2019, p. 16). While phase 1 of the tax was initially planned to end in December 2022, the government announced its extension until the end of 2025 (Godongwana, 2022). However, the outlined price trajectory is more ambitious and envisions levels of at least $20 in 2026 and $30 in 2030. Yet, the gradual phase-out of free allowances in phase 2 is not concretely defined. Overall, while the South African carbon tax in the targeted sectors is not significant, its future development will be important for effects caused by the CBAM. The likelihood of this is further examined in later chapters.

3 Theories, Concepts and Conceptual Framework

Overall, I utilise a framework that mainly draws upon theory-driven policy evaluation and the literature on carbon price regressivity to identify where and how the CBAM might affect income inequalities in South Africa. I define the constituent concepts and outline how they are integrated.

3.1 Theory-based Policy Evaluation

The objective of this thesis is to examine consequences of a policy instrument by studying an exemplary case. This makes my research a form of policy analysis or evaluation. However, the vastness of this field requires further specification as to how my approach relates to the broader discipline. I will briefly outline what policy evaluation and its theory-based variant are and then describe how and why I apply certain elements for my research. Utilising elements from the practice of (theory-based) policy evaluation has the central benefit of guiding the analysis. It adds structure and rigour to the research by building upon experiences from a wide range of scholars as well as decades of methodological development. However, it is also important to acknowledge the limitations of this approach.

3.1.1 Definition and Placement within the Practice

Policy evaluation can be defined as the "assessment of the merit, worth, and value of administration, output, and outcome of government interventions, which is intended to play a role in future, practical action situations" (Vedung, 1997, p. 3). While there are multiple delineations of the concept, the practical applicability of the evaluation's results is particularly relevant to my approach and will guide the analysis.

It is common to differentiate between ex-ante and ex-post policy evaluation (Smismans, 2015). The evaluator either tries to anticipate the effects of a given policy or attempts to empirically review its outcomes after implementation. For studying distributional impacts of BCA, any analysis can only be ex-ante, due to a lack of adopted policies. For my selected case, the EU CBAM, a retrospective assessment is impossible. As of now, the legislation has not been adopted and the mechanism is planned to take full effect only in 2026.

Another crucial decision for every policy analysis concerns the evaluation criteria; that means, what kind of effects are examined (Mickwitz, 2003). My analysis focuses on unanticipated rather than anticipated consequences and studies impacts that lie outside of the policy's target area. Hence, this thesis will not be able to definitively answer the question if BCA is overall a good policy. I also do not grapple with the probability of it achieving its goals or successfully solving a problem. Instead, I aim to contribute to a holistic assessment by closely studying the possibility of unintended side effects in terms of exacerbating inequalities in exporting countries.

The analysis of distributional impacts of BCA should not be seen as an isolated empirical question. The aim is to contribute to a broader normative discourse about whether the policy is just and its outcome defensible. Accordingly, this research can be understood as a contribution to a, what Fischer termed, *systems discourse* as part of a more reflexive form (*second-order*) of evaluation (Fischer, 1995). Even though my research does not focus on the stated goals of the policy, it is in line with the tradition as it examines the policy by estimating "unanticipated problems with important societal consequences [and] […] consequences […] that are judged to be equitably distributed" (Fischer, 1995, p. 111). Utilising this approach, I intend to bridge the fact-value dichotomy by incorporating both normative concepts and empirical analysis.

I will primarily utilise elements from a specific form of policy analysis: theory-based evaluation. The distinction lies in the focus on the underlying causal mechanisms this approach seeks to

explicate (Weiss, 2000). Hence, the central benefit is to be able to understand how outcomes originate; in other words, it allows the identification of potential routes to impact. Chen considers the investigation of unintentional impacts a "great advantage of theory-driven outcome evaluation" (Chen, 2015, p. 334). The central element of the evaluation technique modelling the different steps and relationships for a given policy is called intervention theory[4]. Constructing and testing an intervention theory is the component I will employ for the purposes of this thesis.

3.1.2 Intervention Theory

An intervention theory can be understood as the "beliefs and assumptions underlying an intervention […] expressed in terms of a phased sequence of causes and effects" (Weiss, 1997, p. 501). It can be structured in multiple ways. Theory in evaluation can be used to examine either or both of these two policy components: 1) the processes around the implementation (action model); 2) the outcomes and intervening mechanisms (change model) (Chen, 2005). While there are good arguments for and a trend towards more comprehensive intervention theory models (Rogers, 2008), this thesis will construct a change model, focusing on mechanisms that could lead to adverse distributional outcomes. This particular emphasis (instead of an all-encompassing policy evaluation) and the exploratory nature of my research validate this focus. Nevertheless, this does not imply a complete disregard of relevant actors and implementation details but underlines the attention to the intervention's implications. To facilitate an easier apprehension of how the outcomes materialise and could be altered, I construct an overview of the relevant actors and their interrelation with the change model.

To operationalise the use of an intervention theory, one option is "to determine which outputs, outcomes and causal links to collect data on" (Mickwitz, 2003, p. 424). It can be applied to generate assumptions that can then be tested. This approach is used in this research project. To develop an intervention theory, Donaldson (2001) outlined four sources of information: 1) theories from prior research, 2) implicit assumptions of implementing actors, 3) direct observation of the policy's performance, and 4) exploratory research to test assumptions. The second and third sources will not be utilised. The examined policy is not in effect yet and the research focuses on outcomes outside the target area as well as the implementing entity's jurisdiction (i.e., outside the EU). Hence, I will mainly rely on existing theories about mechanisms underlying the policy and conduct exploratory research on surrounding factors and the specific context.

The selected structure for the intervention theory builds on the approach suggested by Chen (2015). It comprises three main stages: intervention, determinants, and outcomes. *Determinants* is the term used to describe through which initial results of the policy intervention the subsequent outcomes occur (Hoffmaister & Román, 2012). The links between each of these steps and elements are governed by moderating mechanisms. I adapted this framework by differentiating between multiple outcomes, explicating when they occur and how they relate. I distinguish between immediate, intermediate, and ultimate outcomes (Mickwitz, 2003). The final structure guiding my analysis is shown in Figure 3-1.

[4] Referred to by many authors as programme theory. However, intervention theory is considered the more comprehensive term (Vedung, 1997). It is therefore used in the context of this thesis, given the more open and exploratory approach.

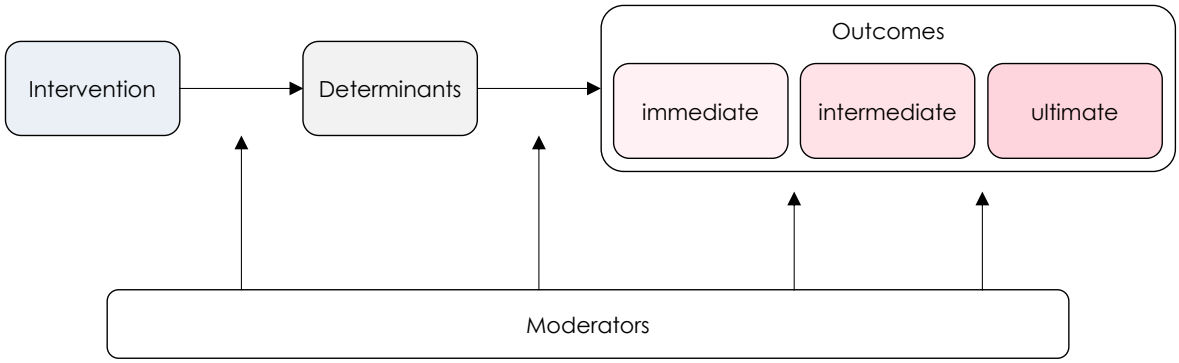


Figure 3-1: Generic intervention theory framework

The early development stages of the policy instrument make an in-depth understanding of underlying mechanisms especially important. Rather than trying to empirically determine if the EU CBAM results in increased inequality in South Africa, this thesis aims to contribute to a deeper understanding of how such an instrument might lead to adverse distributional impacts. Therefore, the utilisation of an intervention theory is strongly conducive. As illustrated in Figure 3-2, the goal is to explicate and detail the connection between the CBAM implementation (intervention) and higher inequalities (ultimate outcome). For both the identification and investigation of the intervention theory's links I mainly utilise expert interviews. However, this is complemented by background research and analysis of empirical data. This is suitable, as theory-driven evaluation is not tied to certain methodological approaches and can comprise both qualitative and quantitative methods (Donaldson, 2007; Smith, 1994).

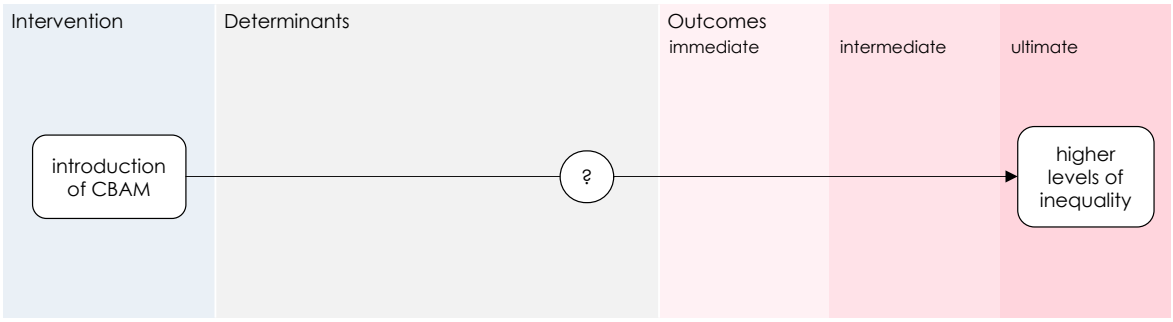


Figure 3-2: From the intervention to the ultimate outcome of higher inequalities

3.1.3 Limitations

There are limitations of theory-driven evaluation in general as well as specifically for the context of this thesis. The goal of explaining policy outcomes by way of explicating an intervention theory is seen by some as inherently unfeasible and beyond the task of an evaluator (Scriven, 1998). Some go even further and argue that the attempt to explain the underlying mechanisms can be misleading and counterproductive (Stufflebeam & Shinkfield, 2007). These objections are ideological and therefore difficult to prove or disprove (Coryn et al., 2011). However, the concerns can be addressed by acknowledging and discussing residual uncertainty about the exact functioning of the studied policy. The goal of my research is not to definitively assess the BCA policy's distributional effects but rather to identify potential routes to impact and estimate their likelihood. Therefore, a focus on exploring the underlying mechanisms is more appropriate than determining the overall "merit, worth and value" (Scriven, 1991, p. 1) of the policy, which is how Scriven defines the evaluation process. Some also argue that traditional evaluation approaches are ill-prepared for estimating fairness and distributional aspects (te Boveldt et al., 2020). A multi-level approach is a suggested remedy to avoid premature aggregation blurring

differentiated impacts. Since these differences in impacts are at the centre of this analysis, this is no major reason for concern. Finally, ex-ante evaluations are generally considered to be more difficult or at least subject to higher levels of uncertainty (Herrick & Sarewitz, 2000). As this is unavoidable in the case of BCA, however, this aspect serves as motivation for particular diligence and acknowledgement of possible ambiguities.

3.2 Definitions of Justice

Justice is arguably among the terms most difficult to define unambiguously. Deeply rooted in philosophy, there are many different perspectives and interpretations, even within social justice theory. However, that does not mean that *justice* or the quality of a policy outcome to be *just* is entirely arbitrary. Instead, the assessment depends on the selected justice angle. A careful delineation is therefore essential to use the concept in a meaningful way. This thesis will primarily apply the model of distributive justice as an interpretive lens.

Sovacool and Hess (2017) identify five relevant interpretations: morality or merit-based justice, distributive justice, procedural justice, cosmopolitan justice, and justice as recognition. All these forms could potentially be related to the policy instrument that is the subject of this thesis. Does BCA contribute to affording more welfare to those that are more deserving of it (merit-based justice), or does it manifest unequivocal respect for individuals (cosmopolitan justice), especially for those particularly vulnerable or marginalised (recognition-based justice)? Elements of procedural justice could reasonably be assessed on the basis of the legitimacy and openness of the policy process. However, considering possible contributions to or violations of distributive justice, the equitable allocation of resources and burdens, is overall most tangibly relatable to potential outcomes of the policy.

Distributive justice deals with the allotment of resources and its fairness or legitimacy (Gilabert, 2012). While BCA has primarily environmental objectives, the charge it introduces clearly has the potential to change trade flows, production patterns, and, thereby, the distribution of economic welfare. If this change results in higher, lower, or equal levels of inequality, is the subject of this thesis. Inequality is not per se assumed to be unjust. However, John Rawls' *difference principle* states that inequality is only justified if it improves the situation of the "least advantaged members of society" (Rawls, 1999, p. 65).

Especially when related to climate change and sustainability, distributional equity is often expanded to inter-generational considerations (Klinsky & Golub, 2016). This widens the scope in both temporal directions. Future generations will be severely affected by the outcomes of present-day consumption and emission levels. Similarly, the actions of past generations affect us today. There are philosophical arguments for and against taking into account historical emissions (Meyer & Roser, 2010). However, European countries' disproportionately high contribution to climate change and colonial exploitation validate particular attention to adverse distributional effects from EU policies (IPCC, 1996). Overall, while acknowledging the importance of justice considerations that go beyond the current generation, this thesis will mainly study inequalities within today's societies.

3.3 Inequality

For many, there is an intuitive appreciation of what *inequality* means. However, the term encompasses a remarkably wide range of different interpretations. Therefore, it is crucial to contextually define the term and its usage to ensure a common understanding. For the purposes of this thesis, I present an overview of the various dimensions and then narrow in on a definition and delineation most relevant for this research. Trying to place the concept in a wider context

of sustainability and justice, I illustrate briefly why inequality should be avoided and summarise the current situation in South Africa.

3.3.1 Definition and Delimitation

The reduction of inequalities is an essential component of striving toward holistic sustainability. This is exemplified by its inclusion in the UN Sustainable Development Goals (SDGs). SDG 10 aims to "reduce inequality within and among countries" (United Nations, n.d.) and comprises multiple dimensions. While integrating all inequality-relevant attributes is not feasible, recognising this multi-dimensionality I include several facets, such as racial, regional, and gender-based differences.

In political debates about which kind of inequality should be considered unfair, it is often differentiated between inequality of opportunity and inequality of outcome (Kanbur & Stiglitz, 2016; Lefranc et al., 2008). Some argue that policymakers should focus on (and limit themselves to) achieving equality of opportunity; in other words, they should aim to level the playing field. This interpretation emphasises access to education, networks, and other determinants of (economic) success. Going beyond this interpretation by implementing policies to influence the actual outcomes is sometimes seen as intrusive and paternalistic. However, as Atkinson put it very eloquently, "if we are concerned about equality of opportunity tomorrow, we need to be concerned about inequality of outcome today" (Atkinson, 2015, p. 11). Equality of opportunity determines outcomes and outcomes determine opportunities. The two concepts are so strongly intertwined that, even though this thesis examines impacts on outcomes, this research also has implications for opportunity-based inequalities.

This dynamic is very applicable to the idea of a BCA and its potential limitations in acknowledging the importance of inequality. The policy is designed to level the playing field. Under the CBAM, for example, every company selling steel in the EU should pay the same price for embodied emissions. This is meant to create equality of opportunity. However, this disregards existing inequalities, represented in their simplest form by vastly different levels of GDP in the countries exporting steel to the EU. Hence, by not addressing present inequality and only superficially creating equal opportunities (i.e., everyone has access and pays the same) this falls short of dealing with inequality concerns in a way that can be considered fair or sustainable (Bauer et al., 2020).

While there are many other important forms, in this thesis, the focus will lie on economic inequality, and, more specifically, income inequality. It is likely the most used definition in the international development discourse. Its prevalence can be attributed to the ease of measuring and its perception as a suitable proxy for access to different goods. Income is also the measure used to determine poverty levels. Extreme poverty is defined as having an income of less than $1.90 per day (World Bank Group, n.d.-b). Relative poverty is even determined by comparing different incomes and is therefore inextricably linked to inequality. This relationship is also manifested by certain forms of measurement, for example, the Foster-Greer-Thorbecke (FGT) indicator combines the two dimensions (Foster et al., 1984). Further, high correlations with other forms of inequality strengthen the suitability of the economic variant. Economic inequality can both contribute to and result from unequal access along other important social dimensions, e.g. political participation, opportunities across genders, or land access (Brady, 2004; Carter, 2004; Harkness, 2018).

Income inequalities can be considered on different levels. The two most common ones in policymaking are between-country and within-country inequalities, either calculating the distribution of national or individual incomes (Chancel et al., 2021). Whereas distributional impacts of BCA between countries are likely, these effects are relatively well-understood (e.g.,

Böhringer et al., 2018). This thesis will focus on how inequality within exporting countries could be affected. In addition to the absence from the BCA literature, within-country disparities constitute more than two-thirds of global income inequality and are further gaining importance (Chancel & Piketty, 2021). For a comprehensive analysis of the mechanisms potentially leading to higher inequalities, I examine effects on the disposable income, which includes consumer price increases (e.g., for electricity) in addition to considering changes in earnings. The most common measure of income inequality is the Gini index (Cowell, 2011). While this study includes no calculations of Gini coefficients, the indicator's underlying definition and logic provide the methodological background to my qualitative considerations. It is the expression of a distribution as a decimal number between 0 and 1, representing perfect equality (everyone has the same income), and perfect inequality (one person receives all the income).

3.3.2 Problems with Inequality

There are numerous reasons why excessive levels of inequality should be avoided. Beyond the philosophical stance (see chapter on distributive justice) that too high or indefensible levels of inequality are inherently unjust, there are also various practical downsides to it. From an economic welfare perspective, unequal distributions are considered inefficient. The underlying concept summarised by the IPCC as the "prioritarian view of social welfare" (IPCC, 2014, p. 223) describes the non-linear relationship between income and well-being. This is based on the idea that well-being is maximised when it is more equally distributed (Parfit, 1997; Sen & Foster, 1997). The underlying mechanism is that for individuals with a high income, the additional happiness retrieved from an increase in income is relatively smaller. This justifies giving *priority* to the least well-off. The same effect of a decreasing correlation between income and subjective well-being can also be observed on societal levels for entire countries (De Neve & Sachs, 2020; Easterlin et al., 2010). The traditional arguments for inequality rooted in neo-liberal economic theory were also largely disproven. There is little evidence for the claims that inequality is both a necessity for growth and would lead to so-called *trickle-down effects* at the lower end of the income distribution (Greenwood & Holt, 2010; Herzer & Vollmer, 2013; Skott, 2017). Furthermore, the highly influential *Kuznets curve*, which hypothesised that inequality would ultimately decrease with higher levels of GDP, has little empirical backing (Piketty, 2014). This implies that achieving distributional equity requires active and intentional policymaking.

Beyond being economically inefficient and not self-regulating there is a whole range of other negative outcomes associated with heightened levels of economic inequality. While causality is difficult to prove (Babones, 2008), there is a consistent correlation between high inequality and worsened health (Wilkinson & Pickett, 2006). Reduced social capital resulting from inequality makes people more prone to diseases (Kawachi et al., 1997; Uphoff et al., 2013). These effects occur across different categories. Infant mortality levels correlate strongly with distributional inequities (Lynch et al., 2001) and mental health can be significantly compromised (Ribeiro et al., 2017). In unequal societies, the risk of depression is relatively more pronounced for people with lower incomes but is also heightened for wealthier individuals (Pickett & Wilkinson, 2015). Other important social metrics are also linked to inequality. Crime correlates with and is likely a result of widely spread income distributions (Kawachi et al., 1999). General happiness and life satisfaction, which is broader than the aforementioned well-being, are negatively impacted as well (Schneider, 2019). This results mainly from the perception of unfairness rather than only from a lack of income for certain individuals (Oishi et al., 2011).

Finally, there are important connections between high levels of inequality and greater impacts on ecological systems. This includes but is not limited to GHG emissions and climate change. Higher inequalities are strongly linked to higher carbon footprints (Chancel et al., 2021). Particularly in lower- and middle-income countries, inequality hampers the implementation of

more ambitious climate policies (Klinsky & Winkler, 2018). Overall, the reasons for reducing or at least avoiding the increase of inequalities are manifold.

3.3.3 Inequality in South Africa

South Africa is the country with the world's highest income inequality (Sulla et al., 2022), which implies that any given increase has exceptionally severe implications in this context. The inequalities are multidimensional, strongly interrelated with extreme poverty and have important connections to climate change and other societal problems.

Recent figures from the World Bank show that income inequality levels in South Africa have declined marginally (the Gini coefficient changed from 0.684 to 0.670 between 2008 and 2018) but remain by far the highest in the world (the second-highest is found in Namibia with a Gini of 0.593) (Sulla et al., 2022). With around 75%, the labour market constitutes the largest income source (Statistics South Africa, 2019), and wage disparities contribute the most to the unequal distribution (Bhorat et al., 2020). These inequalities resulting from labour income are increasing, and their effect is exacerbated because people with lower wages are more likely to share their pay with unemployed individuals (Wittenberg, 2017). While this relationship appears simple (wage differences result in income inequality), the underlying reasons and the decomposition along different dimensions are crucial to apprehending the context.

A large share of today's inequalities in South Africa can be attributed to the legacy of apartheid and colonisation (Bhorat, 2004; Moyo, 2014; Sulla et al., 2022). This is particularly true for the multi-dimensionality of distributional inequities. To disentangle the high levels of inequality and definitively attribute shares of it to certain characteristics is complicated due to strong correlations between different dimensions (Akanbi, 2016). However, analyses have identified racial differences as the biggest contributor, followed by (closely correlated) education levels (Piraino, 2015; Sulla et al., 2022). The systematic oppression and classification along racial lines by the apartheid regime remain clearly visible in present income differences. Whereas Black[5] South Africans receive an average income of around R6,900 per month, the income of white individuals is more than three times higher (R24,600) (Statistics South Africa, 2019). People identifying as *Coloured* and *Indian/Asian* lie in between, with R9,300 and R14,200, respectively. Additionally, the generally lower incomes of disadvantaged population groups are also more unequally distributed (Statistics South Africa, 2019). The Palma ratio (i.e., the share of all the income received by the top 10% divided by the share received by the bottom 40%) is almost three times as high for Black as for white South Africans.

This differs from the dynamics of regional and gender inequalities. Whereas people in rural parts of South Africa have substantially lower average incomes than the urban population (R11,700 and R40,300, respectively), the inequality levels are higher within urban areas (Statistics South Africa, 2019; Sulla et al., 2022). This is mirrored by differences between the country's provinces, with incomes in Gauteng and the Western Cape (home to the main metropolitan areas) exceeding the average by around 60% (Statistics South Africa, 2019). Similarly, there is a significant gender wage gap in South Africa, particularly pronounced among lower incomes (Bhorat & Goga, 2013). Female workers receive around 38% less than their male counterparts (Sulla et al., 2022). However, the inequality within the group of women-headed households is relatively smaller (Statistics South Africa, 2019). Overall, racial, regional, and gender differences all constitute relevant criteria for examining South African inequality levels and impacts.

[5] All references to *Black* South Africans will be capitalised in this thesis. While it's argued from a US American context, the underlying reasoning to do so can be found here: nytimes.com (Coleman, 2020)

As inequality only describes a distribution, it does not depict the situation of the least well-off. Considering the income levels of the individuals at the lower end of the distribution is important to estimate the social impacts from increased inequalities. In the South African context, inequality is poverty-relevant. With more than 16 million people (27% of the population) living in extreme poverty, increasing inequalities are very likely to aggravate the deprivation of essential needs (World Data Lab, n.d.). Poverty is also disproportionately affecting women, individuals in rural areas, and people of colour (Zizzamia et al., 2019).

Inequality in South Africa is strongly linked to vulnerability to environmental and other social problems. For instance, the adaptability to climate change impacts, such as droughts and floods, is very limited in poorer areas (Davis-Reddy & Vincent, 2017). Consequently, integrating policies for inequality reduction and the climate transition is seen as essential in the country's context (Winkler, 2018). Furthermore, the repercussions of inequality outlined in chapter 3.3.2 are largely confirmed in studies of the South African situation. For example, risks of depression are attributable to distributional inequity (Burns et al., 2017) and general well-being and happiness are also dependent on unequal income levels (Kollamparambil, 2020). All in all, inequality has severe implications for the South African society and an aggravation of this should be avoided.

3.4 Carbon Pricing and Inequality

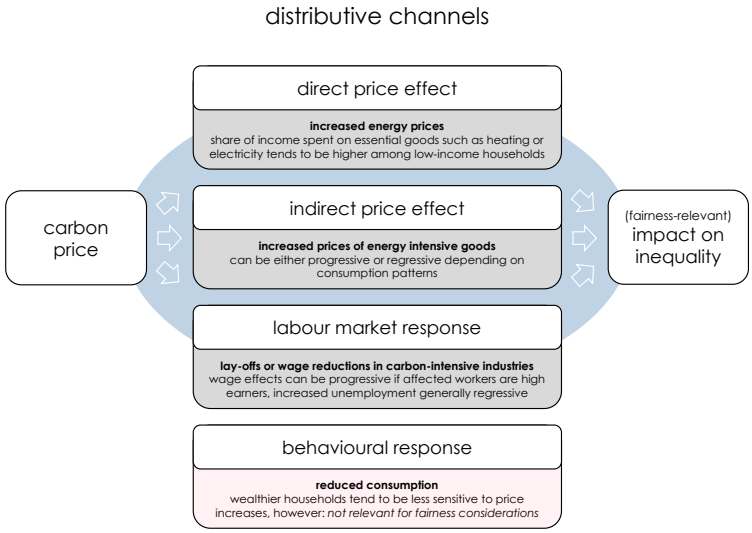
A central rationale underlying the concerns about adverse distributional effects from BCA lies in the potential regressivity of carbon pricing in general. That means that introducing a price on GHG emissions could lead to higher inequalities by disproportionately affecting vulnerable and lower-income households. In this section, I summarise the discourse around carbon price regressivity, outline the different channels through which regressive outcomes may result, and show how this relates to BCA. Finally, I introduce important factors on which the distributional impacts depend and synthesise the evidence from studies examining the South African context.

Much of the research on the inequality effects of carbon prices focuses on wealthy industrialised countries (Ohlendorf et al., 2021). While this research helps identify the potential threat, it is important to acknowledge the limited external validity of these studies for other contexts. The literature on high-income countries is included to illustrate the general risk and for the synthesis of relevant factors. Subsequently, I will focus on more context-specific models and calculations to estimate the likelihood of regressive effects of carbon pricing in South Africa. For carbon prices in rich countries, research consistently shows regressive outcomes (Grainger & Kolstad, 2010; Ohlendorf et al., 2021). This is often attributed to the relatively carbon-intensive consumption of individuals in lower-income households. However, some more recent studies came to different conclusions about within-country inequality impacts in the EU, suggesting a more nuanced and context-dependent relationship than previously assumed (Feindt et al., 2021; Landis et al., 2021). This ambiguity is heightened with the expansion to lower- and middle-income countries. An elaborate study by Dorband et al. (2019) suggests that in most low-income countries the effects of a carbon tax would be progressive. Some middle-income countries, however, are important outliers and show regressive outcomes. The results from a recent and comprehensive meta-analysis suggest a similar pattern (Ohlendorf et al., 2021).

3.4.1 Distributive Channels of Carbon Pricing

For better apprehension of these outcomes, I introduce a framework outlining the routes via which regressive results can occur. Antosiewicz et al. (2022) identify four channels that determine distributional outcomes of carbon prices (see Figure 3-3). Direct and indirect price effects result from higher costs for consumers. Both routes are widely recognised and usually pose the foundation of studies modelling distributional implications of carbon pricing

(Ohlendorf et al., 2021). While the direct effect refers to increases in energy prices based on the fuel's carbon content, indirect price effects are related to the consumption of goods with embodied carbon emissions. The assumption underlying direct effects is that individuals at the lower end of the income distribution spend more of their income on basic energy needs. This is in relative terms. On average, less affluent households have smaller and fewer cars and houses, leading to less fuel consumption. However, in relation to their disposable income, poorer households need to spend more on these goods. Recently, this relationship is aggravated by cost barriers to electric vehicles and the installation of new heating technologies. Direct effects are sensitive to regional differences; impacts on poorer rural and urban households often differ substantially and should therefore be studied separately (Okonkwo, 2021). Indirect price effects stem from internalising externalities (here, costs and damages resulting from GHG emissions) on all goods according to the emissions associated with producing and providing them. The mechanism operates like the one underlying direct effects: lower-income households face a higher price increase relative to their income leading to higher inequalities. However, the indirect channel tends to be less strong or certain (Goulder et al., 2019). As these goods and services are further removed from fundamental needs (such as lighting, heating/cooling, mobility) the distributional outcomes through indirect price effects are more dependent on specific consumption patterns. If the share of "luxury emissions" (Shue, 1993) is sufficiently high in a given society, carbon pricing could be distributionally progressive. Both price effects are subject to substantial context-specific variation and tend to differ strongly between high- and lower-income countries (Dorband et al., 2019).



Source:
Own elaboration, based on Antosiewicz et al. (2022)

Figure 3-3: Distributive channels of carbon pricing

The reaction of companies and the labour market, in general, constitutes the third channel through which carbon prices relate to inequality. This route is less commonly included in the academic literature but can have very important implications and shift the overall balance between progressive and regressive outcomes (Antosiewicz et al., 2022; Goulder et al., 2019). Labour market responses refer to the way in which employers – mainly in fossil fuel and other carbon-intensive industries – react to the economic hardship with regard to their workforce. Interpreted more broadly, this also includes the potential and speed for the substitution by *green* jobs. In general, this channel can take two different forms: wage and employment effects. Both can influence distributional outcomes. However, changes in wage levels or trajectories tend to have smaller effects and, if the workers in the affected industries are above-average earners, the effect is generally progressive. On the other hand, if carbon pricing leads to net job losses and

lastingly increased unemployment, the outcomes can be expected to be regressive and relatively stronger. I will therefore focus on the risk of lay-offs and a persistent increase in unemployment. Behavioural responses form a fourth channel potentially influencing distributional outcomes. This describes how individuals adjust their consumption behaviour in reaction to the carbon price. As high-income households tend to be less sensitive to price increases, behavioural effects usually mitigate regressive outcomes. However, as this mechanism is not pertinent to any fairness or equity assessment, behavioural responses will not be considered. In this thesis, I will examine direct and indirect price effects as well as labour market responses – particularly in the steel and aluminium industries – that could follow from the introduction of the EU CBAM.

3.4.2 BCA and Carbon Pricing

The reason why distributional implications from carbon pricing apply to BCA policies lies in the strong interrelation of the two concepts. Carbon prices are generally implemented in form of a tax or an emissions trading system. The studied policy instrument of BCA constitutes neither of these. However, as BCA aims to expand domestic carbon prices to also cover imports, the effect and goal of the policy is a more comprehensive carbon price.

The mere fact that the two concepts are inextricably linked is insufficient for estimating where and through which channels regressive outcomes may occur. This requires more analysis and justification. I assume that potentially regressive effects could arise from two main mechanisms: immediate and knock-on effects. The immediate effects result from the BCA raising a price on the embodied carbon in the targeted imported goods. In the case examined in this thesis, this covers steel and aluminium products exported from South Africa to the EU. Direct price effects are not expected as there are no sizable electricity exports and fossil fuels are not covered by the policy proposal. While there is a potential for indirect price effects, this applies mainly to EU individuals and is therefore not further considered in my analysis. Theoretically, BCA can increase global price levels for emission-intensive goods and thereby also impact consumers in exporting countries via indirect price effects. However, this is a universal consideration and not specific to South Africa or other countries directly affected by the CBAM. With neither direct nor indirect price effects being specifically relevant to South African households, this leaves the potential for labour response effects. A loss in competitiveness in the emission-intensive steel and aluminium sectors can adversely affect the employment situation in these industries. Intuitively, many surrounding variables are moderating the relationship between a carbon price on exports and job losses. Defining and examining these factors will be a central part of the intervention theory and analysis built and conducted throughout this thesis.

The knock-on effects can be summarised as the distributional impacts from the introduction or increase of a domestic carbon price that was (in part) motivated by the BCA. This reaction by exporting countries would not be unanticipated as the policy implicitly encourages it (see chapter 2.3). This assessment appears particularly valid for the proposed policy design of the CBAM. As carbon prices that were already paid in the country of production can be deducted and the revenues are not re-channelled to the exporting countries, this creates a strong incentive to apply (higher) carbon prices domestically to retain (more of) the revenues in the country. In the South African context, the reaction can be clustered into three general scenarios (see Figure 3-4): no carbon tax increase, an increase for aluminium and steel sectors, and a universal increase. Each scenario has potential implications for inequality in South Africa. However, the exact response determines both the scale of potentially regressive effects and, importantly, the channel through which these effects may occur. If there is no reaction and the only price increase results from the CBAM directly (i.e., targeted exports to the EU) the only significant route is via labour market responses as outlined in the previous paragraph. A carbon price increase for only the targeted sectors (i.e., aluminium and steel) would additionally introduce the risk of indirect price effects. The most comprehensive approach of increasing the general levels of the carbon tax on

all goods and services could lead to impacts through all three determined channels. As part of my research, I will assess the likelihood of each scenario by interviewing South African policymakers.

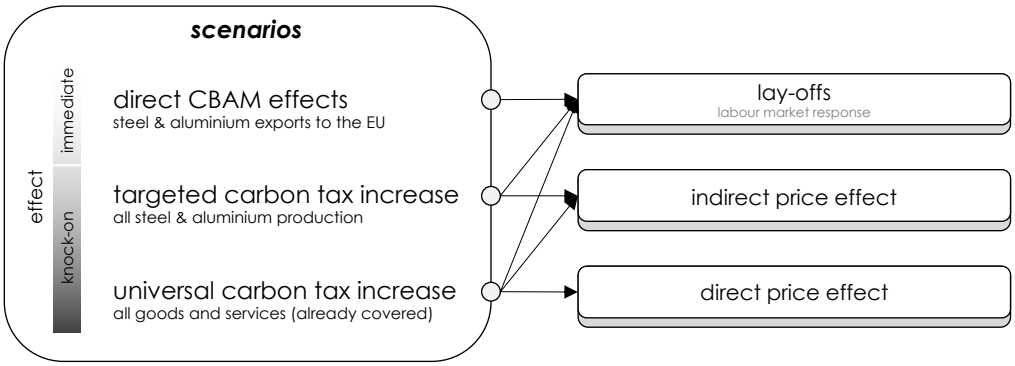


Figure 3-4: Different carbon price scenarios and how they relate to the distributive channels

An important caveat with this assessment lies in the difficulty in attributing changes in domestic carbon prices to the BCA policy. There are many reasons to implement and ramp up explicit[6] carbon pricing schemes. While the exact contribution is likely not quantifiable, estimating if and how strong BCA influences domestic carbon prices is worthwhile given the associated risks for distributional equity.

3.4.3 Determinants of Distributional Outcomes

Inequality effects of carbon pricing schemes are both country-specific and dependent on policy design (Chepeliev et al., 2021; Dorband et al., 2019). I will summarise the respective discourse to give insights into the context-sensitivity for the later analysis. Differences across many socioeconomic dimensions are important to consider when estimating distributional outcomes of a carbon price. In this section, I will outline the most important variables. Even more context-specific historic and cultural factors in South Africa will be discussed in chapter 5. As is highlighted in the introduction of the channels above, consumption patterns play an essential role in distributional outcomes. On a more granular level, Farrell (2017) provides a meticulous decomposition of factors. In addition to car ownership and space heating technologies, he identifies location, occupation, education levels, and household composition to be important determinants. Particularly regional differences, mainly between urban and rural households, are emphasised by researchers in the field (e.g., Okonkwo, 2021; Yusuf & Resosudarmo, 2015). However, given the complexity and interrelatedness of societal characteristics, it remains difficult to define straightforward and generalisable relationships.

The details of how a carbon pricing scheme is introduced also heavily influence potential inequality effects (Bureau, 2011; Stoerk et al., 2019). The most important element, as it emerges from the literature, is the earmarking or targeted re-channelling of the revenues generated through the scheme (Dorband et al., 2017; Gonzalez, 2012). This can comprise targeted subsidies for food or transport, a climate dividend (equal-per-capita transfers) or, particularly relevant for BCA, international redistribution from high- to lower-income countries (Soergel et al., 2021). However, revenue recycling needs to be carefully implemented to be effective from a (re-)distributional perspective (Farrell, 2017). In line with the previous paragraph, it is important to account for socioeconomic differences in each society. Other aspects of the policy

[6] Explicit carbon prices differ from implicit ones in that the GHG emissions are the central determinant of the tax or fee. Implicit carbon prices, e.g., energy or fuel taxes, do not qualify for deduction under the proposed CBAM.

design influencing distributional outcomes are the coverage (i.e., which sectors and emissions are included) as well as price levels and trajectories (Boyce, 2018).

3.4.4 South African Context

After having established that distributional outcomes occur through various channels and depend on multiple socioeconomic variables, I briefly summarise the literature on what is known about carbon pricing in South Africa and how it relates to inequalities. Several studies model the effects of implementing a tax on GHG emissions in the South African context, either separately or in comparison to other countries. Comparative investigations show that South Africa is among the countries in which poorer households are most severely affected (Dorband et al., 2019; Soergel et al., 2021). This is corroborated by other context-specific analyses, which consistently find regressive impacts (Devarajan et al., 2011; Merven et al., 2014; Okonkwo, 2021). Some models indicate differentiated impacts across racial and regional groups and highlight the importance of targeted revenue recycling (Alton et al., 2014; van Heerden et al., 2006). While there is variation in the findings and employment effects are often not studied in detail, direct price effects seem to constitute the most significant distributive channel (Devarajan et al., 2011; Dorband et al., 2019; Okonkwo, 2021).

I further expand on these findings in the results section (see chapter 5.4.2) to complement the analysis. Yet, overall, South Africa appears particularly vulnerable to regressive outcomes from carbon pricing. This is both relevant for assessing the potential impacts of the CBAM in the country itself and for contextualising these findings.

3.5 Conceptual Framework

The previously outlined concepts are combined into a framework that will guide and structure the analysis. While the results from the first research question contribute to the investigation of impacts, the framework is mainly utilised for RQs 2 and 3 to examine and contextualise likely effects.

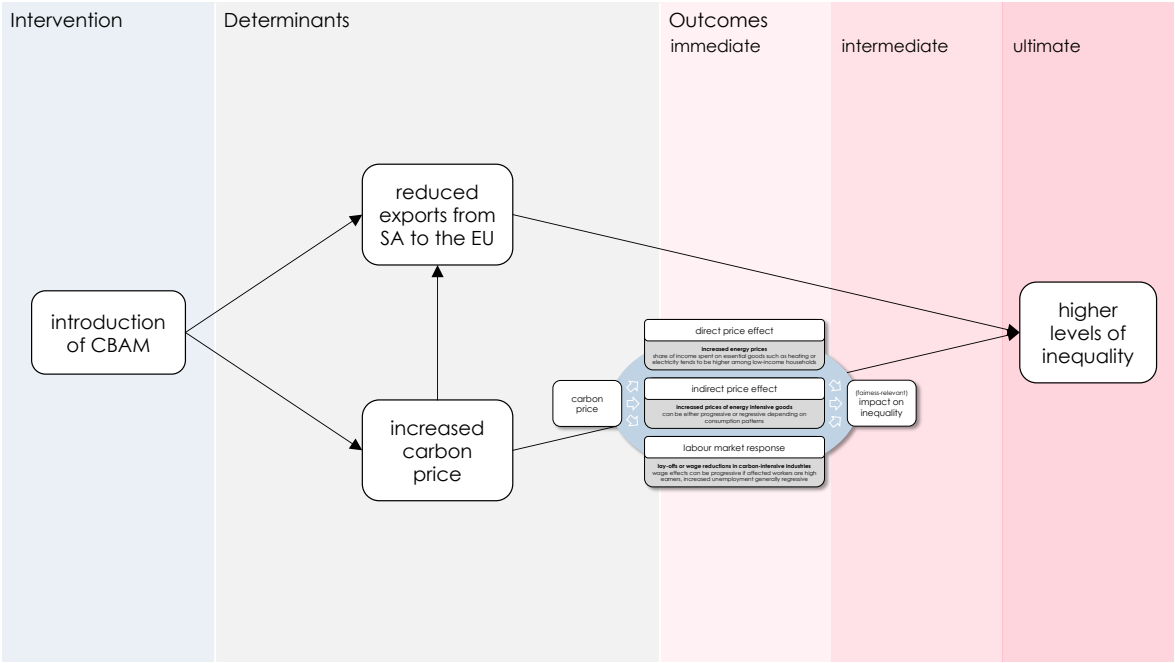


Figure 3-5: Conceptual framework integrating the distributive channels of carbon pricing into the intervention theory

I construct an intervention theory to study two main routes to impact, which arose from the literature review. Combining the gained insights into the policy instrument and how it relates to distributional impacts, the identified paths to exacerbated inequalities are 1) through direct effects from decreased exports in the targeted sectors, and 2) indirectly through increased carbon prices, mainly by South Africa raising the domestic carbon tax in response to the CBAM. These two routes are derived from the outlined definition and specifics of inequality, the policy mechanisms, and the literature on carbon price regressivity.

The intervention theory, which illustrates how the CBAM can lead to higher inequalities in South Africa, is the centrepiece of the analytical framework. It simultaneously functions as input and output of my research. The simplified version, depicted in Figure 3-5, derived from the literature constitutes the scaffolding of the approach and helped create the initial version of the interview guide.

4 Research Design, Materials and Methods

This section explains how I intend to find answers to the research questions and achieve this study's aim. For this, I outline the data collection and analysis methods applied for each RQ and illustrate their function in the broader research design. This chapter further clarifies which data was gathered and used to generate insights.

4.1 Research Design

I study effects on something that is, in theory, ultimately measurable: different forms of inequality. However, since the policy under examination has not yet taken effect, all quantifications would consist of projections. Furthermore, the assumptions underlying any calculation of changes in inequality would be vast and highly uncertain. At this point, exploring potential relationships between circumstances in exporting countries and aspects of the policy design promises more valuable insights than specific quantifications. How exactly these different variables interrelate and result in measurable effects could be subject to future research. Hence, my research design is mainly qualitative with some complementary quantitative assessments for validation and providing adequate background information.

Table 4-1: Research questions, their purpose, and associated methods

RQs		Method	Purpose & Relation to other RQs
1	How is the risk of increased inequalities in exporting countries represented in the EU CBAM policy process?	Explorative document analysis (consultation process, EU policy documents)	Motivate the research (if absent) Insights about potential routes (RQ2.1) and policy design (RQ3.2)
2	What are the likely effects of the EU CBAM on inequalities in South Africa?	See below (RQs 2.1 and 2.2)	Core of the research objective
2.1	What are the **mechanisms** through which these effects can occur?	Construct intervention theory based on: literature review; initial interviews (mainly researchers)	Inform interview guide for answering RQ2.2; Investigate relevant circumstances (RQs 3.1 and 3.2)
2.2	**How likely** are these to occur?	Interviews with local stakeholders; empirical background data	Reasons given will inform RQs 3.1 and 3.2
3	What context-specific factors determine the likelihood of the CBAM affecting inequalities in South Africa?	See below (RQs 3.1 and 3.2)	Inform policymakers (about how to avoid adverse effects); illustrate (limits to) generalisability
3.1	What **socioeconomic conditions** in South Africa are relevant?	Extract from the intervention theory's relevant moderators and mechanisms	Show how outcomes in other regions may differ
3.2	Which aspects of the (CBAM's) **policy design** are relevant?	Extract from the intervention theory's relevant moderators and mechanisms	Demonstrate how the CBAM (or other BCA policies) can mitigate adverse impacts
Objective	**Increase our knowledge of equity impacts associated with the design and implementation of the EU CBAM as applied to South Africa**		

My approach to answering the research questions is best classified as a case study. I tried to gain insights by examining the particular circumstances of the EU CBAM and South Africa as an affected country. While the knowledge generated with this approach is necessarily context-dependent, this does not imply that the findings are less valuable or irrelevant (Flyvbjerg, 2006). As South Africa can be considered an extreme case it is more likely to provide useful insights. The design is to a large extent emergent (Creswell & Creswell, 2018). The exploratory nature of the study entails that initial learnings led to slight adaptations of the research plan (mainly collecting additional information on the industries due to a shortage of first-hand data).

The primarily qualitative approach allowed me to explore a wide range of relevant aspects. However, it was more challenging to keep the procedure structured and focused. To deal with this, awareness of the research aim was important but not sufficient. To structure the analysis, I utilised a framework of theory-based policy evaluation. This guided the interview process by pointing out relevant elements in the policy design and intervention theory on which equity impacts depend. Mapping out the intervention theory with a focus on inequality relevant side-

effects helped identify and detail the potential routes to impact (RQ2.1). Subsequently, I used the stakeholder interviews to determine the likelihood of these impacts being realised (RQ2.2). These conversations paired with the statistical background analysis also provided insights into the specific South African context and how that relates to potential impacts on inequalities (RQ3.1). By comprehensively tracing the intervention theory and estimating the constituent links and moderators I also generated a deeper understanding of relevant elements in the policy design (RQ3.2).

Additionally, answers to the first research questions informed the analysis of the second and third. Capturing stakeholder views from the political process contributed to examining the routes to impact (RQ2.1) and relevant policy design decisions (RQ3.2). If the analysis finds that the distributional aspects in exporting countries are largely absent from the EU impact assessment and the policy process in general, it contributes to the relevance of this research.

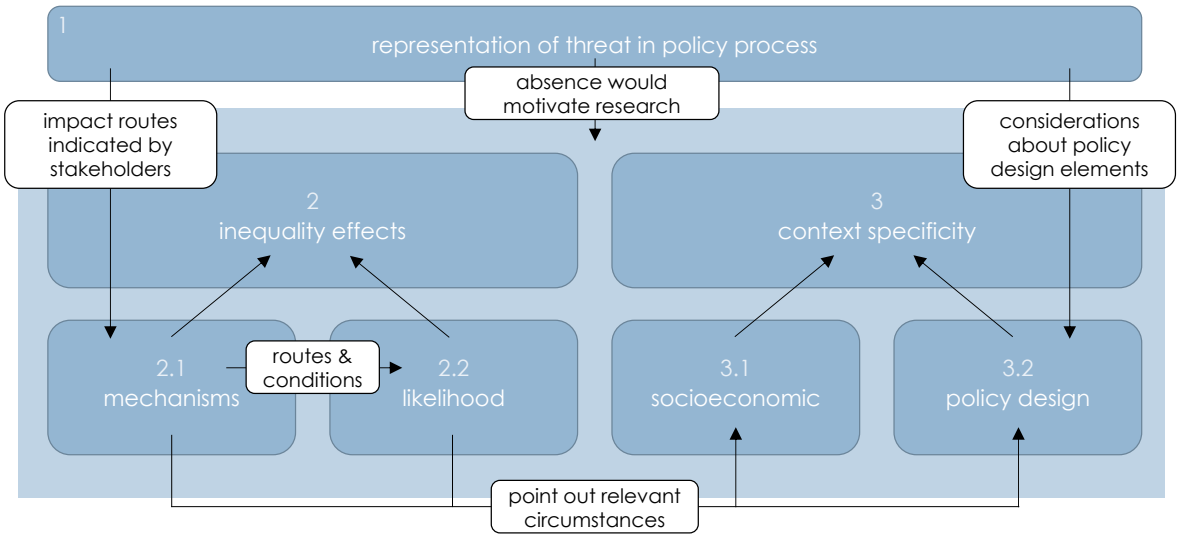


Figure 4-1: Research design and how the RQs interrelate

4.2 Methods Used to Collect Data

The main source of data consisted of semi-structured interviews with different experts. To answer RQ1, I collected and relied on documents that are publicly available. However, for all other questions, interviews were essential. I was in South Africa during part of the interview period but also conducted some remotely. While methodological consistency is generally desirable, using both in-person and remote interviews was justifiable as there is no strong comparative component involved. To secure interviews, I utilised my existing network in South Africa in both academia and government. I used a snowballing approach to expand the range of potential participants and augmented this with directly reaching out to different organisations.

To complement the qualitative analysis, I gathered data about different dimensions of inequality (income with a focus on racial, gender, and regional differences) and aimed to contrast this with the composition of the workforce in the affected industries. For this, I utilised publicly available statistics and combined relevant interview requests (for industry or company representatives) with asking for workforce data. For other empirical information to verify and analyse the different links throughout the intervention theory, I mainly utilised official trade data and quantifications conducted by other researchers.

For my approach, there were two main challenges associated with the data collection. First, both policymakers and business representatives were likely to have a general opinion on the policy

under inspection. This could influence their assessment of the particular effects I want to examine. While subjectivity is inherent to the method and not problematic per se, I had to formulate questions carefully to gather specific information and not just a representation of preconceived views about the CBAM. Second, the availability of data was limited. This refers to difficulties with securing suitable interviewees as well as the challenge of obtaining granular and recent statistics.

4.3 Materials Collected

The collected data is differentiated by the research questions it is intended to help answer. For RQ1, I gathered documents representing the EU CBAM policy process. To answer RQs 2 and 3, I utilised different sources to construct the intervention theory and evaluate its links. This comprises mainly stakeholder interviews but is complemented by different quantitative elements.

I aimed to capture insights from the policymaking process on the EU side to gauge whether and how inequalities in exporting countries were considered. This is particularly relevant for RQ1 but offered some insights for the subsequent analysis. The policy proposal and the impact assessment provide context for the Commission's legislative approach. To broaden the scope of the policy process, the documents submitted by stakeholders during consultation and feedback periods pose valuable sources of information. This data was easily accessible as the submissions are publicly available on the European Commission's website (European Commission, 2021a). I examined various documents and traced the discussion of potential distributional effects throughout the process. Table 4-2 shows the inspected documents in chronological order and indicates their content and length. Given my exploratory approach to this document analysis, I decided to define the scope comprehensively. Including additional documents did not substantially increase the effort but reduced the risk of unduly omitting important mentions of inequality. Overall, this analysis covered 3,132 pages; the majority thereof stems from stakeholder submissions, while EU institutions contributed 476. This distinction based on the authorship of the document was central to the examination.

Table 4-2: Examined documents from EU CBAM policy process

	Time		Document by	Content	Pages
2020	04 March	1	Inception Impact Assessment European Commission	Outline of the Commission's plan defining the context, problem, objectives and policy options	4
	04 March - 01 April	2	Feedback Period: Submitted Documents Stakeholders	224 respondents, 135 submitted elaborating documents, thereof **119** in English	801
	22 July	3	Public Consultation: Survey European Commission	123 questions mostly presenting pre-defined statements and asking about levels of agreement or importance	-
	22 July - 28 October	4	Public Consultation: Submitted Documents Stakeholders	615 respondents (answers to the survey), 215 submitted elaborating documents, thereof **191** in English	1,024
2021	05 January	5	Public Consultation: Summary Report European Commission	Brief presentation of survey responses	7
	23 April	6	Regulatory Scrutiny Board Opinion European Commission	Shortcomings of a draft impact assessment report	7
	14 July	7	Regulation Proposal (plus Annexes) European Commission	First legislative proposal detailing the policy's components and implementation	72
	14 July	8	Impact Assessment Report European Commission	Detailed account of problem definition, objectives, policy options and potential (environmental, economic, social) impacts	207
	15 July - 18 November	9	Feedback Period: Submitted Documents Stakeholders	194 respondents, 149 submitted elaborating documents, thereof **119** in English	831
	21 December	10	Draft Report European Parliament - Committee on the Environment, Public Health and Food Safety	Amendments of the Regulation Proposal and their justification	85
2022	15 March	11	Draft Regulation Council of the EU	Adapted draft of the Regulation Proposal	94
					3,132

Reflecting the exploratory and emergent approach, the range of interviewees was fairly wide. I gathered opinions from local industry (aluminium and steel), labour union and government representatives as well as academics who are more familiar with the specific context. To complement these inputs with a civil society perspective, I also conducted an interview with an NGO. All interviewees are summarised in Table 4-3. In addition, as one of the first steps of my research, I talked to several researchers from South Africa about my project to gauge its relevance and develop initial ideas for my approach. However, as I did neither transcribe nor systematically analyse these conversations, they were not formally included in my thesis.

Table 4-3: List of interviewees

Category	Respondent	Interviewee
Researchers	1	University of Sussex / UNIDO South Africa | Associate Research Fellow / Energy and Low Carbon Coordinator
	2	University of Cape Town | Professor in Economics, Director of the Development Policy Research Unit
Civil Society / NGO	3	Oxfam South Africa | Board of Directors
Policymakers	4	Policymaker
	5	Department of Trade, Industry and Competition | Industrial Development Advisor
Employee Representation	6	Congress of South African Trade Unions (COSATU) | Head of Policy Unit
	7	COSATU | Parliamentary Coordinator
Industry	8	ArcelorMittal South Africa | Group Manager: Environment

An interview guide (see Appendix I) helped structure and focus the conversation. To ensure comparability and allow for a synthesis (instead of a mere collection) of stakeholder views the general structure is identical across different interviews. However, to allow for flexibility, natural flow, and topics to emerge, it does not predetermine all questions in detail but rather broad themes and potential follow-up cues. There will also be slight variations depending on the kind of stakeholder. This consists of additional questions that are mainly relevant for policymakers on the one hand and industry and employee representatives on the other hand.

To validate, complement, and contextualise the insights obtained from interviews, I gathered statistical background data from different sources. This comprised information on trade flows, carbon intensities, and socioeconomic circumstances of South Africa and the targeted industries.

4.4 Methods Used to Process Information

For the data analysis, I organised and coded the information to gain an overview and derive likely relevant circumstances influencing inequalities. After preparing the data by transcribing the interviews and gathering complementary information, I developed a general understanding of the data I generated. Subsequently, I applied a hybrid approach and incorporate both predetermined and emergent codes into my coding procedure. To support this approach, I utilised NVivo, a computer-assisted qualitative data analysis software. The tool helped structure the procedure and aided the rigour of my analysis. However, it was important to be mindful of the limitations of such an approach (and the underlying technology) and recognise the researcher as the main generator of insights (Heracleous & Fernandes, 2019).

Overall, the analysis of the interviews was marked by an iterative approach. The initial interviews with the researchers were mainly but not exclusively used to complement the findings from developing the conceptual framework and further construct the intervention theory and identify relevant mechanisms. In all subsequent interviews, I incorporated the new findings (or codes)

in the interview guide. New codes (i.e., relevant mechanisms or contextual aspects) were continuously integrated into the analytical framework. Thematic analysis as a coding approach and the flexibility inherent to the method (Kiger & Varpio, 2020) were strongly conducive to my analysis of the generated data. I utilised a selective pattern-based approach, in which I coded all data but only kept the themes that were ultimately relevant to my research questions (Clarke & Braun, 2017).

In contrast to the interviews, the document analysis to answer RQ1 does not aim for comprehensive coding of the material. Instead, a predatory approach was applied. I utilised a wide range of inequality- and fairness-related search terms to determine if and how distributional impacts are considered. The instances identified by this method were coded and the ones most central to *inequality* analysed more closely. I differentiated the approach for documents from EU institutions and stakeholders, as the official communication by the policymaker is more essential to motivating the rest of the research and therefore required a more thorough examination.

Finally, I complemented the analysis by including some quantitative elements. I drew upon different socioeconomic statistics relevant to inequalities in South Africa and its industries. This served to identify patterns and then validate and contextualise the qualitative findings. The main goal of this empirical data analysis, e.g., the comparison of carbon intensities between the South African and other steel and aluminium industries, was to augment the interview results and provide indicative information about quantifiable links in the intervention theory.

5 Results and Analysis

In this section, I present and analyse the results in an integrated manner. First, I examine the results from the document analysis covering the CBAM policy process to answer RQ1. Then, I introduce the intervention theory, which constitutes the main output of this thesis and the centrepiece of the analysis of all subsequent research questions. Chapters 5.3 and 5.4 trace the mechanisms along the two potential routes to higher inequalities and thereby serve to answer RQ2 and its two sub-questions by discussing both the mechanisms and their likelihood. Drawing heavily upon these findings, the final chapter aims to further interpret and contextualise the results and thereby answer RQ3.

5.1 Representation of Distributional Concerns in the Policy Process

The potential impacts investigated in this thesis were not addressed in any of the examined EU policy documents. While some distributional implications are considered, this is restricted to inequality effects within the EU and disregards impacts in exporting countries. Some stakeholder submissions, however, do problematise these consequences. Overall, the discussion of the social dimension and normative facets of the policy proposal is much more pronounced in stakeholder documents, even though the majority of the submitted feedback stems from business representatives and only a small share from civil society actors[7].

Table 5-1: References in the examined documents and applied search terms

Themes	Search Terms	References (thereof in EU documents)
Equality	**equality, inequality**	**76 (2 / 3%)**
Equal	equal, unequal, equally, unequally	323 (28 / 9%)
Distribution	distribution, distributional, distributive	171 (48 / 28%)
Regressivity	regressivity, progressivity, regressive, progressive[1], regressively, progressively[1]	15 (7 / 47%)
Equity	equity, inequity, equitable, inequitable, equitably, inequitably	46 (- / 0%)
Fairness	fairness, unfairness, fair, unfair, fairly[1], unfairly	509 (10 / 2%)
Justice	justice[1], injustice, just[1], unjust, justly, unjustly	152 (6 / 4%)
Poverty	poverty, poor	27 (4 / 15%)
Social	social, socially	367 (37 / 10%)
Indicators	Gini, Atkinson, Theil, Palma	-
	Total	1,691 (142 / 8%)
	Page Ratio EU / Total	15% (476 / 3,132)

[1] manual check to exclude use with different meaning (e.g., *fairly* as in *relatively*)

Table 5-1 provides an overview of the search terms used to parse the collected documents. The number of results and the relative share of references in EU documents is only to indicate the general distribution of instances in which these words were used. Therefore, this quantification does not by itself allow for elaborate interpretations. However, it does support the abovementioned notion that normative aspects are underrepresented in the EU documents relative to the stakeholder concerns. In all EU documents, there are only 16 references to equity,

[7] Taking into account both feedback periods and the public consultation, the EU received feedback from 1,034 stakeholders. 658 (64%) of that are classified as companies or business associations, 202 (20%) as citizens, 83 (8%) as NGOs, 22 (2%) as research institutions, 13 (1.3%) as unions, and 8 (0.8%) as environmental organisations (European Commission, 2021a).

fairness, or justice (0, 10, and 6, respectively) compared to more than 700 across all materials. This is far less than the 15% suggested by the overall page ratio between inputs from EU institutions and all examined documents. Mentions of poverty or social implications are also relatively few but closer to being proportional (10 and 15%, respectively).

The instances of more inequality-specific terms provide a more nuanced picture. While inequality and the related adjectives are mentioned relatively rarely by EU institutions (3 and 9%, respectively), references to distributional and pro- or regressive impacts are comparatively frequent (28 and 47%, respectively). To better understand their context, I examined these mentions more closely.

The principal and nearly exclusive source of distributional concerns among the EU documents is the full impact assessment report. Both inequality references and most mentions of (un-)equal (17 of 28), distributional (45 of 48), and regressive (7 of 7) impacts are from this document. All these references are part of an elaborate analysis that examines and even quantifies distributional impacts of the proposed policy, both within and across countries. However, all calculations and other considerations are limited to EU Member States. Therefore, it does not address the subject of this thesis, namely effects in exporting countries. The only mention of "distributional impact […] across countries, especially developing economies" (European Commission, 2021b, p. 11), is part of a summary of the stakeholder feedback, which is also repeated in the regulation proposal but not further discussed.

A few specific issues, which can help embed the research in a broader discourse, emerged from the exploration of these pre-determined themes in the stakeholder submissions. Two central aspects concern the recycling of revenues and the exemption of particularly vulnerable countries. The former was also coupled with the concern about regressive distributional effects in some instances. As many contributions came from industry representatives, creating a level playing field for international competition and trade law compatibility were frequently invoked concepts. Yet, these facets will not be further examined. Overall, the presence of distributional equity concerns (in exporting countries) in stakeholder submissions coupled with their absence in EU policy documents adds to the validity of exploring these impacts.

5.2 Construction of the Intervention Theory

The necessary first step to estimating the likely impacts of the policy is to build out the intervention theory and define the elements determining the outcome. This entails specifying the initially defined routes to impact via export reductions on the one hand and carbon price increases on the other hand. The framework is detailed by including immediate and intermediate outcomes as well as defining moderators and conditions, which then can be meaningfully investigated. With this approach, it is possible to operationalise the examination of the links and their probability. Where moderators and conditions apply is represented by the numbers (termed *nodes*) in Figure 5-1. For example, the aspects summarised under node 1 can be understood as the answer to the following question: "What has to be true, so that the introduction of the CBAM leads to reduced exports from South Africa to the EU, and what influences the degree or direction of that relationship?" These numbered points, or nodes, will guide and structure the further analysis.

The conditions and moderators, which could also be interpreted as the independent variables influencing the link between two chain elements, were derived from multiple sources. While some aspects arose from studying the relevant literature on BCA and carbon pricing, many others were pointed out by stakeholders. Both the submissions from the policy process and the (initial) expert interviews helped compile the many factors regulating the potential distributional outcome. Other qualifying components follow from logical inference. For example, it must be

the case that South Africa exports at least some goods in the defined categories to the EU for the CBAM to be able to adversely affect this output. Elements like this are subject to empirical inquiry rather than estimation by stakeholders. This is another important distinction for approaching each component. I clarify the respective source and process of verification alongside its explanation.

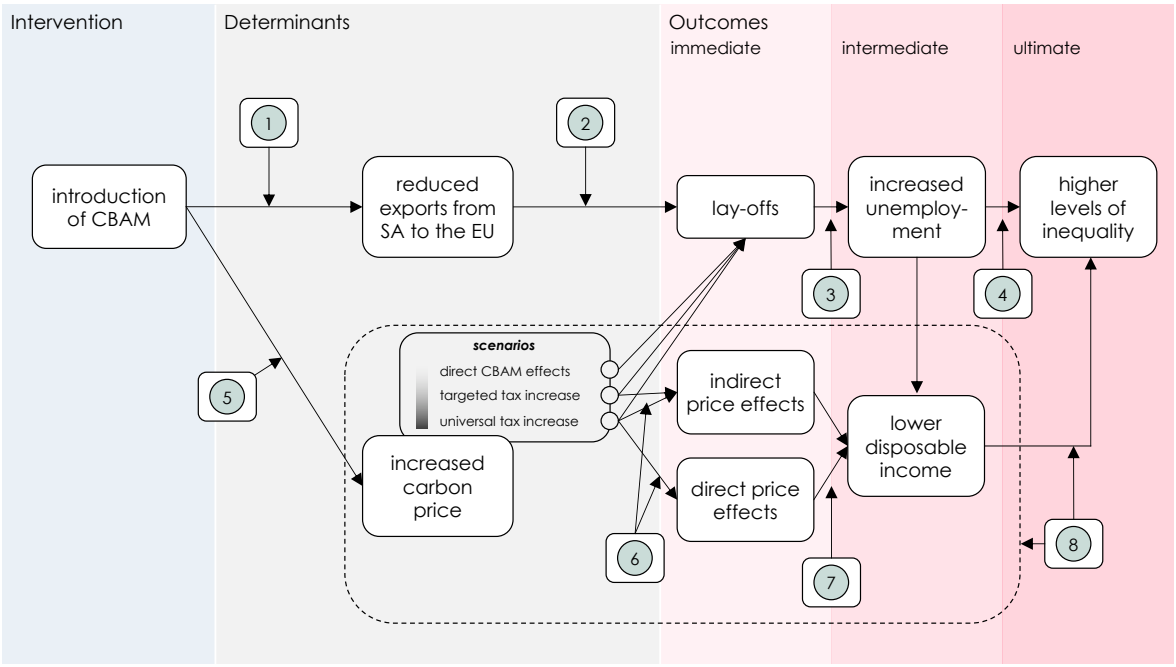


Figure 5-1: Intervention theory

Even though presented as a sequential process, developing and testing the intervention theory was an iterative and multi-layered procedure. As the different elements simultaneously served as both the coding framework and guideline for the interviews, it was updated continuously.

Explicating the involved actors and their relationships on a general level aids the apprehension of the underlying mechanisms. As the policy implementation is not yet finalised, constructing an elaborate action model and focusing on the relationships is less likely to produce valuable insights. However, a broad understanding of which organisations are targeted and interact along the identified routes to impact is crucial to identify and meaningfully assess the links of the intervention theory. An overview is summarised in Figure 5-2.

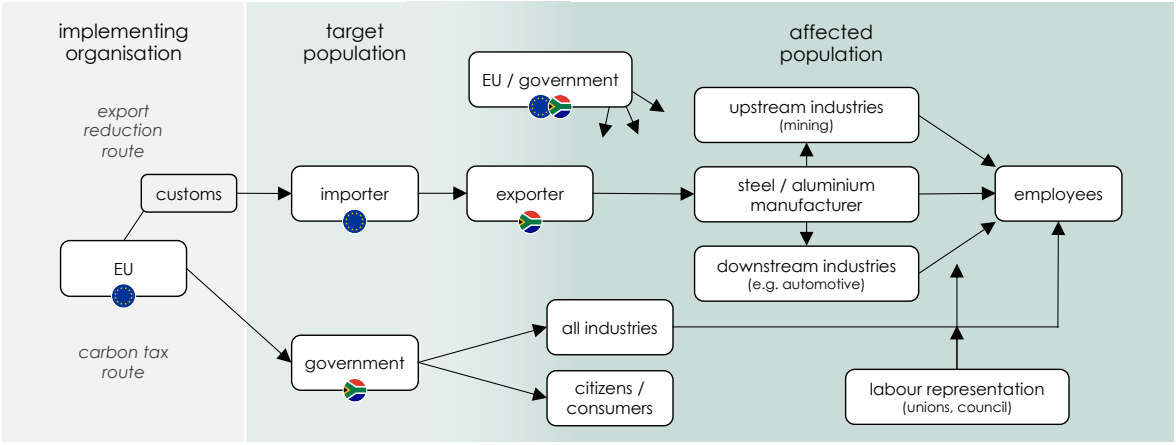


Figure 5-2: Actor network relevant to the likelihood of distributional impacts of the CBAM in South Africa

The actor who is responsible for the design of the CBAM is the European Union, whereas the customs authorities perform the actual implementation. For the impact route via export reductions, the policy's immediate target population consists of EU companies that import the specified goods, as they need to purchase the certificates for the embodied GHG emissions (EC, 2021). The first organisations relevant to impacts in South Africa are the exporters and, strongly related, the manufacturers of these goods. The price increases following from the CBAM are likely borne here, and emission reductions can only occur within the local industry. At this point, both the EU and the South African government can facilitate emission reductions and support investments to maintain competitiveness and alleviate declines in output and earnings. Ultimately, this affects employees who could lose their jobs. That comprises workers in the targeted sectors as well as, indirectly, in up- or downstream industries.

In a different way, the EU policy targets the South African government by introducing incentives to install high explicit carbon prices domestically (carbon tax route). If this leads to an increase in the carbon tax, it directly affects all citizens via direct and indirect price increases. At the same time, all other parts of the economy could be adversely affected, potentially leading to further lay-offs. Finally, labour representatives play an important role in governing the link between reduced industry output and employment effects. This actor framework serves as an important backdrop for the ensuing analysis.

5.3 Higher Inequalities Through Export Reduction

The first of the two identified routes to impact revolves around potential reductions of South African exports resulting from the EU CBAM. If exports decrease, this could lead to lay-offs, and then, in turn, to higher unemployment levels and, finally, exacerbated inequality. This section investigates the individual links and moderating factors to examine the validity alongside this cause-and-effect chain.

5.3.1 From the CBAM to Lay-offs

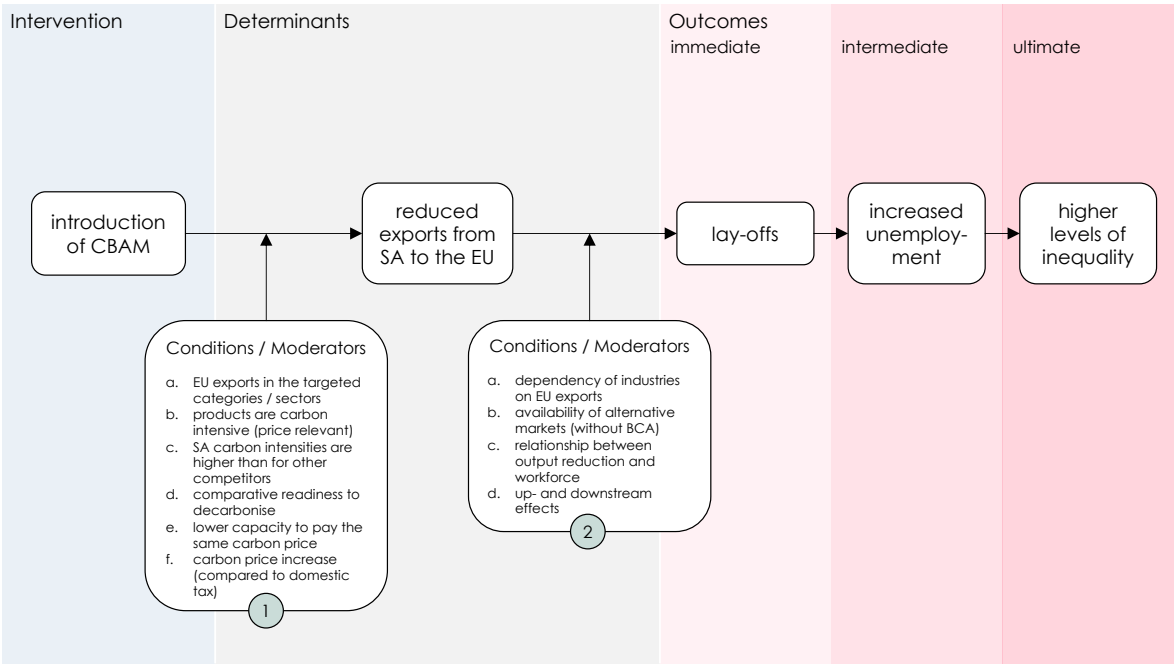


Figure 5-3: Moderators and conditions governing the links between the policy implementation and lay-offs

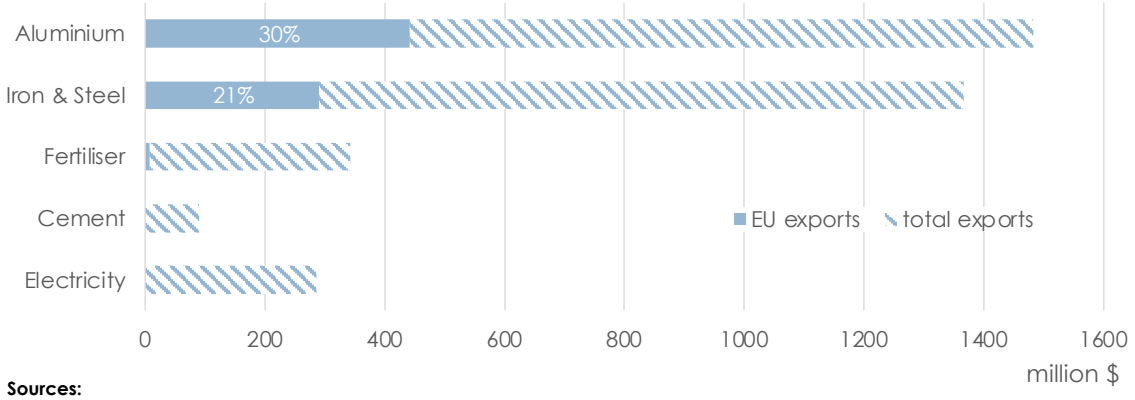
This chapter examines how the CBAM could lead to export reductions and then in turn to lay-offs. As reasoned earlier, wage effects will not be considered in detail due to their limited and

ambiguous effects on inequality levels. Studying these links requires the integration of empirical information and the reasoning of experts about the South African steel and aluminium sectors.

EU exports in the targeted sectors (1a)

It must logically be the case that there are at least some present (or planned future) exports to the EU in the defined categories. Otherwise, no impacts could arise from the route of export reductions. The CBAM as proposed by the European Commission covers imported goods from five different industries: cement, electricity, fertilisers, iron and steel, and aluminium (EC, 2021). While a scope expansion is explicitly discussed as an option in the proposal, this thesis assumes the implementation for the initially determined sectors. To assess potential impacts on a given country it is crucial to examine its current economic and export profile with respect to these industrial outputs. In the case of South Africa, aluminium and steel are relevant to these considerations.

South Africa does not export electricity to the EU and cement exports (valued at a few hundred thousand US dollars) are negligible (Chatham House, n.d.). Fertilisers are similarly insignificant; in 2020 the exports in this category totalled less than $7 million. For reference, South Africa's GDP in the same year was $335 billion, 93 thereof from exported goods and services (World Bank Group, n.d.-a). Exports from the aluminium as well as iron and steel sector, however, are comparatively substantial (Chatham House, n.d.). Global aluminium exports were at $1.7 billion, $450 million of which went to the EU. Commodities traded as part of the category iron and steel are even higher in value, however, it is important to exclude iron ore from the considerations as it is not covered by the scope outlined in the proposal. The remaining actual iron and steel products account for $2.6 billion, $370 million thereof went to the EU. Overall, there are some exports from South Africa that would be subject to an EU carbon price, which validates the further examination of potential adverse effects.



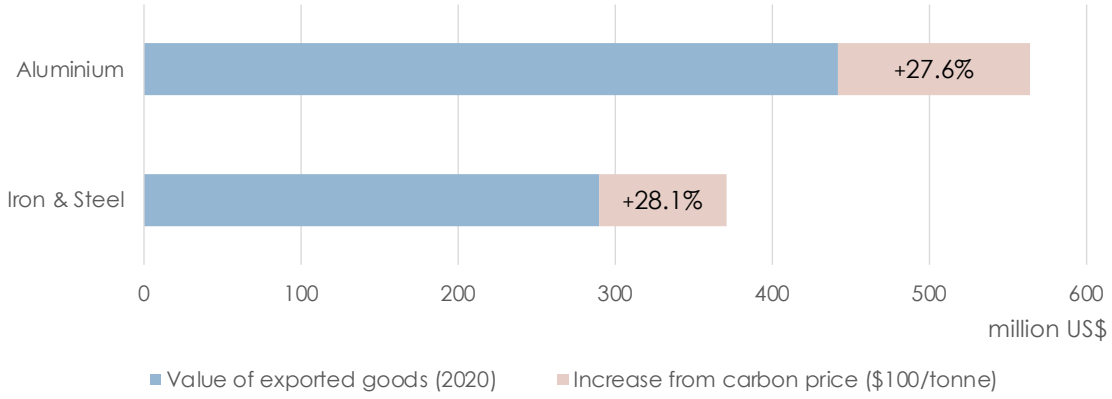
Sources:
Chatham House (n.d.)
Electricity: United Nations (n.d.)

Figure 5-4: South African exports of CBAM-relevant goods in 2020

Carbon-intensive products (1b)

A simple but important empirical question is whether a carbon price would have a considerable effect relative to the current prices of the targeted goods. Marginal changes are unlikely to cause any substantial ripple effects. Considering carbon price levels together with the monetary value and carbon content of traded goods leads to the conclusion that the CBAM effect would be significant.

Applying global average carbon intensities, the steel and aluminium trade flows from South Africa to the EU in 2020 account for around 2.03 million tonnes of CO_2-equivalents (Chatham House, n.d.) As outlined above, the value of the traded goods in that year was around $730 million. Assuming a price of $100 per tonne of GHG emissions (i.e., around the current EU ETS rates), this would amount to more than $200 million. For aluminium as well as iron and steel products, this would amount to an average increase of more than one quarter (27.6 and 28.1%, respectively). Illustrated in Figure 5-5, these numbers serve only to provide an approximate indication of the proportions. However, it is important to acknowledge the limitations of the underlying data[8]. Complementing these numbers, research suggests that internalising emission costs leads to substantial output reductions and price increases in these markets (Martin et al., 2014; Smale et al., 2006). Overall, the high carbon intensity relative to the product value indicates that applying a carbon price through the CBAM could have sizable effects.



Source:
Own calculations based on: Chatham House (n.d.)

Figure 5-5: Value of the South African exports to the EU and by how much a carbon price could increase it

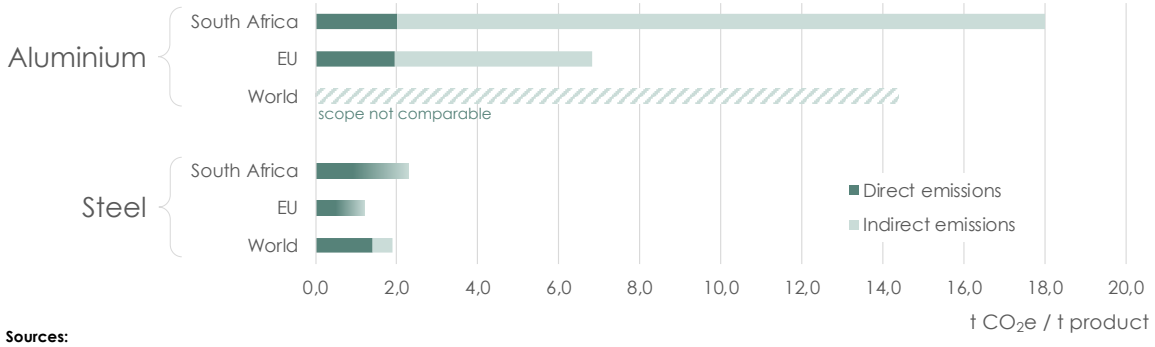
Relative carbon intensity (1c)

The price increase of aluminium and steel would be insignificant for South African industries if they were uniform across countries and companies. However, the embodied emissions vary substantially and higher than average carbon intensities result in a competitive disadvantage. As hinted at in the previous paragraph, emissions per tonne of steel and aluminium produced in South Africa tend to be disproportionately high.

While GHG emissions from both South African steel and aluminium products are greater than the EU and world average, there are important differences between the sectors. For iron and steel, the indirect emissions (scope 2) are less relevant and generally constitute around 25% (World Steel Association, n.d.). In contrast, the production of aluminium requires a lot of electricity, which can elevate the indirect share of emissions to up to 90%. This extreme case is South Africa, which was identified by two separate studies to have the highest emissions intensity among all examined countries (Eurometaux, 2021; Paraskevas et al., 2016). However, considering only direct emissions, the difference to the EU average, for example, is relatively small. As the inclusion of scope 2 emissions is still subject to consideration under the CBAM

[8] First, it includes scope 2 emissions, of which the inclusion in the CBAM is still debated and leads especially for aluminium to a substantial overestimate. Second, partially mitigating the first shortcoming, world average emissions underestimate the actual values in embodied in South African products, as will be shown in the next section. There is little variation for different iron and steel emission factors. Lower and upper bound estimates for aluminium, however, show additional costs between 9.2 and 82.6% of the product value.

(EC, 2021, p. 23), this is a crucial policy design decision for the South African aluminium exports. Overall, based on the studied proposal, steel exports are likely to have higher-than-average emissions, whereas this is uncertain for aluminium products.



Sources:
Steel - World (World Steel Association, 2020; IEA, 2020); EU & South Africa (Climate Action Tracker, 2016)
Aluminium - World (Saevarsdottir et al., 2020); EU & South Africa (Eurometaux, 2021)

Figure 5-6: Comparative emission intensity for aluminium and steel production

Comparative readiness to decarbonise (1d)

To include future impacts both until and after the final implementation in 2026, it is important to estimate how well the South African industry is prepared to mitigate these emissions, relative to competitors abroad. For this, I will mainly rely on stakeholder insights.

Steel and aluminium are both deemed 'hard-to-abate' sectors as their decarbonisation requires substantial technological advances or at least rigorous and widespread implementation of advanced technologies (Rissman et al., 2020). Globally, both are considered *not on track* by the International Energy Agency (IEA, 2021a, 2021b). It is therefore important to go beyond establishing that the South African industries are not on track either and pay special attention to the contextual factors that aggravate this lack of preparedness. In general, all interviewed stakeholders agreed that the sectors are not ready and, on average, likely behind international competitors. However, the identified reasons diverge widely, and their soundness will be examined in this section.

Recurring themes highlighted by stakeholders were deficiencies in policy coordination, financial barriers, and a general lack of environmental ambition within the industries. A few interviewees pointed out circumstances which could accelerate a transition. Many deemed the policy environment to be not conducive to the decarbonisation of these sectors. Some focused on the lack of foresight: "We have an industrial policy that's based on fossil fuels, that's the biggest problem, it does not envisage the future without fossil fuels and coal production" (R6)[9] and "we leave things to the last second, then we panic when we're in trouble" (R7). Related to this, the harmonisation of different policies emerged as a central challenge ("the Department of Energy, the Environment Ministry, […] they're all moving in different directions" (R1)). Others cited mismanagement in the public utility company Eskom as a central barrier to decarbonising the electricity grid as a major input into production (R2). However, this is only relevant to CBAM considerations if indirect emissions will be included in the scope.

Another consideration, which also has bearing on the government's role, concerns the availability of finance to fund the transition to low-carbon technologies. As an industry

[9] Respondent 6 – A full list of interviewees and their respective numbers can be found in Table 4-3

representative phrased it, "the main barriers towards decarbonisation are currently the availability of renewables at the right price" (R8). A policymaker familiar with the industries sees South Africa at a disadvantage, given the high investment requirements, which "the EU is much better able to afford than a country like South Africa" (R5). This is partly a result of generally lower financial capabilities (illustrated by GDP per capita levels) and high-income countries failing to meet climate finance pledges (Timperley, 2021). Yet, the corporate structure of transnational ownership[10] is argued to have contributed to this disparity ("they are actively trying to develop greener steel […] drawing very substantially on public funding […] and in countries like South Africa, plants of the same company […] have all these adverse environmental effects" (R5)).

A third pillar consists of lacking determination to shift to environmentally favourable production processes. A labour representative expresses frustration at the inaction ("I think they are far from [being ready]" (R7)) and argues that it necessitated the implementation of the domestic carbon tax. Underinvestment by parent companies and a "corporate strategy not at all oriented towards driving decarbonisation in the South African economy" (R5) allegedly contributed to the unpreparedness. A steel industry representative, while acknowledging that "from a decarbonisation point of view […] we are not always comparing all that well with the European Union, for instance" (R8), states that the commitment to support other domestic industries (e.g., sourcing less suitable but local coking coals) may have contributed to environmental shortcomings.

On the other hand, some stakeholders point to relatively ambitious and mature plans to utilise hydrogen and refer to favourable geographic conditions for renewable energy production (R1, R8). Overall, however, the assessment of South Africa's comparative readiness to decarbonise steel and aluminium production is grim.

Lower capacity to pay the same carbon price (1e)

A company's profitability and financial health are important factors in considering its ability to cope with the additional cost induced by carbon prices and maintain current output levels. If South African industries are in a worse position to remain competitive, export reductions would be more likely. While concrete numbers were not attainable, stakeholder reasoning suggests that impacts are probable.

The central point articulated by multiple interviewees is that the sectors – the steel industry in particular – are struggling financially even without substantial carbon taxation. One provided reason revolves around the effects of a general economic downturn, with plummeting growth rates and declining GDP per capita levels (World Bank Group, n.d.-a) leading to a diminished demand base (R7). This is accompanied by a shortage of investment in the industry (R5). As a result, there have been job losses, reduced efficiency levels, and accumulating funding needs for cleaner technologies (R3, R4, R5). This aspect is echoed by a steel industry representative who points out the disparity created by (public) funding in Europe compared to South Africa, which will lead to a "profit erosion" (R8) through carbon pricing. Without specific data on either South African or international producers, the assessment, particularly for the aluminium sector, remains uncertain. Yet, overall, the industries appear relatively ill-prepared to stay competitive when faced with high carbon prices.

[10] The main steel and aluminium producers are owned by companies headquartered in high-income countries (ArcelorMittal: Luxembourg, Columbus Stainless (Acerinox): Spain, South 32: Australia).

Carbon price increase (1f)

An empirical question, which is central to the determination of impacts, is whether the CBAM will result in an increase in carbon prices for South African companies. Otherwise, no effect could be attributed to the EU policy. On the surface, the carbon prices in the EU and South Africa diverge substantially (as of May 2022, around $95 and $9 per tonne of emissions, under the EU ETS and South African carbon tax, respectively).

Seemingly simple, three issues complicate this assessment: time, allowances, and the market. First, the CBAM is set to take effect in 2026. In the meantime, many changes could be made, both to the South African and the EU carbon pricing regime. This comprises many uncertainties. Second, one of the uncertainties pertains to the phase-out of free allowances for EU companies. As the levy which is imposed on exports is determined by the effective carbon price paid by the EU industry, the ambiguity around the extent and speed of the phase-out of exemptions is essential to determining the relative price levels. Third, since the EU ETS does not define a price corridor let alone a clear trajectory, this encompasses further volatility.

Predominantly, the uncertainty about phasing out the free allowances in the EU obfuscates the assessment. While the system is based on a benchmarking approach to encourage abatement, the most efficient producers currently receive free allocations for all embodied emissions. The CBAM proposal outlines the ambition to replace the allowances gradually, without providing details (EC, 2021, p. 17). Overall, it appears reasonable to assume that, given the comparatively higher ETS levels, South African producers will continue to pay less domestically. However, as this is very dependent on the exact policy design decisions, it remains opaque.

Industry dependence on EU exports (2a)

The first chapter in this section (1a) demonstrated the export levels of the CBAM-relevant steel and aluminium products. However, while these are critical to gauge the maximum absolute output reductions, assessing the importance of the EU exports for the industry altogether offers insights into how much of a disruption it could potentially cause. If the exports constitute only a fraction of the overall output and are not strategically important, a noticeable impact on employment is unlikely.

As pointed out under 1a, relative to the total exports of the CBAM goods the shares going to the EU are significant. Especially for the aluminium industry where it makes up almost one-third of all exports. Additionally, exports, in general, are essential for the South African aluminium sector. In 2016, 17% of final products, 45% of semi-fabricated products, and 74% of primary materials produced in South Africa were exported; in terms of weight, this amounts to a total of 55% (Department of Trade and Industry, 2017). Strategically, the aluminium industry roadmap, a document co-created by companies and the government, strongly emphasises an export orientation and states the aim to "sustain growth through exports" (Department of Trade and Industry, 2017, p. 7). The export dependency in the iron and steel sector is less pronounced. However, a total of 28% of exports in 2019 still constitutes a sizable share (SAISI, n.d.). Strategically, an export focus was proclaimed in the so-called Steel Master Plan, even though it focused on the African continent and stated that a European export strategy was still under development (Department of Trade and Industry and Competition, 2021). Overall, particularly for the South African aluminium sector, exports and exports to the EU play an important role. Subsequently, their reduction could have far-reaching implications for the industry and its employees.

Alternative markets (2b)

Negative impacts could be avoided if EU export reductions could be easily offset by shifting to other markets. In addition to the quantitative dependence on European trade partners examined in the previous section, the level of diversification and the tracing of other potential CBAM implications could aid this assessment. First, if the remaining 70 and 79% of aluminium and steel exports go to a wide range of different countries, this suggests greater resilience and could indicate a higher capacity to moderate changes to the trade portfolio. Second, if the CBAM does not entail an export rebate for EU producers, it could present opportunities for international (including South African) companies to fill this void and replace EU products.

South African industries have established trade relations with a wide range of countries, its steel and aluminium sectors are no exceptions. As one interviewee framed it, "we trade with almost every country in the world, so I think we're in a much better space than most other countries" (R7). In 2020, South Africa exported aluminium and steel to 90 and 136 countries, respectively; thereof, to 43 and 74 countries, products valued higher than $1 million (Chatham House, n.d.). This constitutes a considerable degree of diversification, which could help alleviate the CBAM impacts. Furthermore, as the current CBAM proposal indicates the phase-out of free allowances for EU producers but does not include a rebate for their exports, this could provide some opportunities. An industry representative expressed doubt over whether this policy design decision (i.e., no export rebates) would persist (R8). He stated that the CBAM may even limit export opportunities for third countries because other regions would shift their focus away from the EU market as well. However, this argument is difficult to verify, and its validity depends on the detailed trade flows. It is more likely to hold true for aluminium, as the EU is a net importer in that sector (unlike iron and steel) (Chatham House, n.d.). Overall, many uncertainties remain, and policy design plays an important role. However, based on the current proposal, South African producers would likely be able to partially offset EU export reductions.

Output and workforce reduction (2c)

The relationship between reduced exports and the potential for lay-offs is crucial for assessing the threat of adverse distributional impacts. As argued in chapter 3.4.2, the distributive channel through employment effects poses the greatest risk, and within that, wage reductions are unlikely to have negative effects. Labour is a central input factor for production and workforce consequently correlates with output levels. However, the exact nature of this relationship differs across industries and contexts.

The inclination to reduce workforce levels[11] when production decreases is not easily quantifiable, particularly ahead of time. To assess this for the South African industries, I rely on stakeholder perspectives. Industry representatives and policymakers mainly withheld judgement ("how many jobs may be affected? […] Perhaps still a bit premature to say." (R8)). A labour representative, however, referred to hasty workforce reduction as a characteristic predisposition of the South African industry ("The first thing that they will factor in as a way to cut their costs is to reduce labour, it happens all the time." (R6)). While this is difficult to verify, it can suggest possible reactions. One researcher cautioned that steel and aluminium production itself tends to be less labour-intensive than different forms of manufacturing but is strongly interconnected to other sectors (R2). Therefore, incorporating effects in up- and downstream industries is crucial. Overall, the residual uncertainty about how directly a decline in output translates to a

[11] While I refer to it as "lay-offs" in the intervention theory, workforce reduction can also occur via fluctuation without replacement. Whereas the impact on the individual employee is higher in the first instance, both are equivalent in terms of distributional impacts and are therefore considered.

reduction in workforce is high, but the general connection most likely exists and may be subject to multiplier effects across other sectors.

Up- and downstream industries (2d)

The degree to which the South African steel and aluminium industries are embedded in the local economy is important to estimate potential knock-on effects in other sectors beyond the ones targeted directly by the CBAM. Before examining the sectors' overall economic importance in terms of the number of associated jobs in the next section, I will briefly outline, based on stakeholder views, the nature of its relationships to surrounding industries.

Whereas upstream industries, primarily mining, are well-established in South Africa, downstream industries are, as a policymaker expressed it, "relatively underdeveloped, [including] employment in those industries" (R5). Further, there appears to be a partial detachment. For example, while the car industry is an important part of South African manufacturing, the local industry does not produce many grades of automotive steel (R5). In addition to the sequentially connected sectors in the steel and aluminium value chain, it is important to include small-scale formal and informal jobs that revolve locally around the plants. Pointed out by one labour representative, this comprises, for example, individuals selling food to the workers or operating a dry-cleaning business or a kindergarten right outside the factory (R6). These livelihoods are strongly dependent on the existence of the industries. Overall, the lack of downstream integration weakens the link between CBAM and losses of manufacturing jobs. However, upstream mining operations are crucial and amplify the risk of devastating impacts on local communities.

5.3.2 From Lay-offs to Higher Inequality

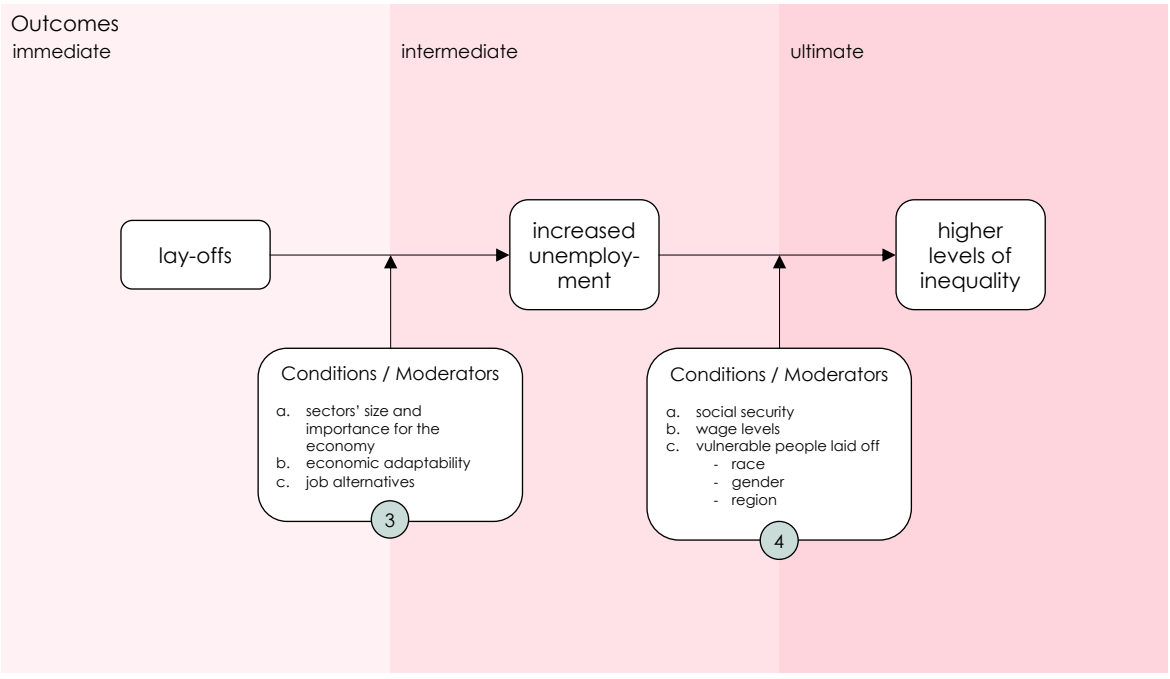


Figure 5-7: Moderators and conditions governing the links between lay-offs higher inequality levels

After tracing the links determining how the CBAM could lead to laid-off employees in South Africa, this section examines moderating variables and circumstances between these lay-offs and higher inequality levels. The significance of the steel and aluminium sectors as well as the flexibility of the South African economy and labour market influence how the workforce reductions translate to unemployment levels. Other contextual factors, such as unemployment

benefits and the wages of dismissed workers regulate the impact on income inequality. Increased inequality along a racial, gender, and regional dimension is dependent on the workforce setup.

Importance of steel and aluminium industries (3a)

The significance of the targeted sectors within the South African economy is a decisive criterion for the extent to which unemployment levels would be affected. This comprises multiple dimensions. The number of jobs each sector sustains, both directly and in associated industries, is crucial. Yet, the relevance to national income levels and structural economic development also needs to be considered. If the industries were relatively insular with little contributions to employment and GDP, no substantial effects on inequalities could be expected. This section examines the importance mainly by synthesising stakeholder arguments, supplemented by some empirical data.

On a general level, most respondents view the industries to be of high relevance for the South African economy and society, referring to them overall as "profoundly important" (R3), "critical" (R2), "very, very important" (R1), and "playing a significant role in the economy" (R6). The main reasons mentioned by interviewees revolve around securing employment. However, the industries' direct impact is controversial. On the one hand, they are said to "employ a significant labour force" (R6), especially "blue-collar workers" (R3). Yet, others point out that "as a job generator they are less important" (R2) and "per Rand of investment they directly employ a fairly limited number of people" (R5). This is argued to be due to the industries' high capital intensities (R2, R6), which make their direct contribution to employment relatively small (compared to their size in economic terms).

Hence, the immediate impact on jobs is likely limited. However, most respondents point to substantial multiplier effects (R1, R2, R5, R6, R7, R8). These materialise in different ways. Despite the relative disconnect from downstream industries discussed under 2d, the sectors are assumed to have "a huge impact on employment in the rest of the manufacturing industries" (R5), because of steel and aluminium's importance as a physical input. Upstream and other surrounding industries constitute a sizable labour force as well. The regional dimension is emphasised (R6) and illustrated by an example of a plant closing, which resulted in the direct loss of only about 500 jobs but had "devastating impacts on the local community" (R7). As pointed out by one researcher, the multipliers are not limited to ripple effects in the form of additional job losses (R1). Instead, it is common that one income supports many more individuals beyond the immediate household, which is disproportionately affecting Black people (Mangoma & Wilson-Prangley, 2019).

The sectors' economic importance is discussed in a nuanced way. While the share of South Africa's GDP is relatively small (R2), the export revenues the industries generate are seen as "significant" (R7) and they were identified as an integral part of the economic recovery after the downturn caused by the Covid-19 pandemic (R6). Other considerations were highlighting their role as a "key industries" (R2) for fostering labour-intensive industrialisation and their importance for infrastructure development (R8). This point is complemented by one policymaker addressing the potential demand shifts from the climate transition, which could result in different outcomes for steel and aluminium ("greener industrialisation will require lighter, stronger metals such as aluminium" (R5)).

These findings are largely corroborated by official reports and numbers on the industries. The iron and steel sector is viewed as "fundamental to manufacturing" in South Africa, both economically and by employing 190,000 people (Department of Trade and Industry, 2018, p. 156). Further, the central downstream industries are found to contribute R600 billion (around 15%) to GDP and provide around 8 million jobs. The South African aluminium sector employs

around 11,600 individuals directly and 84,600 indirectly in downstream and associated industries (Department of Trade and Industry, 2017, p. 12). Additionally, it is assumed to provide substantial benefits for people in related informal sectors (mainly scrap collectors). Overall, both industries appear relatively important, particularly because of the jobs they (indirectly) sustain.

Adaptability of the South African economy (3b)

Having established the significance of the industries, a general estimate of the economy's flexibility can provide insights into the capacity to mitigate job losses in other areas. While a high degree of adaptability could help avoid higher unemployment levels, many stakeholders do not concur with such an assessment, however, there are opposing views.

In general, the flexibility is seen as dependent on lock-in effects and economic diversification. Whereas one economist holds that, "in South Africa, you have very high levels of concentration, […] it's inhibiting innovation" (R2), a labour representative deems the economy "quite adaptable" as it is "more diversified than in any other country in Africa" (R7). This illustrates the relative nature of the variable; compared to some economies it can be considered more adaptable, compared to others less so. Sceptical views dominate in particular about the adaptability regarding low-carbon alternatives. The main reasons revolve around the dominance of carbon-intensive industries, infrastructure deficiencies and workforce flexibility (R1, R7). I will examine the last point more closely in the next section. One argument in favour of high levels of flexibility concerned the overarching economic problems: "I think when a system is as broken as what South Africa is, adaptability becomes quite easy; when you don't have jobs and your economy doesn't grow […] I think we're in the best place to adapt" (R6). While there is some credibility to this, a radical systematic overhaul is unlikely to meet the criteria of a smooth adaptation that contains social adversities. Overall, the South African economy is seen as not very adaptable and, hence, compensating workforce reductions as improbable.

Job alternatives for laid-off workers (3c)

Another factor that could mediate the effects of potential lay-offs is the availability of other jobs that the dismissed employees could take up instead. If there were many open positions in the economy that aluminium and steelworkers could do, there would be no increase in unemployment.

As unemployment levels in South Africa are currently very high (35.3%) and many individuals are searching for jobs (Statistics South Africa, n.d.), it is unlikely that workforce reductions can be easily compensated. As a labour representative summarised the situation, "one job lost is one job too many" (R6). While there was a recent spike following the Covid-19 pandemic, a large share of the unemployment levels is considered structural rather than transitory (A. Banerjee et al., 2007; Festus et al., 2016), underlining the difficulty of instantaneous transitions to new forms of employment. This is complemented by the argument that much of the unemployment can be attributed to defects in the education system and inadequate skill levels (R1, R2, R5). As an indication, in 2020, 82% of workers in the steel industry were classified as low- or semi-skilled (Quantec, 2022). As the informal sector is seen as unusually small for a middle-income country with high poverty levels, it does not provide an alternative either (R2). Overall, an easy compensation of job losses through other employment opportunities is unlikely.

Levels of social security (4a)

As individuals who lose their jobs will not be in a position in which they do not earn any income at all, it is important to not only consider the previous wage levels but also the unemployment benefits. The difference between the two is relevant for calculating inequality impacts. However, since I do aim to model or quantify the effects, this discussion will be very brief.

Unemployment insurance in South Africa pays monthly amounts between R3,500 (minimum) and R6,630 (maximum) depending on previous income (Horn, 2021). The maximum applies from an income of around R17,700. These levels are substantially below the average income of R11,510 but fairly close to the median income of R5,410 (Kerr et al., 2019). However, it is important to note that these benefits are paid for a maximum of 238 days (if continuously employed for at least 4 years) (Republic of South Africa, 2002). Overall, the payments received by unemployed individuals in South Africa do not mitigate inequality effects from lay-offs in a substantial and lasting manner.

Wage levels of workers (4b)

After having established how much laid-off employees can receive from social security services in the short and medium-term, the previous wage levels are necessary to determine the difference in income. As the unemployment benefits result in incomes lower than average and close to median levels, if workers are not among the wealthiest individuals, their dismissal will contribute to increased inequalities. While the exact effects on the Gini coefficient require comprehensive modelling, generally, higher former wages lead to higher impacts.

Workers in the aluminium and the iron and steel sector are likely to earn above-average wages. The official statistics show that the gross earnings of employees from the industries classified as *iron and steel* and *precious and non-ferrous metals* are substantially higher (25 and 53%, respectively) than the arithmetic mean across the other sectors (Statistics South Africa, 2022). Overall, this suggests relatively high impacts on inequality from losing jobs in these industries.

Group composition of workers along inequality-relevant dimensions (4c)

For the assessment of different forms of (income) inequality impacts, it is important to incorporate the demographics of the affected workforce. Examining the effects on already disadvantaged groups aids a holistic evaluation of distributional impacts. Unfortunately, I was not able to obtain reliable statistics on the workforce composition in the affected industries. Instead, I rely on stakeholder insights pointing out mechanisms, which could result in disproportionate vulnerabilities.

For people of colour and Black individuals in particular, the impacts are likely disproportionately high. While there is little empirical backing for the argument that the aluminium and steel sectors play an exceptional role in this regard, the multiplier effects in Black communities are generally higher. This phenomenon, describing the far-reaching effects from one income supporting multiple individuals, is called Black Tax (Chikane, 2018; Mangoma & Wilson-Prangley, 2019). One interviewee from an NGO pointed out that, within these industries, Black people predominantly participate as blue-collar workers, who are particularly susceptible to lay-offs resulting from output reductions (R3). Even despite the absence of concrete figures, there is reason to assume that people of colour will be affected more than white individuals.

The situation along gender lines is more complicated. Lay-offs directly in the industries are more likely to affect males, as they comprise around two-thirds of workers in the manufacturing sector (Statistics South Africa, 2022). However, this comes with important caveats. As outlined in previous sections, there are substantial multiplier effects from a struggling steel or aluminium industry. This is where stakeholders identified a "downstream effect for gender equality" (R6), which, as a researcher described, occurs in "associated industries, such as retail" mostly employing women (R2). Additional vulnerability originates from an imbalance regarding contractual certainty (R6). According to a labour representative, women find themselves more often in precarious employment and are therefore deemed more likely to be dismissed. Overall, a reliable estimate about which of the two opposing mechanisms prevails is difficult, but gender constitutes a relevant dimension in the distributional considerations.

Regional specificity emerged as an important aspect for estimating inequality outcomes resulting from decreased industry outputs. In line with previous deliberations, the main concern is about multiplier effects, which are assumed to be strongly localised and therefore differentiated by region (R6). A given steel or aluminium plant is considered a "critical element and a cog in the community that's going to generate downstream jobs and have strong regional multiplier effects" (R2). This does usually not affect the most vulnerable rural areas, as the locations are generally peri-urban (R6). However, a union representative points to the increasing risk of "creating ghost towns" because of big employers closing production sites (R7). In general, regionally concentrated effects are likely to occur, but if this would exacerbate regional inequalities is less certain. Finally, some stakeholders emphasized that despite current shortcomings and risks, there are also opportunities for stronger participation associated with the climate transition, both in general and in the targeted industries (R3, R6). Overall, as this brief discussion showed, the consideration of historically disenfranchised population groups is essential for assessing distributional equity.

5.3.3 Summary

Adverse distributional effects resulting from export reductions in the South African aluminium and steel industries are likely to occur. However, the magnitude of these impacts may be limited. Most moderators governing the link between the CBAM and decreased EU exports strongly indicate that such a reduction would take place (node 1). Yet, the conditions that need to be fulfilled for this to translate into lay-offs are slightly more ambiguous (node 2). While it is likely that possible workforce reductions lead to higher unemployment (node 3) and then to exacerbated inequalities (node 4), these connections are characterised by modest uncertainties about the constituent moderators.

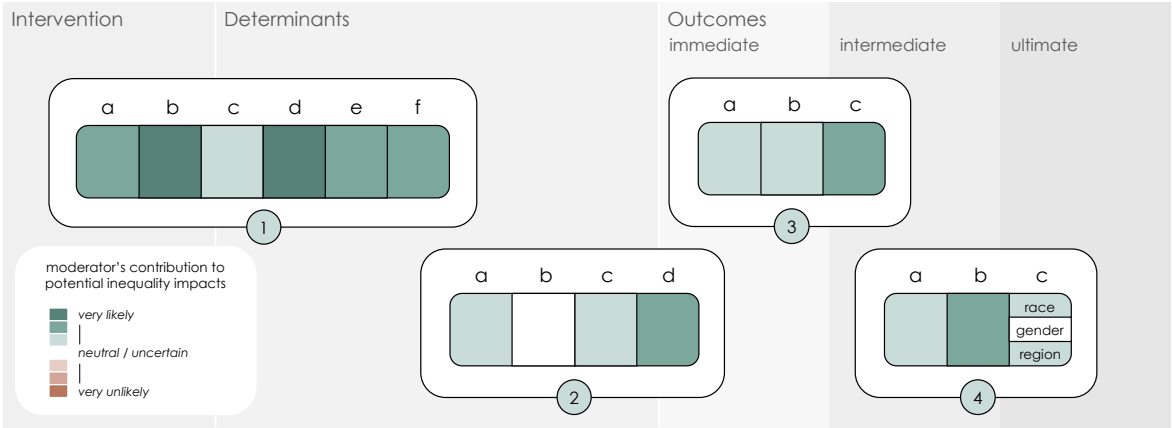


Figure 5-8: Likelihood of the export route to result in adverse distributional effects, broken down by nodes and constituent moderators and conditions

The main actors affecting the distributional outcome via this route are the EU as a policymaker and the South African steel and aluminium companies. Beyond that, labour unions and the South African government are important. The EU exerts influence through policy design decisions, such as the phase-out of free allowances, scope definition, and allocation of revenues. This will mainly determine whether and to what degree the CBAM will lead to export reductions (node 1). While customs authorities and importers only act as intermediaries, South African companies producing and exporting the products can mitigate distributional impacts by working to reduce carbon intensities, retaining employees, and diversifying their export portfolio. The South African government can facilitate a more adaptable economy and labour market, with a focus on decarbonisation. This is particularly relevant for renewable electricity generation if indirect emissions will be included in the policy scope. Other levers are labour protection laws

and the expansion of social security (i.e., unemployment benefits). In a similar yet less direct way, labour representatives contribute to maintaining threatened jobs.

It is likely that, compared to the counterfactual of no CBAM, exports to the EU in the targeted sectors will be lower. The conditions that there are any exports in the defined categories (1a), which are generally so emission-intensive that carbon pricing would be an important cost factor (1b) are fulfilled. A competitive disadvantage resulting from higher-than-average emission intensities (1c) is likely for steel exports. Direct emissions from South African aluminium products are unexceptional, however, embodied indirect emissions (which could be added in the policy design) are extremely high. The sectors and the national energy system are deemed relatively ill-prepared to decarbonise (1d) and the financial capacity to absorb the additional costs is estimated to be comparatively low (1e). Whether and by how much the effective carbon price would be higher than from the domestic carbon tax (1f) is mainly dependent on the phase-out of free allowances, but an increase appears likely. To cause employment reductions EU exports need to constitute a sizable share of industry output (2a), which is the case, though more so the for the aluminium than for the steel sector. Partially compensating export losses by shifting to other markets (2b) seems possible, but how directly overall output reduction translates into lay-offs (2c) remains largely speculative. Substantial multiplier effects up- and downstream, as well as in other associated industries (2d), would be likely to occur and exacerbate the overall impact. Employment reductions do not necessarily lead to substantially higher unemployment levels. However, the relatively high significance of the targeted sectors (3a), low economic and labour market flexibility (3b), and generally few employment alternatives (3c), make compensation for job losses unlikely. Higher inequalities as a result of increased unemployment are generally likely, but the degree is mainly conditional on who is laid-off and the level of unemployment benefits. While relatively low and short-term, social security provisions (4a) help mitigate some of the impacts, whereas slightly above-average wage levels in the affected sectors (4b) worsen the distributional effects. How different forms of inequality are affected (4c) proved difficult to estimate in the absence of reliable data. Yet, the stakeholder insights suggest disproportionate effects on Black South Africans and regionally concentrated impacts.

5.4 Higher Inequalities Through Increased Carbon Prices

The second route via which higher levels of inequality could result from the introduction of the CBAM consists of increased carbon prices. While the first route constitutes the direct effects and its implications for employment in the targeted sectors, this section mainly deals with the likelihood and effects of increasing the South African carbon tax in response.

5.4.1 From the CBAM to Different Carbon Pricing Scenarios

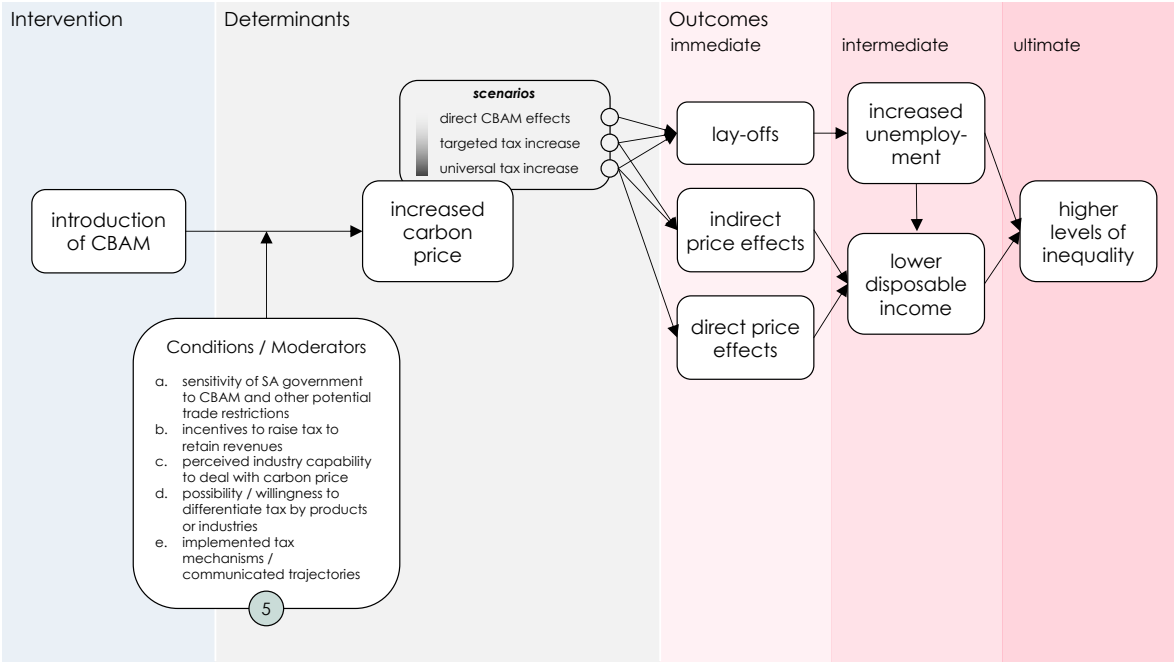


Figure 5-9: Moderators and conditions governing the links between the policy implementation and increased carbon prices

This chapter examines the likelihood and potential impacts of the South African government increasing domestic carbon prices in response to the CBAM. Studying the rationales and arguments help estimate the probability of different scenarios. This is important since raising the tax in general or limiting the increase to the affected sectors differ not only in terms of magnitude but also determine the distributive channels (indirect/direct price effects) through which impacts could occur.

Sensitivity of South African government to CBAM (5a)

Investigating how aware South African policymakers with influence on carbon taxation are of the CBAM's implications is essential to this impact route. If the EU policy was not part of any considerations around determining carbon tax levels, there would be no connection and no potential inequality impacts attributable to the CBAM. While it would be an arduous task to estimate the exact contribution of the CBAM to any carbon tax increase, some qualitative insights can illuminate the general connection between the two policies.

A labour representative involved in parliamentary decision-making and the negotiations around the carbon tax argues that the policy is inherently responsive to external pressure and "about protecting trade relations" (R7). This is echoed by an administration member, saying that loss of competitiveness and "facing these border carbon taxes through the EU" (R4) is a central reason for ambitious carbon tax levels. The possibility of BCAs in other countries was brought up as well.

For the recently overhauled proposals for tax levels and trajectories, the same policymaker stated, they took into account multiple circumstances (R4). Suggestions from academic and grey literature were the foundation and the commitments in the updated Nationally Determined Contribution (NDC) under the Paris Agreement guided the ambitiousness. However, "global developments around carbon pricing, around the CBAM, were taken into account". The outlined surge in ambition from 2026 onward was to align the tax with both the next NDC

period and the start of CBAM requirements. The external communication of the carbon tax modifications substantiates this claim. Both the budget speech by the finance minister as well as the full budget review reasons for the increases with reference to upcoming border adjustments: "South Africa's exports of carbon-intensive goods such as iron and steel are likely to face carbon taxes in Europe, which will reduce their competitiveness" (National Treasury, 2022, p. 49).

As outlined above, the diversity of motivations underlying a carbon tax renders the attempt to definitively ascribe a portion of its increase to the CBAM virtually impossible. This is exacerbated by the temporal dimension. Since the policy has not been enacted and is only expected to take effect in 2026, the degree to which it is taken into account can change. Overall, while it is not portrayed as the central motivation guiding the trajectory of the tax, the CBAM is very much part of the considerations and influenced and influences South African carbon pricing.

Incentive to raise carbon tax for retaining revenues (5b)

The CBAM generates a financial incentive for South African policymakers to raise the levels of the domestic carbon tax. Examining the strength and awareness of this incentive is important to estimate a likely reaction. As this aspect depends mainly on how the CBAM is implemented, it will be further dissected in the chapter dedicated to policy design implications. Based on the current proposal's specification, the incentive arises from the fact that the CBAM revenues are not re-channelled and (only) explicit carbon prices qualify for deducting from the border levy (EC, 2021). Therefore, the only way for South Africa to keep the revenues from these exports in the country is to mandate an equivalent national carbon price.

In the budget speech, the Finance Minister demonstrates that revenue generation and retention are part of the consideration. After announcing the new carbon tax levels, he stated that "without compromising our ability to collect revenue, we have managed, through these tax proposals, to keep money in the pockets of South Africans" (Godongwana, 2022, p. 16). One interviewee also pointed out that tax proceeds may be an important rationale for increasing the domestic carbon price, given the government's struggle to generate tax proceeds (R7). Overall, the incentive exists and appears to be on the radar of political decision-makers.

Perceived readiness of industries to deal with (higher) carbon pricing (5c)

The perception of the economy's capability to absorb higher carbon taxes is central to the inclination to raise the tax levels. If policymakers believe that even a small increase would have devastating effects on industries, they would be less likely to ratchet up the price.

As one labour representative explained, the negotiations around carbon tax levels with businesses were trying to strike the balance between "curbing externalities and maintaining employment levels" (R6). That is aligned with a colleague's view, who added that this fear of job losses, while it has some merit, does not reflect the whole picture (R7). Yet he acknowledges the risk of effects piling on: "Some are really struggling for other reasons. But if it was too rushed, too big all at once, […] it could collapse some companies, this can be the thing that pushes them over." Nevertheless, he shows optimism that price increases will materialise, advocating for the phased-in approach. References to the government's cooperative approach in the past (suspending tax payments and increases), however, suggest a high sensitivity to industry's difficulties. Despite the particularity of the situation, the President's deferring the carbon tax payments at the beginning of the Covid-19 pandemic showcases that perceptiveness (SARS, 2021).

This notion is complemented by the perceived strong opposition of particularly carbon-intensive industries ("industry will definitely not want [increased carbon prices]" (R4)). Though, the lack of readiness in certain sectors is ascribed to already existing problems rather than being an effect of carbon pricing. Hence, there seems limited sympathy for the argument that high carbon taxes are at the core of economic challenges. That the industries affected by the CBAM are seen as particularly vulnerable ("these sectors have been running at losses for the last decade or so […] challenges go beyond the carbon tax, […] it will just exacerbate the situation" (R4)) casts doubt on the scenario of a differentiated tax increase targeting steel and aluminium, which is examined in the next section. Overall, while the situation is ambiguous, the economy is not assumed to be well-prepared and concessions in form of less ambitious carbon prices seem likely.

Possibility and willingness to differentiate carbon tax levels (5d)

One possible scenario is a carbon tax increase only for the targeted sectors. This would help retain the revenues that would otherwise go to the EU and simultaneously sidestep direct price effects on inequality. However, this might intensify indirect price and employment effects in the steel and aluminium sector compared to the direct CBAM implications (price only on exports) that were examined in the previous chapter or an increase that is more comprehensive but less stark. The inclination to differentiate the tax is examined to gauge the likelihood of this scenario.

A policymaker familiar with the context acknowledges the principal implication of uniform prices that "there would be sectors that would be winners and losers" (R4). This implies a general readiness to accept and not iron out any adverse effects for some actors. However, the de-facto differentiation through free allowances and exemptions currently works the other way around, requiring industries such as steel and aluminium to pay less per tonne of emissions. While it is common to exempt trade-exposed industries, it complicates a rapid increase for these sectors (given the phased-in approach favoured by the administration). It seems to be a possibility but is still under consideration: "We will have to look at what does it mean from our side. How does that align with what price would be applied on exports of these products to the EU? It would be possible to ratchet up the domestic carbon price on these sectors." (R4). However, the specified means do not suggest a highly differentiated approach; higher marginal increases and possible allowance reductions were cited as ways to enact this. Overall, a relatively uniform carbon tax increase, aligning prices by abolishing exemptions, appears more likely.

Implemented and communicated tax mechanisms and trajectories (5e)

This element serves as a sort of counterfactual. Recognising the previously enacted carbon pricing mechanisms is essential to estimate additionality. This includes tax levels, outlined trajectories, and exemption rules. The difficulty of temporal aspects (i.e., effects can lie in the future) was acknowledged above. However, differences between the approach outlined in the original legislation and the adaptation communicated in 2022 can be seen as indicative of the government's perceptiveness.

The Carbon Tax Act introduced the policy at R120 (around $7.50) per emitted tonne of carbon and stipulated a yearly increase to adjust for inflation plus 2% until 2022 (Phase 1) (Republic of South Africa, 2019, p. 12). The trajectory from 2023 onwards (Phase 2) was left open and only specified inflation adjustments. In the budget speech 2022, the Finance Minister announced to extend Phase 1 until the end of 2025, which includes significant exemptions and free allowances for (trade-exposed) industries, and laid out the plan for steeper tax increases (Godongwana, 2022). The full budget review cites "carbon taxes in Europe" (National Treasury, 2022, p. 49) that South African exports would face as part of the reasoning for the increased ambitions. Furthermore, the outlined path only lists minimum values ($20 in 2026, $30 in 2030), leaving room for higher tax levels in response to the CBAM depending on how it gets implemented.

Overall, particularly for future tax increases, it remains difficult to estimate the contribution of the EU policy.

5.4.2 From Carbon Pricing to Higher Inequality

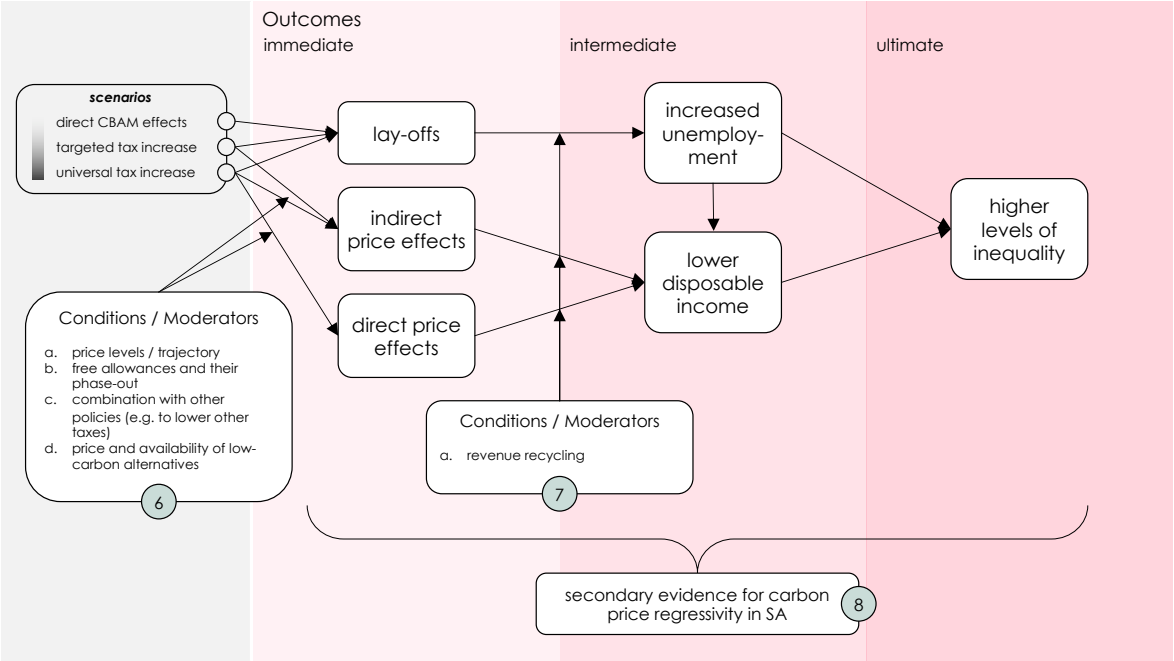


Figure 5-10: Moderators and conditions governing the links between increased carbon prices and higher inequality levels

After tracing how the CBAM could lead to higher domestic carbon prices, this chapter examines the moderating variables governing the intensity of primarily indirect and direct price effects. Furthermore, I inspect the South African approach to revenue recycling as a central tool for ameliorating adverse distributional effects and will then summarise the findings of other studies on carbon pricing in South Africa.

Price levels and trajectory (6a)

Predictably, the central factor determining the magnitude of inequality impacts across all distributive channels of carbon pricing is the price level; higher tax rates have higher effects. Also important is the pace at which the price is increased. A common reasoning is that if companies and the economy are afforded more time to adjust, impacts can be mitigated (Rozenberg et al., 2020). This section examines the South African approach to shaping the price levels over time.

The importance of a phased-in approach, i.e., starting with low prices and increasing them continuously, was emphasised by multiple stakeholders (R4, R6, R7). It is seen as a compromise between environmental ambition and protecting economic interests. In the first few years of the carbon tax, this method was applied and also the most recent proposal for the tax's future development adheres to this principle ("government proposes to progressively increase the carbon price every year", (National Treasury, 2022, p. 49)). It foresees at least $20 in 2026, $30 in 2030, and $120 in 2050. These proposed levels are substantially more ambitious than originally outlined and, as discussed earlier, already include some considerations of the CBAM. Further increases to align the prices more closely with the EU levels are possible, however, statements from a policymaker cast some doubt on a very significant ramp-up. They stressed the importance of providing "price certainty on the carbon tax over the short, medium and

longer term" to guide industry investment (R4). Furthermore, a full alignment was ruled out: "We cannot at this stage implement a carbon price equivalent to what the EU ETS price is, […] there would be implications in terms of economic growth" (R4). Overall, while further increases are uncertain, the current price levels are sizable enough to have distributional implications.

Free allowances and their phase-out (6b)

Closely related to the nominal price levels is the approach regarding allowances and exemptions. This is important as it determines the price effectively paid, which is the relevant amount for reductions under the CBAM[12] and distributional outcomes. To date, free allowances are extensively distributed. If this were maintained, distributional effects would be lower.

As mentioned above, the overhaul of the carbon tax presented in 2022's budget extended the phase of vast allowances until 2025 but announced their gradual reduction to "strengthen the price signals under the carbon tax from 1 January 2026 to 31 December 2030" (National Treasury, 2022, p. 49). An influential policymaker emphasised the need for eliminating the exemptions and referred to the need created by the CBAM, among other factors: "in terms of the CBAM, we may have to reconsider and fast-track the process for phasing down the allowances" (R4). Overall, free allowances under the South African carbon tax, which are environmentally counterproductive but could play a role in mitigating inequality impacts, will be reduced from 2026 onwards, at least in part in response to the EU policy.

Combination with other policies (6c)

Neither distributional nor environmental outcomes are determined by a single policy but result from several related factors interacting. A brief introduction of the carbon tax's relation to other policies can help estimate if this generates circumstances that could exacerbate or alleviate inequality impacts.

The awareness of potential adverse economic and distributional effects of the carbon tax is well reflected in the policy design and interviews with negotiating parties. For example, the electricity generation levy and renewable electricity purchases can be offset against the carbon tax liability (Republic of South Africa, 2019). As a policymaker elaborates, "there were concerns about double taxation […] so, we did provide this concession in the design of the tax to cushion households and energy-intensive users in the first phase" (R4). Replacing implicit with explicit carbon pricing is sensible, given the incentive structure the CBAM creates. The South African government also showed that it is willing to defer tax payments. As discussed, the carbon tax was suspended due to Covid-19, a sugar tax was put on hold in response to a struggling industry and the fuel tax was reduced reacting to spiking oil prices following the Russian invasion in Ukraine (Cohen, 2022). The exact distributional implications of those tax reductions require closer examination, but this illustrates that tax reductions are a measure the government is prepared to utilise.

Another insight from the interviews is that the carbon tax is considered "the only direct climate policy instrument in place" (R4) and is generally decoupled from other policies. One respondent identified fundamental inconsistencies in political response to climate change, explaining that considering South Africa's NDC and its Integrated Resource Plan (IRP)[13] "the two are actually talking in opposite directions". In addition to missing coordination, the lack of funding is

[12] This is specified in Article 9 of the proposal, which requires "proof of the actual payment for that carbon price which should not have been subject to an export rebate or any other form of compensation on exportation", EC, 2021, p. 32

[13] The Integrated Resource Plan (IRP), published by the Department of Energy, sets a national framework for future energy production capacities with a focus on electricity.

identified. Yet, both would be necessary to implement the systems and infrastructure for an effective and equitable climate transition. This is further considered in the next chapter. Overall, some recent and outlined policy measures could help mitigate distributional impacts, however, the apparent lack of a holistic approach potentially undermines this by obstructing a more frictionless transition.

Price and availability of low-carbon alternatives (6d)

The readiness to shift to renewable and low-carbon technologies is essential to assess the intensity of impacts resulting from carbon prices. If alternatives are not available at reasonable costs, carbon taxes can lead to adverse distributional outcomes. This occurs both via employment effects in the absence of green job alternatives and through rising prices of energy and products, where low-carbon substitutes can only be afforded by relatively affluent individuals (e.g., electric vehicles). With renewable technologies becoming cheaper globally, this mechanism loses relative importance. However, country-specific differences can be vast. A brief review of the South African situation shall indicate the vulnerability.

South Africa has favourable geographic features for large-scale production of renewable energy (Altieri et al., 2016; Fluri, 2009). However, institutional and economic factors as well as lock-in effects create massive challenges for moving away from fossil fuels quickly and without major socioeconomic disruptions. Calculating an energy transition index, the World Economic Forum ranked South Africa 110th of 115 examined countries, both overall and in terms of transition readiness (World Economic Forum, 2021). Building on this, the decarbonisation will also likely cost substantially more. Some estimates suggest annual expenses of around 12% of GDP, which is about 5 and 10 times more than the US and the UK, respectively (Walwyn, 2020). To contextualise this, it is difficult to disentangle carbon pricing effects from ones that are associated with the general need for a climate transition. However, high taxes on emissions are considered a less appropriate tool in the early stages of this fundamental transformation, especially if not complemented by supporting policies (Finon, 2019; Tvinnereim & Mehling, 2018). Overall, especially for poorer people, in South Africa, climate-friendly alternatives seem on average more difficult to obtain, which makes the country more vulnerable to negative inequality impacts.

Revenue recycling (7a)

The conditions and moderators analysed this far influence which carbon price would effectively result from the CBAM introduction and regulate the distributive channels. A crucial aspect of the policy design applies after the taxes were collected and potentially trigger initial effects: the recycling of revenues. The decision about how to allocate the carbon tax proceeds can have enormous effects on the distributional outcome of the policy (Rausch & Schwarz, 2016; Steininger et al., 2014). Understanding if and how the South African administration plans to re-channel the revenues is therefore central to the overall assessment from an inequality perspective.

The discourse around revenue recycling is multifaceted. A broad interpretation by some stakeholders necessitates a closer look at what exactly is meant by the term. One union representative emphasises how integral the assumption of using the funds to "pay for something social spending related" (R6) was to the negotiations leading to the tax's implementation. A policy paper issued by the government at the inception stage of the carbon tax echoes this sentiment as it announces the exploration of "potential recycling measures through either the tax system or expenditure" and stresses the need for "measures to address potential adverse impacts on poor, low-income households and industry competitiveness" (National Treasury, 2022, p. 65). This was recently reiterated in a presentation by the National Treasury which underlines the importance of minimising "potential adverse impacts on low-income households

and industry competitiveness through targeted revenue recycling" (Hemraj, 2022, p. 3). The ambition to use revenue recycling for moderating adverse distributional effects appears to be present. However, this far, there is no substantial re-channelling of the revenues implemented in the legislation and it is not clear what exactly would be funded.

One reason for the absence of revenue redistribution mechanisms lies in the low proceeds generated to date. The argument is that since the tax level is low and free allowances are pervasive, recycling would not have sizable effects. This is complemented by the interpretation, that some allowances and exemptions constitute a form of revenue recycling. A policymaker holds that recycling the revenue back into the economy is crucial to "minimise the impacts on growth [and] can be used to support a just transition" (R4). One of the more concrete examples is the funding of an energy efficiency tax incentive. Other more progressive approaches, such as the free provision of basic energy needs and public transport subsidies, were mentioned as theoretical options rather than tangible plans ("something that we could look at going forward" (R4)). A citizens dividend approach was not considered and ruled out because of high public debt levels. This rationale casts doubt on the government's willingness to implement extensive revenue redistribution. Overall, while the lawmakers acknowledge the need to recycle the carbon tax revenues, the ambivalence and absence of a clear plan to mitigate inequality impacts raise questions about the reliability and timeliness of its implementation.

Secondary evidence for carbon price regressivity in South Africa (8)

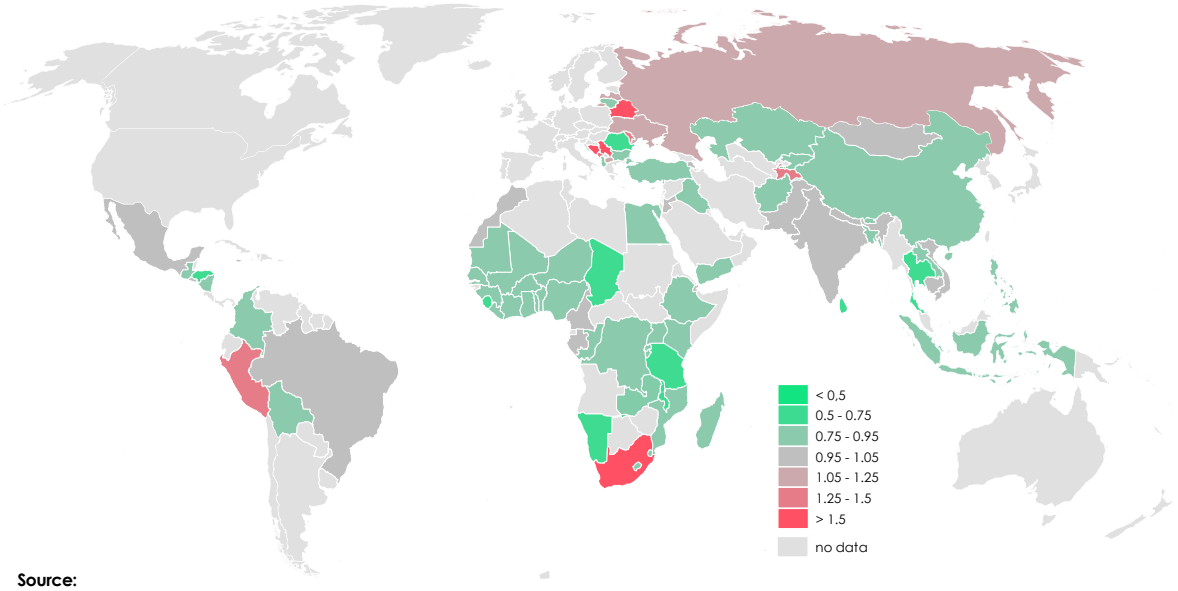
As described in chapter 3.4, there is a vast range of factors that influence the distributional outcomes of carbon pricing. While some were qualitatively discussed in this chapter, a full-fledged quantitative simulation of these effects is beyond the scope of this thesis and would not have been expedient. Fortunately, other researchers conducted such studies, which can be used to estimate impacts. This comprises both analyses specifically of South Africa and international modelling studies in which it was one of the examined countries. The latter additionally provides insights about how the South African situation compares to other contexts. I present a brief overview of the findings here to supplement the preceding analysis.

All eight reviewed analyses apply a quantitative modelling approach to estimate welfare and distributional impacts, thereof six examine only the South African context. Each of these studies concludes negative welfare effects to some degree and those authors who investigate distributional impacts more closely find regressive outcomes. One of the earliest studies identifies adverse effects on unemployment and poverty levels (van Heerden et al., 2006), whereas Devarajan et al. (2011) attribute the regressivity of a carbon tax to low-income households spending relatively more on electricity and other essential but carbon-intensive goods. Similarly, in a recent paper, Okonkwo (2021) concludes that distributionally adverse effects mainly result from rising electricity and public transport prices. In contrast to these findings, a study commissioned by the South African government concluded "small impacts on […] employment, consumption and real wages" (Partnership for Market Readiness, 2016, p. vii) and inferred from that limited distributional effects. While the authors underscore the importance to counteract regressive effects with deliberate policy design decisions, the study was criticised for disregarding dedicated impacts on vulnerable groups in its model (Okonkwo, 2021).

Other investigations detected regressive impacts but then focussed on the potential of revenue recycling to mitigate them; while Merven et al. (2014) modelled different scenarios for using the funds but could not identify re-distributional effects, Alton et al. (2014) estimate that re-channelling the revenues by reducing indirect sales taxes suffices to neutralise regressive impacts and progressive outcomes can be achieved through social transfer expansions. Further options of revenue recycling that were shown to offset and reverse regressive effects are food tax

reductions (van Heerden et al., 2006) and targeted lump-sum transfers for households at the lower end of the income distribution (Okonkwo, 2021). A few considerations from these studies are applicable to different inequality dimensions. Van Heerden et al. (2006) showed that people of colour are more vulnerable to regressive impacts but also benefit most from the progressivity after including the food tax break. In Okonkwo's study (2021), poor rural households were found to be slightly less adversely affected than low-income individuals in urban areas, because the public transport price increases are less applicable due to a lack of access.

Understanding how these findings relate to the situation in other countries will aid the contextualisation of the results. For this, I utilise two studies that model impacts of carbon pricing policies across different countries and thereby enable a comparison of vulnerabilities to distributional impacts. While Soergel et al. (2021) focus on increasing levels of extreme poverty, this provides a reasonable proxy for adverse inequality effects. They find that in an ambitious climate mitigation scenario South Africa is the second-most affected country, and Sub-Saharan Africa would constitute around 60% of the estimated 50 million additional people in extreme poverty by 2030. More specifically, Dorband et al. (2019) model the distributional impacts of a carbon price for different countries. Of the 88 low- and middle-income countries examined in their study, only 12 exhibit regressive effects. South Africa, as illustrated by Figure 5-11, is an outlier and estimated to be particularly vulnerable. The colour scale on the map represents how the impacts on the lowest income group relate to the country's average. In South Africa, low-income households would lose roughly 1.6 times as much (or 60% more) of their income than average. As most other countries are represented in green, this demonstrates that regressive impacts from carbon pricing are not universal.



Source:
Dorband et al. (2019): data represents the ratio between estimated impacts on low-income households and average impacts in a given country; values greater than 1.0 (red) suggest regressive, values smaller than 1.0 (green) progressive effects

Figure 5-11: Simulated effects of carbon pricing on the lowest income group relative to the whole population

Overall, the evidence for regressive outcomes from carbon pricing is relatively clear yet appears to be specific to the South African context. Different forms of revenue recycling were examined and, if applied in a targeted way, are likely able to neutralise these impacts.

5.4.3 Summary

A negative impact on inequality through the route of increased carbon prices is likely. The CBAM will probably lead to higher carbon prices beyond the direct increase examined in chapter 5.3 (node 5). The conditions regulating the distributive channels through which negative effects can unfold are also fulfilled, though to varying degrees (node 6). Revenue recycling as an important countermeasure is unlikely to be utilised extensively (node 7) and modelling studies of carbon price regressivity in the South African context also suggest a high vulnerability (node 8).

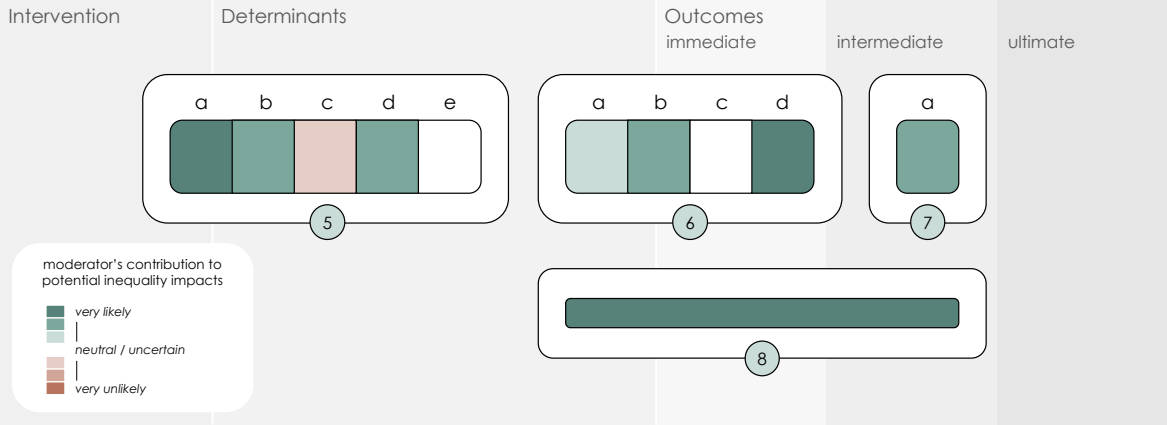


Figure 5-12: Likelihood of the carbon pricing route to result in adverse distributional effects, broken down by nodes and constituent moderators and conditions

The central actor determining the outcome along this route is the South African government. While the EU instigates the entire situation and is responsible for creating the incentive to raise explicit carbon prices, the carbon tax itself was introduced before and its design can mitigate and potentially reverse distributional equity impacts. Furthermore, public institutions and legislation are key in facilitating and coordinating the climate transition. This may help avoid regressive effects and arguably requires instruments beyond a carbon tax. Industry actors and labour representatives are involved in so far as they were and are part of the negotiations around climate policy. Ultimately affected are all citizens, either as consumers or employees in emission-intensive industries.

As noted before, a quantified estimate of the effects and exact contribution of the CBAM is not attainable in the context of this thesis. The government officials are certainly aware of the EU policy and considered the effects for developing new trajectories (5a). In this sense, the proposal of the CBAM already contributed to higher carbon prices, rather than its actual implementation. The incentive created by the policy design is unambiguous, even though it could be eliminated or softened by re-channelling the revenues to the exporting countries (5b). The perceived lack of industry capability to cope with higher carbon prices limits general increases of the tax (5c). However, specifically for the steel and aluminium industry, it makes the scenario of a targeted tax increase, which would sidestep direct price effects on inequality, unlikely (5d). Tax levels that are implemented and announced do not provide much insight for estimating future changes (5e) but are outlined to be high enough to cause ample distributional impacts (6a). The declared rapid phase-out of free allowances, in response to the CBAM, will contribute to higher effective prices (6b). Whereas some policies to offset the higher carbon tax can help alleviate the situation, a general incoherence of the policy mix impedes an equitable transition (6c). This apparent absence of a holistic approach to climate policy at least partially leads to the lack of (affordable) low-carbon alternatives, which would help mitigate inequality impacts (6d). All in all, tracing the

different factors helped identify why and how the CBAM may contribute to higher levels of inequality. In turn, it also points out levers to assuage or reverse the effects.

5.5 Context-specificity

As noted throughout the two previous chapters, many circumstances are specific or even unique to South Africa and the EU CBAM. This limits the findings' validity to the examined context. While it is the stated aim of this thesis to produce context-specific knowledge, in this section, to answer RQ3, I summarise and interpret the most important aspects that make the studied example distinct. In this, I differentiate between two dimensions, manifested in RQs 3.1 and 3.2, by reviewing relevant socioeconomic characteristics of South Africa and policy design elements that distinguish the impacts of the CBAM proposal from other possible implementations.

5.5.1 Socioeconomic Conditions

Whereas every country is unique, South Africa is arguably among the most distinct. In addition to the history of colonisation and apartheid, the country's per capita income is among the highest on the African continent, but the distribution of this is the most unequal in the world (Sulla et al., 2022). Relative GHG emissions show similar patterns (Our World in Data, n.d.), and overall inequalities along racial lines are severe, making the issue multi-dimensional (see chapter 3.3.3). Nevertheless, studying distributional effects in this particular context can contribute to generating knowledge about the underlying mechanisms, as the situation's complexity fosters a more nuanced investigation.

This section summarises and discusses the most important circumstantial factors regulating the links in the intervention theory. Hence, it illustrates the limits to the findings' generalisability and provides an indication of how and why the impacts may differ in other regions. To enable an easier transfer to other contexts, I distinguish between conditions that are either relatively unfavourable or favourable for the country's ability to avoid regressive impacts. This describes circumstances that make South Africa comparatively more or less likely to suffer adverse distributional effects from the CBAM and other BCA policies.

Unfavourable circumstances

There is a large variety of factors making South Africa relatively vulnerable to regressive impacts from BCA. This applies to both identified routes to impact and comprises both larger and more nuanced elements. However, in this section, I avoid reiterating all moderators examined in the intervention theory but focus on exceptional circumstances.

A central aspect is the general susceptibility to carbon price regressivity. As illustrated by the secondary evidence summarised in the previous section (see node 8 in chapter 5.4.2), unlike South Africa, many countries may incur some income losses but are not expected to experience regressive effects from a domestic carbon price. This is crucial as it essentially eliminates the risk of adverse distributional impacts through the carbon pricing route for any region that is not estimated to be vulnerable by these models. Whereas this *vulnerability* comprises multiple socioeconomic elements, energy consumption patterns were identified to be particularly important (Dorband et al., 2019). Since poorer households in South Africa spend a disproportionately large share of their income on (relatively carbon-intensive) energy, regressive impacts result mainly from direct price effects.

Other characteristics of the South African economy and society complement the reasoning for generally regressive impacts from carbon pricing but are more specifically relevant to the route via export reductions in the targeted industries. Exceptionally high existing levels of inequality

themselves, but mainly the underlying factors they resulted from, are contributing to the risk of growing inequities. The legacy of apartheid was unanimously identified by all interviewees as the fundamental reason for South Africa's high inequality and its persistence. Among the extant economic characteristics are a strong focus on mining activities and a lack of industrialisation (R2, R5). This led to a scarcity of semi-skilled and middle-income jobs in manufacturing industries, which could lift people out of poverty and reduce inequalities. The inverse of this is highly relevant to BCA impacts, as the targeted sectors and associated downstream industries provide exactly this form of employment. Hence, job losses in these areas are particularly difficult to compensate (3c). Very high unemployment levels exacerbate this. These are mainly attributed to stark inequalities in the education system and an underdeveloped informal sector (R2).

Further problems result from the reliance on fossil fuels. Lock-in effects in the energy sector and carbon-intensive industries are very pronounced in South Africa (R1). This does not only make its industries more prone to be adversely affected by BCA policies today (1c) but also less able to cope with their effects in the future (1d). A shortage of (dedicated) funding, both within the industries and the government, was identified to be the main reason (R5, R6). While the lack of finance does not constitute a particularity per se, combined with lock-in effects shaped through decades of extractive industrial practices it severely complicates the climate transformation. This circumstance is strongly related to the identified lack of economic adaptability (3b). An additional factor aggravating the ultimate inequality impacts is the multiplier effect due to the traditional household composition, in which one income often supports numerous relatives (R1), disproportionately affecting Black people. Moreover, the workforce composition in the targeted industries is likely to amplify racial inequalities, however, this could not be ultimately verified. Overall, many factors suggest that adverse impacts in South Africa are greater than average, but a few aspects, which are discussed in the next section, likely make it better prepared.

Favourable circumstances

South Africa is relatively well shielded from very severe impacts through BCA policies for a few reasons. Beyond comparatively high economic diversification and the limited contribution of exports in the targeted industries to GDP, there are several broader factors reducing the country's vulnerability. First, technological capacities are considered high, particularly in comparison to other low- and middle-income countries. Established hydrogen industries and Covid-19 vaccine manufacturing were cited as examples of South Africa's ability to react to new developments and quickly implement advanced technologies (R1, R7). This is complemented by a large and reputable scientific community (Sooryamoorthy, 2013). Second, broad institutional capacities can be utilised to facilitate decarbonisation activities. This includes research institutions, industries, and governmental actors. The experiences with the South African carbon tax, in particular, prevent that companies are confronted with fundamentally new requirements. In other countries, the calculation of embodied emissions mandated by BCA policies could pose a substantially bigger challenge (Eicke et al., 2021). Finally, South Africa's climate targets suggest a strong general commitment to decarbonisation and (while not a *socioeconomic* factor) the geographics are considered very favourable for renewable energy generation (Altieri et al., 2016; Fluri, 2009), which aids at least the medium- to long-term readiness.

5.5.2 Relevance of Policy Design

The examination of potential impacts was based on the implementation features as they are outlined in the EU Commission's policy proposal (EC, 2021). As indicated in the previous sections, these policy design details can have very substantial influence on both individual

moderators and links throughout the intervention theory and the overall likelihood of adverse distributional outcomes. This section will appraise the most important policy design decisions and their implications. As the policy is not yet implemented, this exercise is pertinent to both other applications of BCA and the finalisation of the EU CBAM. While the focus lies on the EU policy, I will also briefly discuss the most critical design elements of the South African carbon tax.

Scope expansion

The decision about what is and is not covered by the CBAM has far-reaching implications for its distributional impacts. There are two ways in which the relatively limited scope may be expanded: 1) including more goods, 2) covering indirect emissions. Either expansion would generally increase the risk of higher inequalities through both identified routes, but their impacts unfold differently.

Increased product coverage can entail either more (complex) goods from the targeted industries or the inclusion of further sectors in addition to the five that were initially defined, or both. While the inequality link is not obvious, one general concern with adding more complex goods, raised by an industry representative (R8) and the literature (e.g., Böhringer et al., 2017; Eicke et al., 2021), is an increased administrative burden. This is likely to affect lower-income countries disproportionately, given generally lower statistical capacities. Including more sectors would simply expand the risk beyond impacts from the steel and aluminium industry (1a, 3a) and may strengthen the motivation to increase the South African carbon tax (5b).

A scope expansion by including indirect (scope 2) emissions would affect South Africa mainly through the export route. While it may also increase the incentive to raise the domestic carbon tax (5b), the main effect would likely be on exports of the aluminium sector. As outlined previously, the comparatively high carbon intensity of aluminium (1c) stems primarily from indirect emissions. Since the South African electricity grid is very emission-intensive, this decision would also worsen the competitiveness of any additional product that may be included in the CBAM and relies on electricity as an input.

Revenue recycling

Revenue recycling is one of the most influential levers for policymakers to alleviate distributional impacts of carbon pricing. It also plays an important role when designing the BCA policies. In any case, the exact effects of re-channelling the proceeds from a carbon price depend heavily on what they are utilised for. I will briefly outline the options for the EU CBAM and the South African carbon tax.

Returning the CBAM revenues to the exporting countries or companies can have a significant impact on distributional outcomes. On the one hand, it can directly compensate for losses in competitiveness or accelerate the decarbonisation (1d, 1e) to avoid large export reductions. On the other hand, it could eliminate the incentive to raise domestic carbon prices (5b). If well-designed, it can have positive environmental and distributional impacts. The current proposal of keeping the revenues in the common EU budget arguably disregards the latter.

Revenues from the South African carbon tax can also be re-channelled to offset or reverse regressive impacts of the policy. A price increase resulting from the CBAM would make such a measure even more important. Studies found this to be a highly effective tool, both in general and in the South African context (Alton et al., 2014; Goulder et al., 2019; Okonkwo, 2021), however, as discussed (7a), the way in which the revenues are used is decidedly important and uncertain.

Export rebates

The option to allow EU companies to be refunded for emissions embodied in exports could exacerbate the regressivity abroad. It would eliminate the potential of compensating for the reduction of EU exports in other markets (2b). Even further, it could potentially even slightly decrease export opportunities in other regions, as the EU market becomes less accessible and thereby others more competitive. However, while this policy choice is widely discussed (e.g., Alton et al., 2014; Kardish et al., 2021), it is considered to be likely at odds with trade law (Cosbey et al., 2019).

Implicit carbon prices

Expanding the definition of domestic taxes that can reduce the CBAM prices could partially alleviate the identified regressive impacts. Permitting implicit carbon prices for offsetting affords countries such as South Africa more freedom to choose contextually more adequate and potentially less regressive policy instruments. That could include fuel taxes to foster energy efficiency or the abolishment of fossil fuel subsidies (Finon, 2019; Skovgaard & van Asselt, 2019). In terms of the distributive channels, it would both relatively reduce the carbon prices that industries must pay on EU exports (1f) and allow the government to deliberately form a policy mix without having to rely on (regressive) carbon prices (6c).

Technology transfer

Explicit coupling of the CBAM with targeted technology transfer and international cooperation may help mitigate both global emissions and the negative effects on inequality in exporting countries. While the policy proposal states that the EU should provide "technical assistance" and "stands ready to work with low and middle-income countries towards the de-carbonisation of their manufacturing industries" (EC, 2021, p. 23), it does not provide or indicate any specifics. Some of the interviewed stakeholders interviewed were sceptical about this and emphasised the importance to build and retain capacity within the country (R1, R5). One labour representative argued for a focus on the transfer of skills as a more sustainable alternative (R6). Accompanying a BCA with capacity building is seen as crucial to implementing it in an equitable way (Böhringer et al., 2022; Brandi, 2021). Specifically for inequality concerns in affected countries, it would help with reducing carbon intensities in the medium and long term (1c, 1d) and thereby lessen the risk of distributional employment effects.

Free allowances and price levels

As discussed extensively in the previous chapters, the price that ultimately needs to be paid is crucially important for the likelihood and degree of inequality impacts. For EITE industries, the approach to phasing out the allocation of free allowances is central to determining the effective price levels. Both the policy design on the EU and South African side is highly relevant. For the first impact route, the difference between effective rates determined by the EU ETS and the South African carbon tax moderates the extent to which an export reduction may occur (1f). For the second route, the EU system can influence the levels on the South African end (5b), but domestic decisions about the trajectories of both the tax itself and the exemptions from it are more immediately relevant (6a, 6b).

Whereas the exact price is easier to explicitly determine with a tax than with an ETS, the EU indirectly steers the levels by regulating the total number of emissions certificates. South African authorities can manage the tax levels immediately and could alleviate inequality impacts by delaying or attenuating the price ramp-up. However, this could undermine the environmental rationale of the carbon tax and does not affect the export reduction route. Similarly, the practice of issuing free allowances could be extended. Yet, this would be limited to reducing industry-related impacts (employment and indirect price effects) and not tackle broader distributional

implications. Crucially, if the EU largely maintains its free allowances regime, CBAM impacts through both identified routes would be very limited; however, so would the environmental benefit.

Exemptions and differentiation

Excluding countries with low economic capacities (mainly LDCs) from the CBAM requirements was among the most frequently raised suggestions in the stakeholder consultations and was recurrently addressed by scholars (Lenzi et al., 2021; Mehling et al., 2019). While this could avert the risk of distributional inequities for exempted countries, it would not apply to South Africa as it is classified as a middle-income country (World Bank Group, n.d.-c), despite high levels of extreme poverty. Nevertheless, differentiated price levels better reflecting the CBDR-RC principle (Bauer et al., 2020) could weaken the links along both routes to inequality impacts. Another option revolves around exemptions based on comparable climate ambitions rather than economic capability, which could be operationalised by forming a so-called *climate club* (Leturcq, 2021). However, the legality of differentiation under trade law is doubtful and, while South Africa may be able to join and benefit from the membership of such a climate club, it is mostly seen as complementary to rather than replacing the CBAM (Sartor et al., 2022). Overall, exceptions for South African industries would lessen impacts but are unlikely to materialise.

6 Discussion

This thesis found that adverse distributional impacts of the CBAM in South Africa through both identified routes are likely, validating further examination of these effects. This chapter relates the results to the theoretical framework and previous findings. Additionally, I reflect on the formulated research questions and chosen methodology to answer them. This includes a discussion of this research's contribution and its limitations. Overall, the findings are largely aligned with theoretical assumptions and the limited generalisability is balanced by providing a framework for the investigation of other contexts.

6.1 Results in the context of theory and prior knowledge

A comparison of my results with findings from previous studies is complicated by the absence of research examining distributional impacts within countries that are affected by BCA policies. Instead, I will embed the insights derived from this analysis in the surrounding literature and discuss them in the context of applied concepts and related previous findings.

The research on distributional implications of carbon prices was central to this thesis' initial hypothesis that BCA could result in regressive outcomes as well. While this literature focuses on domestic carbon taxes and emission trading systems, my results suggest important analogies for the CBAM. First, the distributional outcomes of carbon pricing are very context-dependent and subject to many influencing factors (Ohlendorf et al., 2021). Similarly, the multitude of moderators across the intervention theory and relevant country specifics identified in chapter 5.5.1 indicate the same lack of a simple cause-and-effect relationship. However, this applies differently to the two routes via which outcomes may occur. Whereas impacts through export reductions are mainly limited to the distributive channel of labour market responses (Antosiewicz et al., 2022), effects from motivating domestic carbon taxation comprise all channels. A comprehensive analysis from Dorband et al. (2019) shows that progressive outcomes in lower-income countries primarily result from differences in energy consumption patterns. It is therefore likely that the direct effects from BCA through output reductions, which do not affect energy prices, are comparatively more regressive (in these contexts).

Another related academic discourse grapples with the distributional implications of BCA policies, yet only between countries rather than within. Many studies predict burden-shifting from implementing to exporting countries, both for the instrument in general (Böhringer et al., 2012; Steininger et al., 2014; Thube et al., 2021), and the EU CBAM in particular (UNCTAD, 2021). This implies that affected regions on average suffer output reductions either directly from decreased exports in targeted sectors or associated multiplier effects. In terms of the introduced intervention theory, this represents the first link (node 1) between the policy implementation and reduced output. Hence, the detailed cause-and-effect chain developed in this thesis could be used to augment and further inform these usually quantitative considerations. Additionally, these findings suggest that, depending on the specific context governing the links around workforce reductions, these prevalent declines in GDP could translate into higher within-country inequalities.

Discussing this thesis' results against the background of general fairness and justice considerations is important for evaluating their broader relevance. The previously introduced international principles of international (climate) policy (see chapter 2.4) are highly pertinent to this. My findings suggest that the principle of common but differentiated responsibility (and respective capabilities) (CBDR-RC) is not sufficiently recognised by the CBAM proposal. The policy violates it by establishing an incentive to enact carbon prices equivalent to the ones paid in the EU, a region which is among the most affluent and historically most responsible for climate change. As Bauer et al. (2020) argue, even without considering historic emissions,

uniform carbon prices would be severely at odds with this concept. However, as shown by tracing the second impact route in the intervention theory, this could be at least partially rectified by re-channelling the revenues from the policy as this would weaken the incentive for domestic taxes and lessen the burden-shifting.

The other principle the CBAM potentially infringes upon is state sovereignty. Even though carbon pricing instruments are considered to be a less suitable instrument in developing economies (Finon, 2019; IPCC, 2014) and generally most effective as part of a broader policy mix (Tvinnereim & Mehling, 2018), the EU policy only allows explicit carbon prices for offsetting against the CBAM obligations. This was identified as an integral part of the policy design. Changes to it (e.g., by acknowledging implicit prices or comparable ambition of targets) could help mitigate the distributional impacts and in addition uphold the sovereignty of each state to determine adequate context-sensitive climate policies. As BCA unilaterally determines carbon prices beyond the implementing entity's jurisdiction, to a degree, it fundamentally interferes with state sovereignty. However, high-income countries including consumption-based emissions in their policy considerations is arguably essential from a fairness perspective (Baker, 2018). If this is approached collaboratively and accompanied by financial and technological support to facilitate the transition, such a policy can be seen as equitable. Yet, a lack of details about technology transfer and capacity building in the CBAM proposal as well as the disregard for impacts outside the EU (see chapter 5.1) suggests that the policy fails to meet these criteria.

As this thesis found likely adverse effects on distributional outcomes in South Africa, a country with very high existing inequalities, it is doubtful whether the CBAM is compatible with distributive justice concerns. While the context-specificity was established and the magnitude of impacts may be limited, it is unlikely that the CBAM contributes to reducing unjustified inequalities. However, policy design decisions, e.g., about revenue recycling, were shown to have the potential to reverse these impacts.

Whereas research specifically studying within-country distributional effects from BCA is missing from the literature, one study developed an elaborate framework to assess the relative risk of different countries being adversely affected by the CBAM. Eicke et al. (2021) examined the exposure and vulnerability to the EU policy deriving a risk index based on five indicators: EU exports in the targeted sectors relative to GDP, sectoral exports relative to total exports, statistical capacity, carbon intensity, and emission reduction targets. These measures and the underlying information the authors aim to capture constitute a subset of the data I integrated for constructing the intervention theory[14]. There are two central differences between the two approaches. First, the risk index comprises far fewer variables and moderators. Second, the indicators are less specific (e.g., economy-wide instead of sector-specific carbon intensities). Both is justified by the study's focus on comparability (and quantification) instead of an in-depth analysis. While my analysis includes context-specific qualitative considerations and a second route to impact, both assessments find that South Africa is vulnerable to adverse impacts from the CBAM. Eicke and colleagues (2021) estimate it to be more at risk than at least 80% of other countries examined. This can give an indication and complement my considerations of context-specificity to assess the generalisability of this thesis' results.

My research approach and the kind of insights generated as a result are well-aligned with other authors' findings and methodological considerations. Applying theory-based evaluation to

[14] That is with the exception of *statistical capacity*, which is used as a proxy for how prepared companies are to measure the embodied emissions. Being ill-prepared would suggest a high additional administrative burden. That this was not a central issue for South African stakeholders is not surprising, as the domestic carbon tax requires this already.

climate policy is not very common, especially as an ex-ante analysis. However, as discussed by Román et al. (2012), the logic underlying an intervention and its contextual setting are decisive aspects that theory-driven approaches can shed light on. Understanding the policy on these levels is a precondition for targeted design and being able to empirically contrast effects between different contexts. Besides confirming the general risk of regressivity, these aspects of context-specificity constitute the main outcome of my research. While tracing the logical chain was integral to the process (Weiss, 1995), explicating the mechanisms in detail allowed me to move beyond simple cause-and-effect relationships (Astbury & Leeuw, 2010). Further, evaluating programmes that facilitate (environmental) sustainability transitions is considered particularly complex (Mickwitz et al., 2021). Corroborated by the methodological conclusions drawn in other climate policy evaluations (McConnell, 2019), this further justifies my focus on fundamental mechanisms instead of aiming for quantification.

On a broader level, my findings are consequential for global approaches to tackling climate change as well as the general discourse around sustainable development. The EU's failure to take into account impacts outside of its jurisdiction (as shown under RQ1) can have serious implications for the negotiations under the UNFCCC. Such unilateral climate policies adversely affecting third countries could undermine international cooperation. It can be questioned whether the Paris Agreement and subsequent negotiations are sufficiently comprehensive and concrete. However, inconsiderate one-sided climate action by the affluent has the potential to alienate lower-income countries and, as a result, fail to meet both global mitigation targets and justice requirements (Suh, 2022). My results can also serve as a starting point or additional example which warrants further investigation of the nexus between economic relations and the environment. This could entail challenging traditional development narratives and institutions and assessing them for issues ranging from ecologically unequal exchange to neocolonial trade patterns (Dorninger et al., 2021; Infante-Amate & Krausmann, 2019; Sultana, 2022).

Ultimately, the central dilemma that international climate policy needs to solve lies in the inverse relationship of countries' degree of being responsible for and affected by the consequences of climate change (Althor et al., 2016; Füssel, 2010; Hussain et al., 2020). While my thesis does not address this directly, the circumstance is essential for the conclusions drawn from it. Income levels are a central determinant of adaptive capacity (IPCC, 2022b). This applies both to mitigation and adaptation efforts as well as across and within countries. Consequently, integrating equity considerations and redistribution into the policies for the climate transition is essential.

6.2 Strengths and limitations

In retrospect, I would have approached a few parts of this research differently. Overall, however, the methods and research questions were appropriate to generate meaningful knowledge and meet the aim of this thesis.

Studying the risk of distributional impacts by utilising the framework of an intervention theory was appropriate for answering the research questions. The central benefit of this approach lay in its openness and the comprehensive coverage of potentially regressive impacts. While starting out with a general hypothesis – derived from literature – about how distributional outcomes may result, iteratively building and testing the logical chain helped to avoid prematurely narrowing in on a specific mechanism. This approach of integrating the intervention theory's construction into the analytic process and interpreting it as a result in itself helped to ensure that the details would receive adequate attention. Using not only academic literature but also initial stakeholder interviews to refine the theory and identify relevant links and moderators made the analytic structure more robust. It allowed me to modify and enhance the guide for subsequent interviews and collect secondary data and background information more purposefully.

However, the attempt to study the identified routes to impact comprehensively involves an important trade-off. It was not feasible to examine every moderating variable exhaustively. Therefore, some of the individual links and conditions remain subject to significant uncertainty. An alternative approach would have been more suitable to generate more tangible or quantified results. For example, focussing on the first impact route (via export reductions) and utilising econometric models to calculate exact changes to a given inequality indicator could have produced more palpable insights. Even without ultimately quantifying the impact, concentrating on particular empirical links or subsections of the theory and attempting to gather more granular data (e.g., on the emissions intensities or trade flows) constitutes a viable alternative to generating insights related to this thesis' aim. Yet, neither approach would have been able to considerably remove uncertainties about distributional implications of the CBAM in South Africa. This is because of the high degrees of ambiguity inherent to the policy, as it operates in complex settings and outcomes are contingent on still pending design decisions (chapter 5.5).

The main difference between my chosen methodology and the other outlined options is the degree to which they aim to definitively predict inequality effects. Using the intervention theory, I achieved to explicate the underlying mechanisms that determine the distributional outcomes of the CBAM. Since research on this particular issue was previously missing, elucidating the relationships and cause-and-effect links was necessary to enable a complete assessment. After assembling the framework, I examined the individual connections to gauge a general likelihood of adverse effects in the studied context. Therefore, the different analytical approaches should not be understood as substitutes but rather as complements that provide the most accurate picture in conjunction. Having established both a general risk for negative effects in South Africa and a structure that can be adapted for different contexts, future research can elaborate on individual links and quantify likely effects.

Examining potential impacts through the second route via generally increased carbon prices was methodologically less controversial. The main component that is specific to the impact of the CBAM (i.e., whether the EU policy contributes to higher domestic carbon taxes) is not calculable but needs to be assessed qualitatively. Yet, the subsequent question about the distributional impacts of a higher South African carbon tax is quantifiable. My decision to not model and compute these impacts myself but rely on secondary evidence appears appropriate. Given the sizable literature examining the regressivity of a comprehensive carbon price in the South African context, conducting another study about this would have distracted from the core of this thesis and likely not produced any additional insights.

Other important choices about the research process were more general. The decision to separately investigate the South African approach to revenue recycling within the intervention theory created a slight inconsistency since policy design elements were usually discussed in chapter 5.5.2. However, as the focus of that chapter lies on the CBAM policy design rather than that of the carbon tax, this exception is defensible and proved useful for evaluating this route. Furthermore, the structure of the intervention theory was useful to keep the analysis and its presentation organised. While some classifications as *determinants*, *outcomes*, or *moderators* seemed arbitrary and other configurations could have been chosen, the developed framework including the separation of actors and mechanisms (action and change model) generally provided the necessary guidance. Overall, the methodological, theoretical, and analytical decisions were mostly conducive to achieving the goals of this research.

The legitimacy of the defined research questions and the degree to which I managed to answer them requires further deliberation. Acknowledging the limitations of the methodology

(including the type of information interviews can only generate), in general, the RQs[15] were satisfactorily answered, complemented each other in the way it was envisioned at the outset, and contributed to the overarching aim of this thesis. However, some facets of the analysis would have benefited from further elaboration or additional data. RQ1 represents a kind of an outlier in the research design. Its examination did not directly add to solving the defined problem. However, it derives its legitimacy from lending additional credibility to the problem. While it was narrowly defined, answering RQ1 played an important role in further motivating the research. Whereas expanding the scope to less official documents was possible, this would have made the findings only marginally more reliable.

RQ2 and its two sub-questions constitute the core of the research design and their answers are correspondingly central to this thesis' aim. Nevertheless, the "effects on inequalities" were not intended (and are probably impossible) to be determined definitively. Instead, I aimed to shed light on how adverse impacts could and how likely they are to occur. The progress regarding RQ2.1 is represented by the explication of the cause-and-effect chain and moderating variables through comprising and relating different sources. Further mechanisms than the ones included in the intervention theory exist (e.g., the CBAM generally accelerating decarbonisation in absence of just transition considerations) but are unlikely to entail significant (negative) distributional effects. While the relationships between the different moderators and how they relate to different actors could have been made even more explicit, the underlying logic was discussed extensively.

RQ2.2 was slightly less comprehensively answered. However, I collected at least indicative (qualitative and quantitative) data for each moderator and condition to estimate their influence. These assessments can now be refined and expanded. Yet, the degree of certainty varies substantially, and some links are quite speculative. Additional data could have amended these shortcomings. The lack of access to industry representatives is the main source of uncertainty. While I tried to compensate for this gap by consulting public documents from and about the steel and aluminium sectors, future examinations would benefit from including the views of the affected industries more extensively. Related to this, I was not able to obtain company or industry-specific data on the workforce composition. This limited the potential to generate more tangible insights about the different dimensions of income inequality (such as race, gender, and region). In absence of publicly available statistics, immediate contact with company officials would aid further investigations.

The answers to RQ3 were integral to contextualising the findings. Studying a specific case involves a prioritised focus on internal validity (i.e., that the findings accurately describe the particular setting), which was practised throughout the exploration for RQ2. Nevertheless, dissecting the situation to grasp its context-specificity is crucial for both a deeper understanding of important circumstances and an appreciation of how impacts may differ for other regions (than South Africa) or other policy implementations (than the EU CBAM). Both RQ3.1 and RQ3.2 were answered successfully though not conclusively. Chapter 5.5 summarises important (socioeconomic and policy design) factors influencing the distributional outcomes in the studied context. However, these aspects must necessarily result in a simplification. The South African social environment with its unique history of apartheid constitutes a distinct example of how complexity renders a perfect transferral to other situations unattainable. Overall, important factors were pointed out to place the findings in a broader context. Using variations of the

[15] RQ1: How is the risk of increased inequalities in exporting countries represented in the EU CBAM policymaking process?
RQ2: What are the likely effects of the EU CBAM on inequalities in South Africa? (2.1: mechanisms; 2.2: likelihood)
RQ3: What context-specific factors determine the likelihood of the CBAM affecting inequalities in South Africa? (3.1: socioeconomic conditions; 3.2: policy design)

selected research questions could enhance the external validity of the findings, either by asking about the extent to which the factors influence distributional outcomes (i.e., their relative importance) or by investigating the impacts of BCA more broadly rather than examining a specific policy.

The sensitivity of my findings to context-specific factors was extensively discussed in chapter 5.5 (and, to a lesser extent, in the previous paragraph). Altogether, many important circumstances are unique to the effects of the EU CBAM in South Africa. My findings about likely distributional impacts are therefore not generalisable and cannot be assumed for other regions or applications of BCA. However, another output of my research can be utilised to enable the translation of results. The constructed intervention theory offers a framework for examining distributional implications of BCA and can be easily adapted for different contexts. In addition to gauging the likelihood of inequality effects in South Africa, this is a central contribution of this thesis.

7 Conclusions

The problem addressed in this thesis can be summarised as a lack of research about and a risk of adverse distributional effects from BCA policies. After studying how the EU CBAM could influence inequalities in South Africa, I conclude that negative impacts are likely to occur, warranting further investigation. I determined two routes through which adverse effects result: 1) by reducing exports in targeted sectors leading to lay-offs, and 2) by motivating higher domestic carbon prices which may be regressive. Either path is shown to be highly dependent on the policy design and the country-specific context. Consequently, BCA can have distributional implications. However, if policymakers are attentive to this risk, this can be mitigated or even avoided.

7.1 Empirical Conclusions

This thesis achieved its overarching aim to elucidate the CBAM's impact on inequality in South Africa. The main empirical conclusions derived from the analysis are presented in this section as answers to the research questions that guided this study. Subsequently, I demonstrate their importance and implications for policymakers, before presenting methodological conclusions and outlining future research avenues.

RQ1: *How is the risk of increased inequalities in exporting countries represented in the EU CBAM policy process?*

Official documents from EU institutions do not consider the threat of adverse distributional impacts in countries affected by the policy. While the Commission's impact assessment examines the risk of regressive outcomes, this is limited to EU member states and does not cover exporting regions. As part of the stakeholder consultation process, some contributors warned about these effects, but this was not incorporated by the policymakers.

RQ2: *What are the likely effects of the EU CBAM on inequalities in South Africa?*

It can be concluded that the CBAM (as it was proposed in July 2021) would be regressive in the South African context. However, this refers to the direction and does not imply very sizable effects on a national level. Direct impacts from lay-offs in targeted industries are likely to be locally concentrated, whereas effects from a carbon tax increase are more widely spread. Particularly vulnerable groups (across race, gender, and region) are assumed to be affected disproportionately, yet in absence of granular data, this is difficult to conclude with certainty.

RQ2.1: What are the mechanisms through which these effects can occur?

The CBAM's distributional impacts ensue via two different routes. First, export reductions result in employment effects in the targeted and associated industries. Second, employment and price effects follow from increases in the domestic carbon tax, motivated in part by the EU policy. The complex underlying mechanisms were explicated in form of an intervention theory.

RQ2.2: How likely are these to occur?

Along both identified routes, several moderators and conditions regulate the ultimate outcome. Their interconnection and residual uncertainty about individual links prevent a definitive assessment. However, based on the examination in this thesis, adverse effects seem likely. Direct impacts from reduced exports are probably limited, though strongly depending on the policy design. Effects from increased carbon taxes, however, are potentially larger and, arguably, have already started to occur resulting from the CBAM's announcement.

RQ3: *What context-specific factors determine the likelihood of the CBAM affecting inequalities in South Africa?*
The studied case is unique for many reasons. In other countries, the same policy can have vastly different impacts. Similarly, the way in which BCA is designed and implemented can be decisive for distributional implications in any region.

RQ3.1: What socioeconomic conditions in South Africa are relevant?
South Africa is particularly susceptible to carbon prices triggering regressive income effects. This is mainly attributed to energy consumption patterns. Additionally relevant to the route via export reductions, a historical lock-in to a carbon-based economy with a high emission intensity expands this vulnerability to the labour market. Elevated unemployment rates, vast differences in education levels, and a scarcity of semi-skilled jobs limit the capability to compensate further lay-offs. Finally, extreme and multi-dimensional inequalities, largely an apartheid legacy, aggravate the impacts of any additional regressive effect.

RQ3.2: Which aspects of the (CBAM's) policy design are relevant?
Decisions about revenue recycling and scope definition are central to the policy's distributional impacts. Whether and how the revenues are re-channelled influences both the competitiveness in exporting countries (route 1) and the incentive to raise domestic carbon prices (route 2). Applied purposefully, it can eliminate regressivity altogether. In contrast, expanding the scope to more products and indirect emissions potentially exacerbates impacts. Additionally, all decisions shaping the effective price levels are important, and a combination with technology transfers can alleviate adverse effects by supporting the (industrial) climate transition.

7.2 Recommendations for Policymakers and Practitioners

The results of this thesis have important practical implications, primarily for policymakers from South Africa and the EU. Reaffirming a general caveat about carbon pricing, my findings show that it requires careful implementation to avoid negative impacts on social equity. While ambitious climate policies and international approaches are needed, their application mandates coordination and thorough consideration of effects beyond the policymaker's jurisdiction. As the CBAM is not yet in effect and its design being finalised, lawmakers can still adjust the policy to address concerns about inequality impacts in exporting countries.

EU policymakers should aim to ensure equitable outcomes. One of the most effective means to avoid regressive effects is to re-channel the revenues to the exporting countries. This could help facilitate decarbonisation activities, provide funds to mitigate adverse distributional outcomes and lessen the incentive to raise (potentially detrimental) domestic carbon prices. Another way to strengthen the industry transition is to couple the policy with allocating additional technological or financial resources to build local capacity. Acknowledging the need to maintain WTO compliance, exemptions or differentiated price levels for lower-income countries could be considered and other ambitious non-price climate policies recognised. To preserve the policy's environmental integrity, export rebates should not be granted and free allowances phased out. However, as the latter can increase pressures on third countries, the additional revenues should be earmarked to mitigate this. Overall, increased attention to inequitable policy outcomes outside of the EU appears necessary.

South African policymakers, in addition to promoting the aforementioned CBAM design characteristics, can contribute to avoiding regressive impacts in multiple ways. To ameliorate the position of local industries to remain competitive in view of increasing global climate standards (and thereby avoid adverse impacts through route 1), the government should

accelerate decarbonisation activities. As future scope expansions are likely (and a comprehensive transformation necessary), this should not be limited to steel and aluminium industries but comprise the gradual removal of all trade-offs between economic and environmental concerns. To facilitate this, the policy mix should be diversified and an over-reliance on the carbon tax avoided. Given South Africa's susceptibility to regressive impacts from this instrument, any increase should be accompanied by targeted redistributive measures.

7.3 Recommendations for Future Research

This thesis provides a foundation for future research to expand on the generated findings. It further serves as an example of the versatility of theory-driven policy evaluations. Based on my discussion and methodological conclusions, I suggest ways in which researchers can increase and further refine the knowledge about the distributional implications of BCA in different contexts.

By productively utilising an intervention theory for the ex-ante investigation of this policy, I showcased how flexibly this tool can be applied. Particularly, the combination of a predictive approach with the focus on a negative side-effect far removed from the policy goal constitutes an original methodology. The selective application of useful elements instead of a full-fledged evaluation proved very suitable and allowed me to study the mechanisms comprehensively while avoiding distractions. Overall, using concepts from social science theory (such as justice and equity) as a backdrop to the analysis added an important dimension and substantiated its importance.

This thesis has two principal outputs. First, I provide evidence that the CBAM and like policies have the potential to adversely affect inequality outcomes in exporting countries. Second, I establish a framework in form of an intervention theory that explicates the underlying mechanisms. The main avenues for future research consist of either adapting the intervention theory and expanding the scope to other contexts (regions and/or policies) or narrowing in on sub-sections of the cause-and-effect chain and testing them in more detail. Particularly the direct impacts (route 1) could be examined through a quantitative model and incorporate different scenarios (e.g., scope expansion). Other alternatives are an in-depth analysis of specific links and, eventually, the adaptation for an ex-post evaluation.

Overall, the risk of adverse distributional effects from BCA was confirmed and should therefore be subjected to further investigation.

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Appendix

Appendix I – Interview Guide

This structure indicates the broad range of questions and themes I discussed with the interviewees – however, as described in the methods, the was a lot of variation depending on the stage of the process and the particular interviewee.

- Importance of steel and aluminium industry for:
    - South African economy
    - Fighting poverty and inequality in SA
- Adaptability of SA economy
    - Potential for substitution through green jobs
    - Skill of workers in the targeted industries
- View on inequality in South Africa
    - Reasons
    - Different dimensions
        - Regional (by provinces / rural vs urban)
        - Gender
        - Race
    - What factors make it vulnerable to increased or persistent inequalities?
    - How are other policies relevant to inequality?
- Effect of carbon tax on inequality in South Africa
    - How does it relate?
    - Part of consideration
- Industry readiness to decarbonise
    - What are the barriers?
    - How to overcome them?
    - How are aluminium and steel different?
    - Role of technology transfer
    - Role of other forms of cooperation

Policymakers:

- How does the EU proposal relate to SA carbon tax and its trajectory?
    - General price levels
    - Differentiation by industry
    - Differentiation between domestic and export
    - What are the barriers to raising it?

Industry representatives:

- Effect on overall competitiveness / production:
    - Administrative burden
    - Effect on employee situation (potential layoffs)
        - If layoffs, what kind of employees (direct/indirect workforce)?
    - Which locations most likely affected?
    - Potential to expand to other markets
        - Scenario with and without export rebate
    - Technology potential (e.g., green hydrogen)

Appendix II – Consent Form

This form was sent to every participant in advance and collected afterwards.

Distributional implications of the EU CBAM in South Africa
Jannick Leukers

INTERVIEW CONSENT FORM

This form is to ensure that you have been given information about the research project and to give you opportunity to confirm that you are willing to take part in this research. For all activities below, please indicate (with X) which applies to you:

	I have been **familiarised** with the thesis project, I have had the possibility to ask questions and I have received satisfactory answers to my questions.	
	As a research participant, I am **aware of my right** to withdraw participation at any time.	
	I give my consent that the **content of my interview can be transcribed, analysed, and published** in research outputs for the project.	
	I give my consent to be **identified by my position in the organization**	
	I give my consent to be **identified by my organization**	
X	I give my consent to be **identified as:**	
	I give my consent that the interview can be **audio-recorded**	
	I give my consent that an **audio-record of my interview** can be safely stored for future reference.	

Note: Your participation is voluntary. As an interviewee, you do not have to answer all the questions that are asked; you reserve the right to refuse or cease participation in the interview process without stating your reason and may request to keep certain materials confidential. At any stage of the research (until May 20, 2022), you have a right as a research participant to gain access to your own personal data, request its correction or deletion or limitation to processing of data as well as file a complaint about how your personal data is used.

Please, sign below to confirm your consent:

Participant	
Signature	
Date	

For any enquiries regarding this research, please contact:
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Appendix III – Examined Policy Documents: Overview and Links

All documents from the European Commission and the stakeholder submissions are available on the participation website under the European Green Deal. The Parliament and Council are referred to separately.

	Time		Document by	Links
2020	04 March	1	Inception Impact Assessment European Commission	https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12228-EU-Green-Deal-carbon-border-adjustment-mechanism-_en
	04 March - 01 April	2	Feedback Period: Submitted Documents Stakeholders	
	22 July	3	Public Consultation: Survey European Commission	
	22 July - 28 October	4	Public Consultation: Submitted Documents Stakeholders	
2021	05 January	5	Public Consultation: Summary Report European Commission	
	23 April	6	Regulatory Scrutiny Board Opinion European Commission	
	14 July	7	Regulation Proposal (plus Annexes) European Commission	
	14 July	8	Impact Assessment Report European Commission	
	15 July - 18 November	9	Feedback Period: Submitted Documents Stakeholders	
	21 December	10	Draft Report European Parliament - Committee on the Environment, Public Health and Food Safety	https://www.europarl.europa.eu/doceo/document/ENVI-PR-697670_EN.pdf
2022	15 March	11	Draft Regulation Council of the EU	https://www.consilium.europa.eu/en/press/press-releases/2022/03/15/carbon-border-adjustment-mechanism-cbam-council-agrees-its-negotiating-mandate/

Appendix IV – Pre-study

On the following pages, I include the study conducted in a preparatory course in *Applied Research* from December 2021. Herein, I tentatively investigate social implications of BCA mainly by examining the EU CBAM consultation process.

As this paper was not published, I make it accessible here.

To reduce the size of this file, the paper is omitted in this version – for access please reach out to me under jleukers@posteo.de