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Carbon Fee Dividend and Public Acceptance for Increased Climate Taxes

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Abstract

The failure of undervalue or unpriced externalities, such as emissions, have led us to an unsustainable path that threatens our environment, our overall welfare and economic growth.

To make the transaction to a “green economy” as efficient as possible, could policymakers through the usage of policy instruments, increase prices on fossil fuels. However, previous attempts and studies show that there is a general public resistance over increasing prices on fossil fuels to a level that is coherent with the social cost. A key issue for policymakers is therefore to gain public acceptance over increased prices on polluting products. Environmental economists have for decades tried to create the “perfect” policy design that yields most benefits, to further gain public acceptance. However, as complexity of these policies have increased, more oppositional arguments and alternatives have emerged. This has made the process of implementing environmental policies a complex, and costly matter.

The studies by Aasen et al (2019) outlines that the vast majority of the Norwegian population see climate change as a comprehensive issue, however that they do not want their own economy being affected by the “green shift”.

The aim for this thesis is thus to present a proposal on how Norway could gain public acceptance over the implementation of a more ambitious green tax reform in the context of reaching their climate goals by 2030. Implementing a policy design where all the revenue is distributed back to the public, such as the “Carbon Fee Dividend” design, will eliminate many of these hurdles that have been correlative with the present tax system. Goulder (1995) argues that a revenue-neutral policy almost always will achieve the environmental objective, as well as being highly cost-saving. The simplicity of the design, and the perceived ease to mobilize for such a tax scheme, indicate a rapid implementation process. Given scientists' increased concern over current insufficient emission reductions, suggest the need for fast implementation of effective policies.

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List of acronyms and abbreviations

CFD - Carbon Fee Dividend
EU - European Union
EU ETS – European Emissions Trading Scheme
CO_2 – Carbon dioxide
SSB – Statistics Norway (Statistisk Sentralbyrå)
OECD – The Organisation for Economic Co-operation and Development
CAT - Cap And Trade
SF - State Enterprise
The Storting - The Norwegian Parliament
The Regjering - The Norwegian Government
MAC – Marginal Abatement Cost
MD – Marginal Damage

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1. Introduction

Decades of pollution has made our entire ecosystem unbalanced. Since 1956, global temperature has increased about 0,13°C each decade, something that is twice the rate than the last 100 years (Pearson, 2011, p. 9). The continued heating of the world could lead to catastrophic events, and a perceived tipping point is near. We already see how the 1°C of global warming has caused more extreme weather, rising sea levels and diminishing Arctic sea ice, among many other effects (IPCC, 2018). We need immediate and effective political measures in terms of keeping global temperature rise below 2 degree Celsius and reduce comprehensive impacts on both welfare and environment.

The Global Climate Agreement from 2015 indicates that all countries must cooperate for cutting our emissions (IPCC, 2018). However, most countries have failed to follow up on their commitments of more ambitious climate policies (Climate Tracker, 2020).

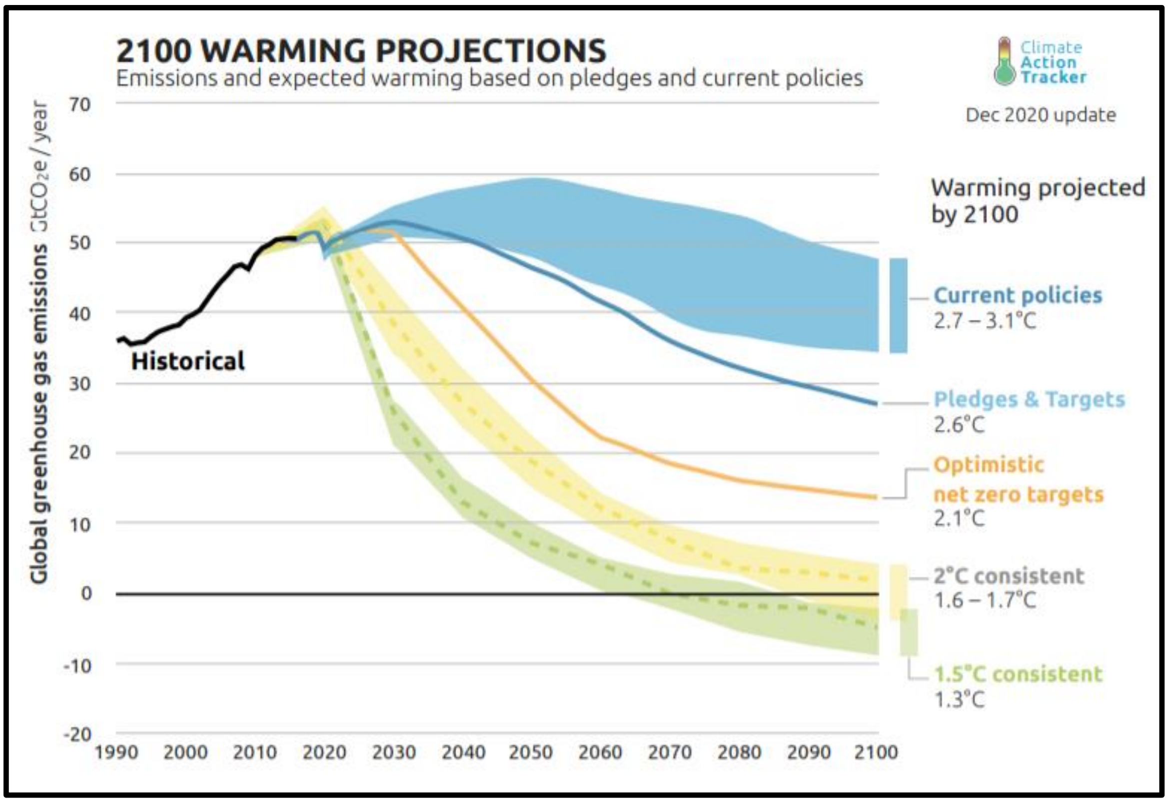

Figure 1.1: *Current policies prediction, pledges and targets, and the Optimistic net zero target. The Optimistic net zero target of 2,1°C target is the "best guess" scenario, and has 50 % chance that it could be lower, and 50 % chance that it could be over. This is the most optimistic scenario of climate change and policies effects (Climate Action Tracker, 2020).*

As projected in figure 1.1, we are on the path of reaching a global warming of 2,7-3,1°C. This indicates the need for new policies to reach the climate goals (Climate Action Tracker, 2020). Increasing fossil fuels prices by making the polluter pay for the externalities, could help this change to be less comprehensive and expensive for society. As economists see taxes as the planning instruments that "profit maximization" automatically guarantees total output will be efficiently produced (Weitzman, 1974).

Gaining public acceptance over increased prices on fossil fuels is therefore policymakers focus. However, previous attempts of increasing prices have caused opposition. This is something president Macron over France witnessed, with the "Yellow-west demonstrations", where middle and lower class citizens demonstrated against higher prices on fossil fuels and essentially an unfair distribution of cost (Cigainero, 2018). Increasing prices on fossil fuels through a price or quantity instrument can in many cases create a greater cost on the lower classes, compared to initial cost-to-income. Therefore, policymakers should consider the effect on distribution of wealth when introducing a new policy. To increase public acceptance over effective environmental policies, environmental economists have for decades tried to outline benefits and costs to find the "perfect" environmental policy design that both reduces emissions and stimulates the economy (Bovenberg, 1999; Sandmo, 2004). This example from France illustrates the importance of choosing a policy design that more easily can be implemented.

Unsustainable path

The failures of not including externalities through governmental intervention and use of effective economic instruments, have led to the accelerating crisis of climate change, as well as increasing social costs. This has led to a difference between private returns or costs, and the returns and costs to society as a whole (IMF, 2017). Fossil fuels are the dominant and cheapest energy source because environmental and social costs are not internalized into the price (Hansen, 2015). As Arthur Pigou already stated in 1920, a failure of including externalities in the price would lead to an inefficient market (Pigou, 1920).

This market failure has led to immense prosperity and profit for the fossil fuel industry, however at the expense of our future. This has increased the inherent risk that we could be on a unsustainable path. (Kapp, 1971; Nicolaisen, 1991).

Since environmental externalities often go across generations, policymakers calculate a trade-off between the optimal strategy that considers both the present- and future generation, and the intertemporal dimension of our emissions. However, as future generations lack a voice in today's policymaking, Perman et al. (2011, p. 183) argues that they have a clear disadvantage in terms of arguing for their case. This has led to unfair policies that have favored present prosperity instead of long-term effects of our actions (Perman et al., ibid). The inactions of previous policymakers, and following the stock effects of our emissions, has therefore made the green shift more comprehensive and expensive (Wallace-Wells, p. 18; IPCC, 2018). This suggests an increasing opportunity cost of not materializing a green shift.

So the key question is; who is going to pay the price for fossil fuels companies' lack of internalising externalities in the price of their products?

As the Figure 1.2 shows, the “Optimum” is where the private and external costs are implied in the costs (IMF, 2017). This gives higher prices and lower demand for the products and further on less consumption and hence less emissions. This is the main goal of policymakers.

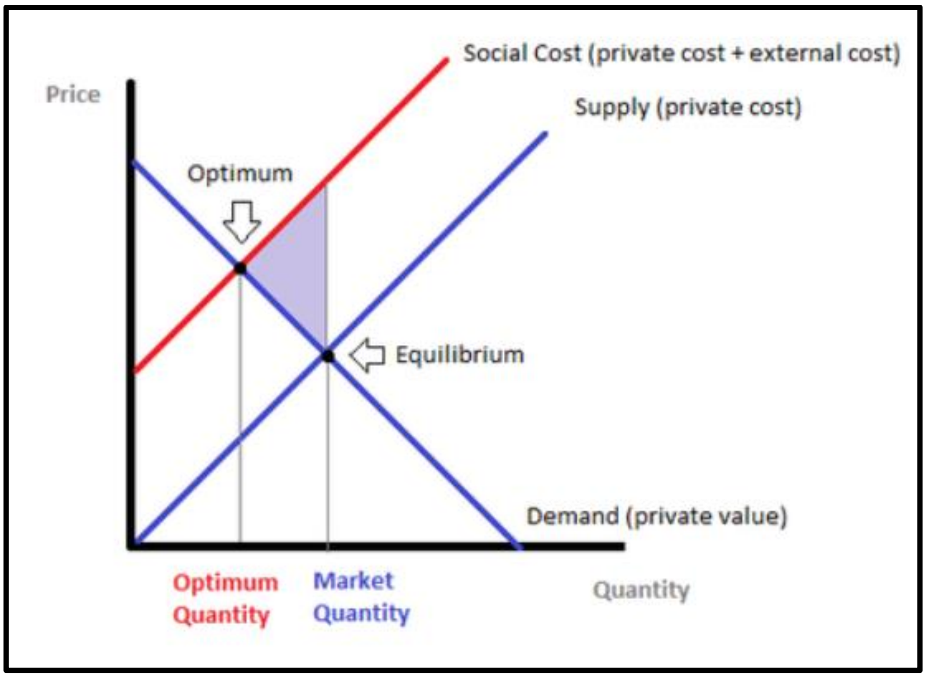

Figure 1.2: *Marginal abatement costs and damages, and the optimal emission level.*

“Equilibrium” is where the price and market quantity is calculated excluding the external cost. This represents the level of quantity in an insufficient market, since external costs are not internalised in the price and further distributed to the society as a whole (IMF, 2017). The purple triangle represents the welfare losses from not internalising external costs.

EU ETS system

The last decades, EUs emission trading of carbon quotas has been the EU's cornerstone to combat climate change. The system covers around 45 % of all greenhouse gas emissions in the EU (European Commission, nd). This cap and trade system was created so companies could, without too much government intervention, lower the total amount of emissions. Minimum governmental interference, and a promise of a slow decrease in emission cap, led to an somewhat uncomplicated implementation. The main idea of the system was that the price should represent the real price of emissions or the cost of a green transition (marginal abatement cost) (Pearson, 2011. p. 133). From a theoretical point of view and complete certainty concerning cost, the result of both policies should lead to the same results. However, because of market fluctuations, such as the global economic crisis in 2008 and lack of data, the supply of quotas has been too high, something that has created low permit prices and hence weakened the incentives for reducing climate gas emissions. This has lowered the effectiveness of the EU ECTS policy and failed to provide sufficient incentives for companies and consumers to change their behavior.

One of the main issues considering the "Cap and Trade" model, is that the model is vastly more complicated and expensive to operate compared to a price policy such as carbon tax (Pearson, 2011, p. 134). However, an essential flaw of the system is that a quantity policy provides an unclear price signal and does not provide any incentives for lowering emissions more than the set cap. This is due to fluctuating quota prices, and policy makers' inability to set a sufficiently low emission cap.

Variable prices of emission reduction can lead to unnecessary expensive small cuts when the prices are high, and unnecessary high emission to low profits when the price is low (Blyth et al., 2017). This can further lead to short-time solutions and less long-time investments, such as improving energy-efficiency and innovation.

The variable prices dilemma, the complex nature of the ETS system, and the market fluctuation uncertainty, may be enough to suggest that a flat and dynamic carbon tax will be a more effective instrument to reach the UN 2030 climate goals (Pearson, 2011, p.134). However, the EU ETS seems to be ingrained, and going to be the policy EU is utilizing for lowering the emissions. Given the EU's experience of ETS in the last decade and promise of a more effective cap of emission, we could assume more effective emission reduction in the future (European Commission, 2020; Regjeringen, 2020a). Since 55 % of the EU's emissions are not under the ETS, domestic measures are almost as important to reach the UN 2030 climate goal. However, domestic measures could suffer under many potential implications, something I will further outline in this paper.

The case of Norway

Norway is an excellent case study because of the overall high public trust in government, high support in environmental protection and a great possibility of a second dividend (Bye & Fæhn, 2009). From 2008, the EU ETS has regulated about 50 % of Norway's total emissions, mainly from petroleum and industry (Regjeringen, 2020a). Almost 70 % of emissions that are not covered by the ETS system, are subject to domestic policies such as taxes and fees (Regjeringen, 2020b).

The EU ETS have set the cap on emission too high to provide the incentives for behavioral change. This could in theory mean that 50 % of Norway's emissions are “out of their hands”. However, Norway has been putting a carbon tax on the oil and gas industries, even though the oil and gas sector is being regulated by the quota system. The reason for a “Double fee” is the insufficient level of the quota prices (Heggedal & Rosendahl, 2015). This suggests that even if the EU ETS system continues to be insufficient, Norway could still reduce their emissions to a level that is coherent to their set climate goals for 2030.

Norway implemented a carbon tax already in 1991, and they have been one of the leading countries when it comes to environmental policy initiatives in the last decades (Finansdepartementet, 2020; Boasson & Lahn, 2017). Norway's present tax design, using the revenue to partly reduce other taxes with undesirable distortive impacts, is based on the second dividend hypothesis. The studies from Bye (2000a, 2000b) suggest that the possibility of a second dividend is very big in Norway, given their high initial taxes. However, earlier examples of increasing the carbon tax have generated public reactions and political disagreement (Lin & Li, 2011). This has led to low tax rates, tax exemptions and that the overall mitigation effects of the carbon tax in Norway have been non significant (Lin & Li, ibid.).

Public acceptance

The failures of implementing effective domestic policies in Norway has been contributed by both political and public oppositions over increased prices, and by Norway's global cost-effective approach (Boasson & Lahn, 2017). The fear of carbon leakage and shifts in competitive advantages, have made Norway lack real incentives in implementing effective domestic policies that reduce emissions (Lin & Li, 2011). The Paris Agreement suggests that global cooperation in reducing emissions is materializing, and since the agreement can ensure global cost-efficient CO2 mitigation, effective domestic measures make more sense. However, as earlier attempts of implementing a higher carbon tax show, as well as the majority of the population do not want their own economy to be affected by increased prices on fossil fuels, suggest that the present tax design would hinder implementation of effective tax levels that reduce emissions (Aasen et al., 2019).

One issue is the short-term view of politicians. Since politicians often focus on being reelected, they mostly focus on short-term effectiveness that gives rapid results. This suggests that long-term environmental policies, that involve near-term costs with only a promise of benefits far away in the future, are not attractive for most politicians to implement without huge public support. This indicates that public understanding and support for environmental policies are critical elements for implementations of effective policies.

The possibilities of a second dividend is highly-attractive for policymakers, when much of the debate regarding double dividend is in terms of whether environmental taxes can be introduced in a way that are costless. The preoccupation and debate regarding the possibility of a second dividend, reflect the desire to make safe decisions about environmental reforms in presence of uncertainty (Goulder, 1995). Policymakers' obsession with the second dividend, has made environmental policies a complex matter, and as the complexity increases, the alternatives, and further on oppositional arguments increases (Bovenberg, 1999; Kallbekken & Aasen, 2010).

Reducing complexity will therefore increase understanding, and further acceptance over increased prices. Studies from Carattini (2017a) and Kallbekken and Aasen (2010) showed public preference towards earmarking. Knowing that the increased taxes goes directly to something meaningful, and not just into the governmental drain, is more acceptable for most people (Kallbekken & Aasen, 2010). However, earmarking is believed to yield much cost, and most economists believe that in a first-best world it is inefficient to earmark revenues, compared to using revenue to reduce other ineffective taxes in the market (Sandmo, 2004). This could make policymakers calculate a trade-off between:

1) less hurdles and sub-optimal policy,
2) or more hurdles with optimal policy.

The key goal for policymakers is to find the optimal trade-off between any given policies (Perman et al, 2011, p. 178). However, given emerging thresholds and the urgency of implementing effective policies that gain public acceptance over increased prices on fossil fuels, fast implementation must be the primary focus. A design that discards many of the oppositional arguments associated with environmental policies, and is also assumed to be highly cost-saving, is a revenue-neutral distribution design (Goulder, 1995).

Carbon fee dividend

A revenue-neutral tax design that has received much recognition for its simplicity and potential efficiency considering reaching the environmental objective, is the "Carbon fee and Dividend" (CFD). This is a carbon tax where all the revenue is distributed directly back to the population, and is therefore revenue neutral for the state (Lundberg & Birkland, 2018). Better explained: the less you pollute, the less are your net costs. With refunding the revenue, will all individuals who emit less than the average be better off financially, and a usual perception is that poor people emit less than rich people on average (James Hansen, 2015; Reinem & Johnsen, 2018). This gives CFD an expected desirable social profile, which further could ease implementation.

This, together with the motivational aspects of possible profiting from being environmentally cautious and simplicit nature of the tax design, indicates faster implementation of effective tax rates under a CFD scheme than under the present tax design. Goulder (1995) argued that revenue-neutral design almost always achieves the environmental objective.

The CFD-design is:
1) Easy to understand
2) Effective considering reaching the environmental objective
3) Assumed to eliminate much of the cost to economic agents due to the refund
4) Has a social equitable profile
5) Does not cause real net welfare changes for the public
6) Motivational aspects of the possibility of profiting from the tax

Even though this policy design could break with Sandmo's (2004) arguments that tax revenues should be spent where the benefits to society are the highest, this policy eliminates many implementation hurdles. Especially regarding public acceptance over increased prices on fossil fuels, given recycling the revenue back to the population will not affect real net welfare changes for citizens (Hansen, 2015).

As mentioned above, given environmental scientists' increased concerns of insufficient climate gas emission reductions, the primary goals of policymakers must be public acceptance and fast implementation of effective policies that reach the environmental objectives (IPCC, 2018; Sakviksrønning, 2015, p. 17).

Previous attempts of raising the carbon tax in Norway, suggest it would be unrealistic to raise the tax levels to an efficient level with the present tax levels, without creating much opposition (Lin & Li, 2011).

The purpose of this thesis is thus to introduce an alternative tax design where one combines these two objectives of reaching the environmental objective, as well as the possibility of reaching a non-environmental objective, with minimum implementation hurdles. This could lead to a fast implementation of an efficient policy with an equitable distribution. Waiting on both calculations, and political, industrial and public agreements when implementing an optimal tax design, must be compared with the deadweight loss of implementing a sub-optimal tax with a faster implementation. Therefore, the introduction of the CFD appears to be a close-to-optimal design, given the urgency of reducing our emissions.

Level of taxation

Economics could help us clarify the economic consequences global warming has on both present and the future and the ethical issues that will be arising, considering both equity and efficiency. Economics could help us find the trade-offs between doing nothing and doing too much (Perman et al., 2011, p.3). But given the fundamental long term time frame of our environment, it is nearly impossible to discount all implications with our present actions, and eventually find the optimal strategies. Therefore, it is of utmost importance that economic analysis adapt dynamically in their analysis of climate change (Weikard & Zhu, 2005).

In the following discussion *cost effectiveness* means reaching a certain emission target at the least cost, while *efficiency* or *optimality* means that marginal benefits are equal marginal costs when policies trigger *cost effectiveness*.

Implementing an optimal tax would in theory lead to maximum benefits in terms of internalising externalities and increasing investments in green technology. However, as markets are dynamic, the optimal taxes could be shown to be non-optimal in terms of change in behavior, technological progress and environmental change, as well as implementation acceptance. This argument is explained in Prescott & Kydland article "Rules rather than discretion" from 1977, whereat they argue that policymakers often fail to consider the dynamic market as a factor when implementing the optimal tax. As explained above, it is nearly impossible for policymakers to realistically know future marginal damages (MB) and marginal abatement costs (MAC). Therefore, policymakers must revise expectations about future costs and damages as new information for each period becomes available.

Figure 1.3 shows an example of the implementation of the optimal tax (T_0). This will consequently lead to a lower marginal abatement cost (MAC_5) in the future, and further on a lower tax base (T_5). The knowledge of both lower abatement costs and lower taxes in the future, could make the industry hold back investments in green technology and green behavioral shifts (Romstad, 2016).

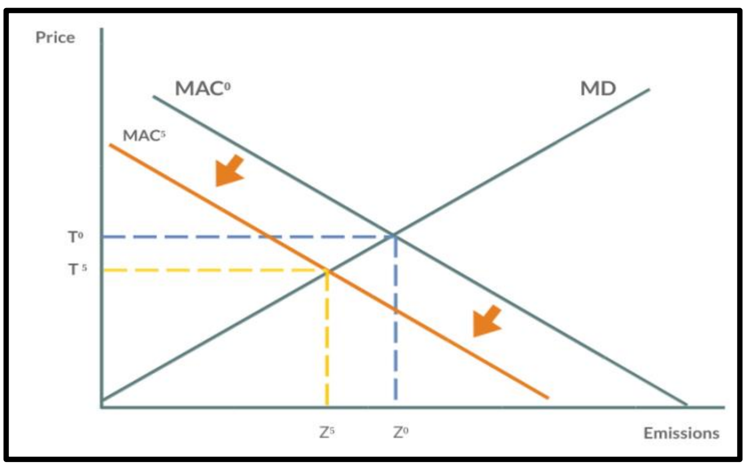

Figure 1.3: *Possibility of emission shifting over time which does not follow time indifference condition.*

To hinder possibilities of shifting emission reduction between time periods, policymakers need to contemplate with **dynamic cost efficiency**. This entails a price path that follows the Hotelling's rule, also known as the Hotelling price path. However, this hinders setting optimal emissions levels in each time period, given these two conditions often cannot jointly be met. As shown in figure 1.4, symbolized with the yellow triangle, this creates a welfare loss. We must therefore compare the benefits of being on the Hotelling price path to its costs, since it is a clear trade-off between reducing the size of the deadweight losses and being off the Hotelling price path. Reaching **dynamic efficiency** entails optimal set emissions levels in each time period that follows the Hotelling price path. This minimizes overall the expected joint costs of not following the Hotelling Price path, and minimizes the welfare losses caused by deviating from a path of static optimal emissions (Romstad, 2016).

Under taxes, economic agents are more free to choose their emissions level, and further be closer to their "dynamic optimal emissions". This means, as explained above, being closer to the trade-off between static optimal emissions versus being off the Hotelling price path. Under tradable permit or "Cap and trade", the overall cap influences the level of emissions, and the flexibility is forgone. Although there is a possibility to sell the permit/ quota, the volatile prices give the quantity based instrument less certain abatement costs. This gives taxes an advantage in terms of adjusting after dynamically, and obtaining dynamic efficiency (Romstad, ibid.).

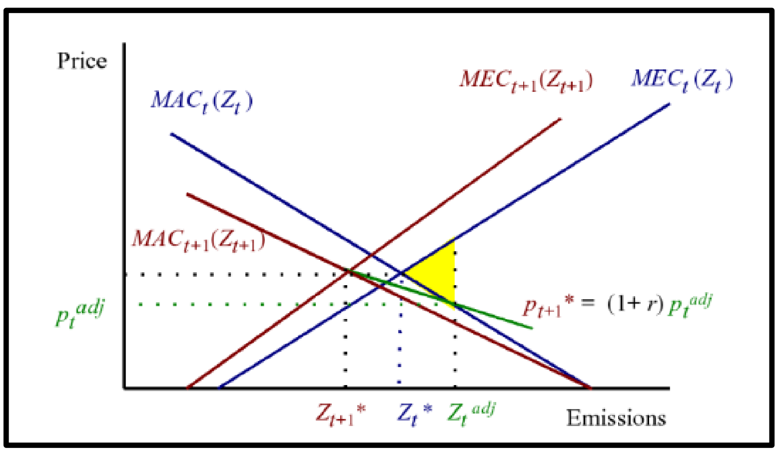

Figure 1.4: *Adjustments in emissions levels to obtain Hotelling price path. The yellow triangle symbolizes the welfare losses following the Hotelling price path. The benefits of being on the Hotelling price path must be compared with its costs (Romstad, 2016).*

As mentioned above, Bovenberg (1999) argues that obtaining both environmental and non-environmental objectives complicates implementation of environmental policies. This argument stands strong with many environmentalists, and is an important argument for the implementation of the CFD (Hansen, 2015). Environmental economists have for decades tried to calculate costs and benefits with different policy-designs, and in the process of doing so, the complexity of these policy-designs have increased. The simplicity, motivational aspects of the possibility of profiting from the tax, as well as the social equitable profile of the CFD model, makes it the best acquitted model to increase taxes to an efficient level, without creating considerable opposition (Hansen, ibid.).

I am further in my thesis going to reason my claim on “Carbon fee and dividend” as the most effective policy instrument for decreasing emissions. My paper is limited to Norway, and the national measures that could be undertaken. However, I discuss the international effects of a national implementation and measures done by the international institutions and how this has and is affecting domestic policies. I am going to reason my claim by looking at environmental economics, history and effects of the existing efforts.

1.2 Main research question

In the previous section I have argued that a CFD design makes it easier to implement higher emission taxes, which in turn would lower climate gas emissions. Adding the fairness of income criterion for tax revenue refunds also makes for a more social equitable profile, which could further ease implementation. This leads me to the main research question:

How Norway should implement "Carbon fee Dividend" for reaching their climate goals for 2030.

Box 1: Results of Canada's implementation of the CFD design:

In 2008, the Canadian state British Columbia implemented a “carbon fee and dividend” where all the revenue from the tax was used to cut labour tax on private households or firms, or to be transferred directly back to the consumer. The tax was supposed to be introduced across Canada, however the proposition received oppositions politically and publicly.

This is an excellent practical example to look at the overall effectiveness of the tax when considering both economical effects and overall emission reduction, since one may compare British Columbia with other Canadian states that have not implemented this tax.

The most striking result is that the consumption of fossil fuels has decreased 19 % compared to the rest of Canada. The seemingly effect of the tax is much higher than what was expected. The emergence of oil-fracking in other states could be one factor that could contribute to this huge difference, but still when excluding this factor, BC has a 13,4 % higher reduction than the rest of the country. Also the initial change in GDP per capita in BC is not any different from the rest of the country in the given period. This suggests that emission reduction has no direct causality with economic decline, as many right-wing politicians assume (Elgie & McClay, 2013).

The huge overall response is 7,1 times more than can be expected in other price adjustments to other goods (Saksvikrønning, 2015, s.64). The huge reduction is most likely also contributed by the psychological effects of a carbon tax. With increased public debates surrounding emission rates and environmental issues, people get more aware of their consumption. This, together with the knowledge of an increasing tax over the next decades, made people start doing behavioral change before price changes would seemingly affect purchasing power. A study that amplifies this theory is Baranzini and Weber's study (2013), regarding Switzerland implementation of a carbon tax in 1993, that showed a reduced consumption of fossil fuels, before the real price adjustments were introduced. We could also assume that the effects of being rewarded for reducing personal emission would make the overall emission reduction faster than assumed.

The studies done by Elgie and McClay (2013) **could not prove causality**, but assume that the implementation of the tax is the main reason for the rapid emission reduction British Columbia. The tax received both political and public opposition when it was introduced in 2008, however the tax has now political support on both sides, as well as around 60 % of the population is positive of the tax. This led to the introduction of the Carbon fee and Dividend in the rest of the country in 2019, something that indicates a growing acceptance towards the tax design (Nuccitelli, 2018). The example from Canada gives us an insight of possible real effects of an introduction of a carbon tax and dividend. Especially considering political and public growing acceptance, economic effects and effectiveness considering emission reduction.

Sources:
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2. Theoretical framework

2.1 Environmental economics

The relationship between our economic system and ecological system has been separated for decades. Our neoclassical growth model has no scarcity in natural capital, something that has made our whole ecosystem unbalanced (Solow, 1974). Environmental economics "address the relationship between our ecosystem and economic system" (Costanza, 1989, p. 1). Following the Paris Agreement, the overall goal for governments is to transform to a "green economy" (UNFCCC, 2018). A "Green Economy" was defined by UNEP as an economy that results in "improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2011, p. 14).

2.1.1 External costs and Pigouvian taxes

Companies value their products after the amount of input it takes to produce a product. In most of production however, there is an external cost that is not represented in their budget. This external cost is considered as something that has a true cost to society as a whole, but no true cost for the single producer (B. Field, 2013, p.67). As shown in figure 1.1 in the introduction, excluding externalities cause lower prices and higher production. This creates an inefficient market, since the market will "over-supply" products. **Environmental economists have expressed the importance of including externalities in products to get optimal market efficiency for decades (Pigou, 1920; Kapp, 1971).**

Similarly, consumers typically look at the impact on their own welfare (utility) when making their consumption decisions. Without rules and regulations , consumers typically only consider the costs and benefits their consumption brings on themselves, and not the effect your consumption has on the society as a whole (Perman et al., 2011, p. 121-123).

Arthur Pigou was the first that presented the analysis of pollution as an externality in 1920, but usage of external costs within environmental economies did not "take off" before the 1970s (Perman et al., 2011, p. 121-123). As policymakers have failed to follow the advice from the environmental economists, has market efficiency been failing. We are over-consuming as the externalities of some products are not internalized in the price. This cost is shifted to third parties like other current institutions and consumers, or future generations (Kapp, 1971).

Externalities are particularly present when it comes to the environment, as nobody typically has property rights to the environment. This implies that in a "free market economy" nobody can in theory legally claim they are a legal entity that is damaged by the actions of others. This is the whole idea behind environmental rules and regulations. For example, a legally mandated emission tax imposes costs on those emitting. If the emission tax rate is set optimally, efficiency is achieved in theory (Pigou, 1920; Perman et al., 2011, p. 123-124). However, one of the main problems with efficiently lowering climate gas emissions is that these emissions “know no border”. This indicates that unless all countries cooperate to lower emissions, the externality and hence the welfare loss will remain (Nicolaisen et al., 1991).

Even though recent years efforts to correlate the inefficient market through the EU’s trading system, the externalities are not internalised in the price of fossil fuels. This creates an unrealistic view of the competitiveness for fossil fuels companies.

Both spatial and intertemporal dimensions must be considered when considering externalities. The **spatial dimensions** must be considered as there is geographical diffusion of external cost (Nicolaisen et al., 1991). The optimal choice of policies could in some cases vary according to geographical conditions, considering that air pollution, soil destruction and waste are local and domestic issues. However, considering the effects carbon emissions have on the ozone layer, and how emissions affect our climate, the external cost is considered a global matter.

The **intertemporal dimension** is a relevant concept when considering how depletion and effects of pollution flows arises with time. Some pollution is strictly a flow problem, where the further damage of the environment could dissolve relatively quickly (Nicolaisen et al. 1991). But in the case of carbon emissions, the flow problem became a stock problem. The environment seems to tolerate a certain flow of emissions, but after a certain threshold it accumulates into environmental degradation. Beyond the threshold of what natural regeneration could handle, environmental quality would decrease and externalities increase in an accumulated effect (Herfindal & Kneese, 1974).

Pearce (1991) argues that the magnitude of externalities and destruction could accumulate over time to the point where it may threaten the sustainability of economic growth for those policymakers that undervalue or unprice environmental issues.

2.1.2 Sustainable growth

The most efficient level of pollution is where marginal damage is equal to marginal abatement costs. As we do not internalise an efficient instrument to correlate the level of emissions to an optimal level, do we have a high hidden social cost in society. This hidden cost may cause the illusion of economic growth and development, however cause decline in future welfare and growth (Kapp, 1971).

The overuse of environmental resources is an inherent risk to sustainable economic growth (Nicolaisen, et al., 1991). Sustainable growth could be defined as non-declining consumption potential. Therefore, sustainable growth requires either non-declining stocks of both environmental capital and man-made capital, or sufficient substitution for environmental capital to keep total capital stocks intact (Haveman, 1989).

Welfare is defined as: $W=W(K,E)$.
W=Welfare
K= Man-made capital
E= Environmental capital

This means that for achieving sustainable growth requires that the real value of environmental depletion must not exceed the real value of net investment in man-made capital (Nicolaisen et al., 1991). This is defined as:

$$-q\Delta E \leq \Delta K$$

where ΔE and ΔK are the change in E and K over time, and q is the cost attached to incremental change in environmental capital, measured in terms of man-made capital.

The overuse of environmental resources and failure of representing external costs in products, have therefore caused the inherent risk that the economy could follow an unsustainable path (Nicolaisen et al. 1991). Technological progress could offset environmental degradation, but both population growth and increased energy use is enough to suggest that there would be an increasing pressure on the environment. This suggests that sustainable growth cannot be achieved unless policymakers use political instruments to raise the market price on pollution towards the real shadow cost of environmental degradation (Nicolaisen, ibid). To achieve sustainability, externalities need to be represented in the market, taking into account long-term effects of our exploitation of the environment.

2.2 Pollution control and instruments

2.2.1 Policy criteria

In this section, I will first explain types of instruments for pollution in general, and then further move on to the specifics of climate gas emissions.

With emerging thresholds, policymakers need to implement instruments that effectively change the behavior of the industry and consumers (IPCC, 2018). The usage of any instruments is likely to involve conflicts or trade-offs between different criteria's and objectives (Perman el al., 2011, p. 144). Policymakers and governments' target should therefore be to implement policies that attain most benefits.

Governments have multiple objectives to consider when implementing a policy. Favored evaluation criteria differs between economists, but cost-effectiveness and efficiency is a repetitive criteria's. Perman et al. (2011, p. 178) criteria's for selection of pollution instruments:

Perman et al. (2011) criteria's for selection of pollution instruments	
Cost-effectiveness:	Reaching the target at the least cost.
Long-run effects:	Does the influence of the instruments strengthen, weaken or remain constant over time?
Dynamic efficiency:	Does it create continual incentives to improve products or production processes in pollution-reducing ways?
Ancillary benefits:	Could a "double dividend" be achieved?
Equity:	What influence does the instrument have on distribution of income and wealth?
Dependability:	To what extent could the instrument be relied upon to reach the target?
Flexibility:	Could the instrument quickly and cheaply adapt for changes if information, conditions or targets are altered?
Costs of use under uncertainty:	How large are efficiency losses when the instrument is used with incorrect information?
Information requirements:	How much information does the control authority need to possess, and what are the costs of acquiring this information?

Table 2.1: *Perman et al. (2011) policy criteria's.*

Achieving these criteria's could help get better acceptance for implementation of the control instrument by e the key agents, i.e., producers and consumers (Perman et al., 2011, p. 178). It is important to calculate trade-offs between different instruments, and choose the instrument with overall minimum welfare loss.

2.2.2 Price policy vs quantity policy

The question is, would it be better to control certain forms of pollution by setting emission standards or by charging a price on each unit pollution? When quantities are implemented, we set the level of output or emissions. With prices as an instrument, the rules explicitly or implicitly specify that profit is maximized at the given parametric prices (Weitzman, 1974). From a theoretical point of view and a complete certainty concerning cost, the result of both policies should lead to the same results. They are also both cost-efficient because they undertake only the cheapest reduction (Pizer, 1997). In practice however, most economists would agree that indirect control by prices as the most effective instrument to lower emissions, while non-economist often prefer direct regulation or a cap on emissions. The reason for this is that economists see taxes as the planning instruments that "profit maximization" automatically guarantees total output will be efficiently produced (Weitzman, 1974).

In Martin Weitzman paper "Prices vs Quantities" from 1974 he argued that the regulators often are uncertain about firms' real abatement costs, and this uncertainty creates a lower deadweight loss under a tax than cap and trade (Karp & Traeger, 2018). However, this is only true if the slope of the marginal abatement cost curve is steeper than the slope of the marginal damage curve, something that is most likely to be the case of global warming (Pearson, 2011, p. 134). The reason that marginal abatement costs are thought to be steeper than marginal damage, is because they are related to flow pollution, whereas the marginal damages are related to the stock of greenhouse gases in the atmosphere. The stock accumulates relatively slowly, hence the impact of a unit of abatement on the stock is relatively small. This argument loses its force when the environment stands over a major tipping point, or if the pollution is permanent rather than temporary (Pearson, ibid.).

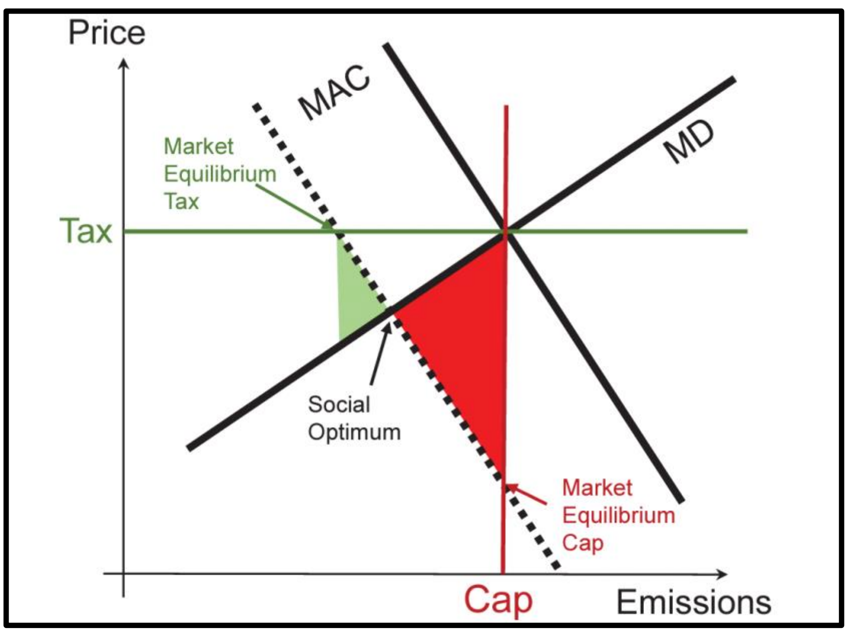

Figure 2.2: *Welfare losses price vs quantity instruments. This example has the assumption that MAC is steeper than the MD. The green triangle is the deadweight loss under a tax. The red triangle is the deadweight loss under quota. The black lines represent the expectations, while the dashed line represent the effects of the taxes in reality (Karp & Traeger, 2018).*

Since expected costs are hard to calculate, policymakers assume some welfare losses when implementing policies. Policymakers job is to try to minimize this deadweight loss. As Figure 2.2 characterizes, MAC is changing from the predicted value after a tax implementation. Under these uncertainties shown in the graph, taxes would be the desired instrument, as there are a smaller deadweight loss under taxes than quotas(Weitzman, 1974).

Moreover, given the last reports from the UN climate panel, there are reasons to believe that thresholds are closing in, and marginal damage as well could change. This could further on reduce the deadweight losses with the usage of quotas, and make it more appreciable than in this given example (IPCC, 2018; Pizer, 1997).

2.2.2.1 Cap and Trade

The "cap and trade" system is overall more complicated and expensive to operate than a carbon tax. However, the essential flaw with the cap and trade system is that it does not provide a clear price signal. Prices depend on supply and demand, something that makes prices volatile and firms can buy and sell emission allowances to reduce their costs. Then, if firms have a lower level of emission than quotas allocated, they could sell these to other companies that have a high marginal abatement costs. This makes firms allocate emission between each other, and does not create any incentives for lowering emissions more than the set cap (Pearson, 2011, p. 134).

Variable prices on emissions makes the costs of emissions uncertain, and further on make long-term investments uncertain, both for the "polluting industry" as well as the "green industry". Lower investments in the polluting industry could make the industries less efficient than it would have been without a policy instrument. While lower investments in "green technology", would shackle technological progress and eventually the green shift (Saksvikrønning, 2015, s.77). The overall effect of this uncertainty created by the variable prices of emissions, is estimated to create an extra cost for society of 16-50 % (Blyth, et al., 2007).

As figure 2.2.1 illustrates, the cost of each unit emission reduction is accumulating as you increase your emissions cuts. Variable prices could therefore lead to expensive small cuts when the price is high, and high emissions quantities at low profits when price is low. A clear price signal would essentially lead to bigger cuts for the same comprehensive price (Blyth, et al., 2007). It is also important to understand that the price-elasticity of fossil fuels also are very low in the short term, compared to long-term perspective. In other words, it will be very expensive for companies to change their behavior and consumption in the short-term perspective. **Therefore, variable prices could cause profitable businesses to go bankrupt "over night", with essentially high costs for the economy and without any increase in production-efficiency (Saksvikrønning, 2015, s.78).**

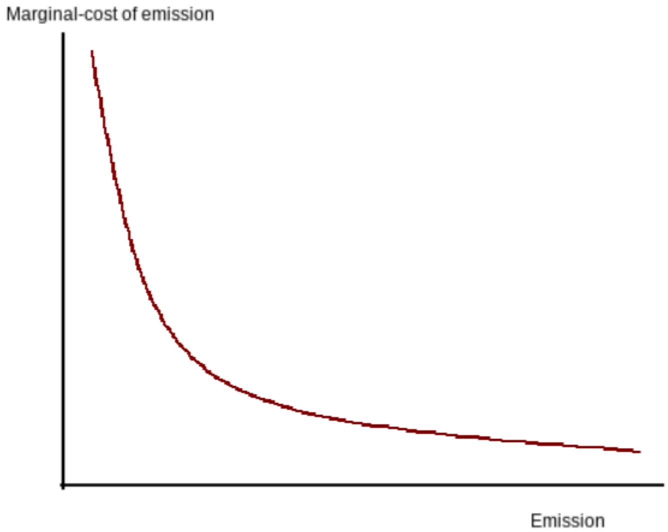

Figure 2.2.1: *Marginal-cost curve for emission cuts.*

A clear price signal on emissions, like carbon tax, creates incentives for behavioral change at the most efficient way. A slowly increasing carbon tax would make long-term investments less uncertain, and would decrease the unnecessary expensive cuts caused by the variable prices. This will increase firms overall investments in green technology and efficiency regarding production (Stavins, 2003). It will further set the incentives for an optimal level of emissions and production, something that would be in both the society and firms best interest.

2.2.3 Advantages with taxes as policy instrument

Compared to instruments such as quotas, the main advantage of taxes as an instrument is *efficiency*. Taxes make each polluter reduce their emission to the point where marginal cost of pollution abatement is equal to the tax. This minimizes the cost of reaching a given environmental target (static efficiency) (Kosonen & Nicodème, 2009). Also taxes increase *flexibility* to the polluters, because it lets them choose the level and method of abatement. As I have stated earlier, the imposing of a tax requires less detailed information than a "Cap", something that lowers the *administration costs* and uncertainty.

The *price signals* taxes give, induces the industry to invest more in less-polluting technologies and constantly seek new abatement possibilities. This causes continual incentives in innovation and technological progress (*dynamic efficiency*) (Kosonen & Nicodème, 2009).

Some economists argue that environmental taxes, even with revenue recycling, always could entail some economic costs (Kosonen & Nicodème, 2009). This is reasoned with the increased excess burden of taxation. However, when accounting for environmental improvement (externalities realisation), many economists would see environmental taxes that are replacing distortional taxes involving zero or negative gross costs (Bovenberg & Goulder, 2002). Environmental taxes that generate both environmental improvement and higher welfare, creates a “Double Dividend”. If the second dividend materialised,, would the environmental objective be materialised without any cost to the economy (Goulder, 1995). This imposes a higher social, industrial and political acceptance and overall easier implementation process of an environmental tax. A second dividend could theoretically be achieved through an effective auctioning of quotas, where the revenue is collected by the governments. However, as the experiences with EU ETS system have shown, there has been major allocation of free quotas, something that makes a great part of the revenue forgone to the industry. This is believed to be one of the great flaws of the EU ETS (Pearson, 2011, p. 135.).

2.2.4 Carbon fee and Dividend

A policy that has received recognition in recent years is James Hansen's fiscal model “Carbon Fee and Dividend”. Hansen’s (2015) fiscal tax design suggests that the revenue is distributed evenly back to the population, something that makes it revenue neutral for the government. This imposes many advantages considering public acceptance over increased carbon taxes (Hansen, 2015).

In 1995 Goulder argued for the possibility of high cost-saving when revenues are returned in a lump-sum of money. The environmental dividend is then almost always achieved, yet the economic dividend is an uncertain question that needs further research (Goulder, 1995).

Hansen suggests that the tax levels should start at a relevant small figure, and continue to rise until the fee matches the cost to society (Hansen, 2009). This should minimize economic disruptions from sudden change. The knowledge of increased carbon fees and the motivational aspect of being rewarded for being environmentally cautious would easier change both the industry and consumers behavior. This could spur innovation and energy efficiency (Hansen, ibid).

The public that is receiving dividends could view the policy as a positive initiative. The increased prices on energy implies higher revenue from the tax, and higher initial income for people that consume less than average. Compared to other tax designs, where increased carbon taxes and initial prices on energy often implies more costs for the public, this design increases the motivational aspect of changing behavior with initially higher carbon prices. This will increase consumption on “green products”, and change cash flow from “energy bad products” to “green products” (Hansen, 2009).

The net effects on public wealth could overall be the same if the revenue is used to reduce assumingly ineffective taxes, however the simplicity of the CFD model, with direct paybacks, will change the public behavior more effectively. For example if the revenue will be used to reduce income tax, would it be hard to understand and acknowledge that this is contributed by the environmental tax, and the motivational aspects of directly profiting from the tax is gone. This indicates that distributing revenue back to the population reduces complexity and increases the understanding of the tax, something that makes it easier to implement and increases acceptance towards the tax (Kallbekken & Aasen, 2010; Bovenberg 1999).

The CFD design could also increase equality if tax revenues are redistributed with this objective in mind. A study from Norway shows that people with high income have remarkably larger environmental footprint than people with average income (Reinem & Johnsen, 2018). This indicates that the redistribution of the revenue could lead to better social redistribution of wealth. This gives the CFD design a social equitable profile.

Note: This argument could be debunked considering the upper-class is more flexible, and could change behavior faster. This indicates the necessity of exploring different distribution designs.

The CFD design also abates many of the political disagreements about different domestic environmental policies. Most right-wing politicians want minimum public involvement in the economy, while most left-wing politicians want fast and effective integration of environmental policies. Therefore, it is hard to imagine high political disagreement when considering both parties criteria's are met.

2.3 Implementation process

The CFD model provides a clear signal to reward businesses, individuals and nations that lead the way in reducing emissions. Smaller implementation hurdles than other policy designs could make this a more superior design in terms of reaching the climate goals of 2030. However, either way the implementation process is both long and difficult; the tax-levels, the geographical challenges, and the macroeconomic effects are some of the many features to consider when implementing a tax.

2.3.1 Level of taxation

The required tax level must overall be determined by the environmental objective (Bowen & Fankhauser, 2017). However, since public attitudes towards environmental taxes are influenced by the probability of increased personal cost, do policymakers need to account for this perspective when setting the level of tax. This is despite the fact that the main purpose of an environmental tax is to discourage harmful behavior and make polluters pay.

There is evidence that the public opposition to an aggressive tax approximately close to the optimal level, may not be persistent. Public aversion tends to reduce after a policy is implemented, and they realize the real cost and benefits, and overall effectiveness of the tax. This suggests that tax rates could be raised to an environmentally appropriate level, after an adjustment period (Carattini et al., 2017a). The adverse effects environmental taxes have on the income distribution and international competitiveness, must also be considered when finding the optimal level of taxation (Kosonen & Nicodeme, 2009).

Waiting on both calculations, and political, industrial and public agreements when implementing an optimal taxation, must be compared with the deadweight loss of implementing a sub-optimal tax with a faster implementation process. Phasing in a low carbon tax at first and further on increasing the tax recording to the pigouvian approach, could be desirable to reduce disruption and to allow time for adaptation (Nicolaisen et al., 1991). This approach could provide overall efficiency gains and increase potential and profitability of innovation in green energy.

Finding the appropriate level of emissions and optimal tax, has also shown to be difficult. The uncertainty concerning future emissions, technological progress, the stock effects of emissions, and the overall cost of reducing emissions, make it difficult to implement a level of tax that is optimal (Nicolaisen et al., 1991). The complexity of nature has made it challenging to fully understand the totality of the effects of man made emissions (Hasting & Wysham, 2010). Recent research on the ecosystem and environmental damage, has increased our understanding of the long-term effects of pollution and thresholds in the ecosystem, but are far from complete. Following the pigouvian approach, where the level of tax is where the company's marginal abatement cost is equal to marginal social cost, has therefore been proven very difficult to calculate (Baumol & Oates, 1971).

The introduction of an environmental tax will reduce net price and quantity for the industry, and further on lead to the industry being less profitable. A “demand-focus approach” has been mainstream economics since 1930, but recent studies have also shown that supply can shift due to a carbon tax, something that could hinder emission reductions (Pearson, 2011, p. 107-111). This is due to the manipulation of prices. Organizations such as OPEC, that have their main interest controlling oil prices with not pushing too much supply into the market, have made the overall oil storage in the world immense (Pearson, 2011, p. 108; Kimami, 2020). This suggests, as presented in figure 2.3, that a preserve-intensive effect could happen. Meaning an increasing carbon-tax could lead to the suppliers pushing supply into the market, depressing prices, causing higher short-term carbon-emissions. This is called the green-paradox (Pearson, 2011, p.107-111). Nicolaisen et al. (1991) therefore suggest an optimal time path to hinder the “green-paradox”, and demonstrates the importance to have a flexible and dynamic tax that could respond as new information occurs. This entails setting an optimal level of emissions in each period that follows the Hotelling price-path, so there should be an indifference to shift emissions today or tomorrow (Romstad, 2016; Hotelling, 1931).

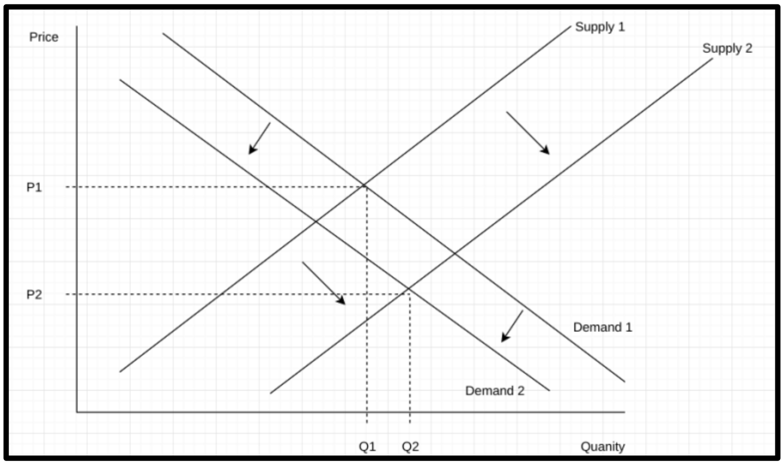

Figure 2.3: *Supply focus approach, "The green-paradox". Demand falls due to increased taxes, however the industry pushes supply into the market, making prices smaller and emission higher*.

The "green-paradox" suggests that it is of critical importance to phase in the tax at a relatively modest level and further on increase the tax following the optimal time path, so we hinder the "green paradox", competitive disadvantages, negative income distribution and other potential hurdles.

2.3.2 Options to use revenue

Since environmental taxes raise revenue, the question regarding optimal use of those revenues arises (OECD, 1996). It is important to be aware of the different distribution designs. Most environmental tax reforms include some sort of redistribution, due to implementation acceptance, possibility of higher cost-effectiveness and "double dividend" (Baranzini et al., 2000).

It has been suggested by fiscal experts that an environmental tax should be treated as general government revenue, as the method could enable governments to optimise the tax system, and incorporate climate change into overall tax and spending decisions (Bowen & Hepburn, 2014).

Some specific options are (Baranzini et al., 2000):
1) Revenue recycling where revenue goes to decrease other ineffective taxes.
2) Earmarking the revenue for improving technological progress.
3) Revenue is used to compensate or distribute revenue back to the population to compensate for negative impacts (CFD-design).

As public acceptance is key to implementation, the importance of public understanding of the tax design and minimizing economic effects on households is critical. Empirical studies have shown that public acceptance for carbon taxes is much higher if the use of the tax revenues are clearly specified (Carattini et al., 2017a). All of these approaches possess their own advantages and disadvantages, but the recycling of fiscal revenues could contribute to some benefits in addition to reducing carbon emissions. This is called the “double dividend”. The outcome depends on how the fiscal revenues are recycled, and the magnitude of the double dividend is highly discussed in the literature. Because it could be easier to set aggressive and effective environmental taxes, with acceptable and effective use of tax revenue.

The optimal use of revenue and the magnitude of the double dividend is difficult to know. Therefore does Goulder (1995) argue for the possibility of high cost-saving when revenues are returned in a lump-sum of money.

Studies from Carattini et al. (2017a), showed that earmarking is the most desired strategy by the public. The major interest in earmarking, may reflect some concerns regarding voters' trust in governments usage of revenue, and the doubt of overall effectiveness of carbon taxes. In general, an optimal carbon tax will set the incentives for behavioral shifts in the market. Subsiding will therefore not be necessary to meet environmental objectives. This implies that earmarking or subsidising will just increase the costs of reaching the environmental objective (Carattini et al., ibid.).

Further studies by Carattini (2017b) showed that once the informants got information of distributional effect of each design, that the preferred option was redistribution through lump-sum transfers, and social cushioning.

2.3.3 Rebound effects

The rebound effect implies that the benefit of energy efficiency will be reduced by the behavioral change that follows as the prices change and the market adapts (Gillingham et al., 2013). From this perspective you can argue that there is no real point in focusing on energy efficiency. In the extreme cases the rebound effect is called the backfire effect. In general there are four parts that spur the rebound effect, both on individual and macroeconomic level, directly or indirectly. On a macroeconomic level, if the demand for fossil fuel falls, for example if a country introduces legislation to limit energy demand, the price will drop as well. This may encourage others to increase their consumption. Also regarding other sectors, they may take advantage of the energy efficiency and boost the energy use in their sector. Gillingham (ibid) and colleagues claim that the rebound effect is exaggerated, and calculated it to be between 20-60%. Therefore, there is no excuse for inaction. In other words, energy efficient technology will save energy, and should be on the political agenda to address global warming alongside other initiatives that are not subject to rebound effects (Gillingham et al., 2013).

A normal assumption of the CFD tax design, is that it does not change real purchasing power for most of the population, hence their consumption could not change. However, the changes in the relative prices need to be taken into account, since the pattern of consumption will be turned towards a more environmentally friendly consumption of goods (Reinem & Johnsen, 2018).

2.3.4 Double dividend

Environmental tax reforms could both create a cleaner environment and at the same time generate employment gains, investments gains and/ or more efficient economy as a whole, this is called the "double dividend" realisation. The "Double Dividend" arises when tax revenues are used in different ways to impact welfare, distribution of income and employment. The chosen distribution method or recycling of the tax leads to different tax efficiency gains (Bovenberg, 1999).

The preoccupation and debate regarding the possibility of a second dividend, reflect the desire to make safe decisions about environmental reforms in presence of uncertainty (Goulder, 1995). Possibilities of a second dividend is highly-attractive for policymakers, when much of the debate regarding double dividend is in terms of whether environmental taxes can be introduced in a way that are costless (Goulder, ibid.). This creates higher incentives for implementing an environmental tax, even so if the environmental benefits are in doubt (Bovenberg, 1999). The theoretical and empirical evidence of a double dividend is not conclusive, but the theory still stands strong within countries applying environmental taxes. The theory falls weak in "perfect" systems, where governments already have achieved optimal welfare without concerning environmental concerns (Bovenberg, ibid). The studies done have mostly been looking at sterilised economies, however most economies have imperfections. Therefore, the second dividend depends mostly on economies that have high taxes with possibility of efficiency gains (Christiansen, 1996).

Studies done on Norway's by Bye (2000a), showed some interesting evidence for the double dividend. Imposing a Co2-tax of NOK 360 per ton Co2, where the revenue is used to decrease "Employers National Insurance contribution", lead to a decrease in emission of 7,9, while an increase in welfare of 0,2. Studies on Norwegian economy therefore diverge from the studies done by Bovenberg and Goulder (1996) that are based on American economy. The reason for this could be that Norway has high initial taxes, which could give an efficiency gain if reduced (Bye & Fæhn, 2009).

To simplify the environmental tax interactions, we could look at the basic economic textbook diagrams:

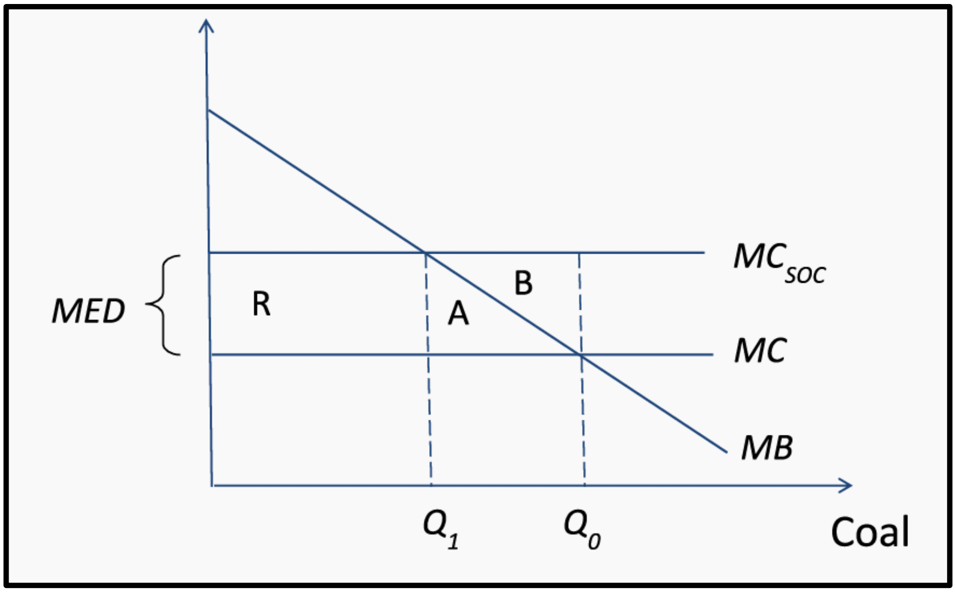

Figure 2.4: *Simple analysis of benefits and costs of an environmental tax.*

In figure 2.4, we look at the coal industry who generates a significant external cost in production (MCsoc). Without intervention, the market equilibrium is Q0, where the marginal private cost (MC) exceeds marginal damage (MB). With an realisation of the external cost through the usage of environmental taxes, the new equilibrium would be at Q1. The new tax would lead to an environmental benefit of A+B (avoided environmental damage). On the other hand, society will at the same time lose consumer surplus represented by A + R, as consumers would have to pay more for the product. This is where the question regarding revenue (R) usage must be considered. If the revenue (R) is recycled back to the economy, for example through lump-sum transfers, the overall cost to the economy would be A. Therefore would this policy represented in this simple analysis offer a net social benefit equal to B, since the environmental benefits (A+B) exceeds the costs (A). (Goulder, 2013). This would generate the first dividend, the environmental objective, being reached.

The second dividend could be reached if the tax revenue are being used to increase the efficiency in the market through fiscal interactions. Using the revenue to reduce marginal rates of existing distortionary taxes such as income or sales taxes, could further on lead to a social value greater than R (Goulder, 2013). The reduction of these taxes could reduce undesirable distortionary costs of these taxes, and improve the efficiency in the economy, something that could lead to a zero- or negative cost of implementation. Considering this hypothesis, environmental taxes do not only improve the environment, but also improve the overall welfare, also called the “double dividend hypothesis”.

The interaction effect is another aspect when considering the double dividend hypothesis. Some economists doubt the real effects of a double dividend, since environmental taxes would overall increase prices on goods and services, something that would reduce real income. Through this mechanism one could arguably assume that environmental taxes is an implicit tax on labor. The tax could therefore further reduce the labor supply, and further on reduce efficiency in society. This is called the interaction effect (Goulder, 2013).

As shown in figure 2.5 below, the optimal level of labor would be L0. Let us assume payroll, income and sales taxes are implemented, and this turns the level of labor to a non-optimal level (L1). If policymakers further on implement an environmental tax, the level of labor would be at L2, further away from the optimal point (Goulder, 2013). However, considering the "double dividend hypothesis", if revenue is used to reduce other distortionary taxes, or if the revenue is distributed through a lump-sum of money back to the population, the overall interaction effects could be zero-out (optimal level, L0) or turn out positive. This depends on the prior levels of taxation in society.

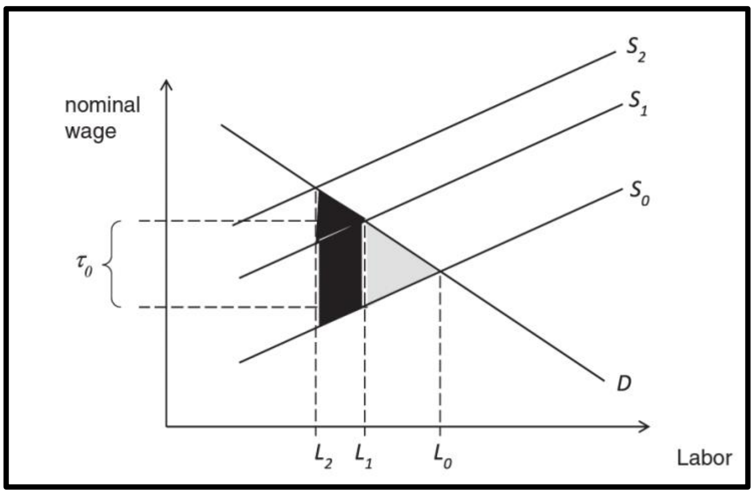

Figure 2.5: *Impacts of labor taxes on labor supply.*

If the level of taxation is already inefficient because of a low tax rate (level of labour is bigger than optimal), the tax-interaction effect could create positive effects, and a double dividend is very likely to happen. However, also as explained over, in countries with high-taxes could the right usage of revenue lead to a second dividend, by reducing distortionary taxes.

As explained, to create a double dividend from an environmental tax is very difficult. **In most cases, the revenue-recycle benefit is not enough to offset both primary costs and the tax-interaction effect.** The basic intuition for an non existing second dividend is the narrowly of the tax. The narrower a tax is, the greater the opportunities to adjust behavior and escape it, and this implies efficiency losses (Goulder, 2013).

For a double dividend realisation, Goulder (2013) concludes the following as necessary conditions:
1) The initial tax system must be inefficient along some non-environmental dimension and

2) The revenue neutral-tax reform reduces this non-environmental inefficiency.

As already mentioned above, there are many ways to use revenue from environmental taxes. The different usage of revenue generate different results, both regarding benefits and costs. The most important consideration is that environmental taxes should decrease harmful behavior, and even if it does not create a second dividend, the environmental benefits might exceed the non-environmental costs (Goulder, 2013).

As mentioned in chapter 2.2.4, Goulder already in 1995 argued for the possibility of high cost-saving when revenues are returned in a lump-sum of money. The environmental dividend is then almost always achieved, and these costs coherent with other tax schemes are discarded.

2.4 Macro-economic effects of environmental taxation

Fear of carbon leakage and the allocation of free quotas has been reducing the effectiveness of environmental taxes. For utilizing the climate issue, we need international binding agreements. Internalizing externalities in the cost of fossil fuels should no longer be a country's independent choice. It is of uttermost importance to avoid countries taking advantage and getting competitive advantages by not implementing carbon taxes (Pearson, 2011, p. 151). One solution is cooperation between economic blocks (between the EU and the US, or Europe and China), that introduce a flat and rising carbon tax (James Hansen, 2015). Further on, those who have not implemented the carbon tax should be levied to an extra toll which removes their competitive advantages from not taking appropriate environmental actions in line with the agreement. This would create strong incentives for implementing the tax, because countries would rather collect the funds themselves than have them collected by the importing countries (Hansen, ibid.). The advantages of being an early adopter of environmental policies will also spur implementation globally (Hansen, 2015). An early implementation could lead to a head-start in "green development".

The barriers of solution and innovation in energy efficient and renewable energy, have mostly originated from the fossil fuel industries' influence on politicians, the media and science. The times are changing, and these barriers are being weakened by the increasing public and scientific opposition, but also by how climate change is starting to cause real environmental effects. Some countries already experience how rising temperatures are affecting the security and health of their population (IPCC, 2018). The competitive advantages of becoming a leader in development of energy efficiency, renewable energies and other "green technologies" is already increasingly being recognized (Hansen, 2015). Countries have to considering the long-term effect, something that has been shown to be difficult when politicians mostly have four years in office. This imposes a competitive advantage for countries such as China, where the leaders seem to make decisions based on best technical information and science, with a more long-term perspective. (Hansen, 2010). The difference between a normal market competition and this, is that the environmental depletion is affecting us all. This suggests that international cooperation is not solely based on the influence by making money, but also saving the planet at the same time. This creates a higher incentive for international cooperation that is fair for all included countries (Hansen, 2015).

2.4.1 Innovation - discourage investment

Putting an additional price on a factor of production would make companies look for alternative methods to reduce emissions. This creates incentives for innovation and greater energy efficiency. Compared to the command and control instrument frequently used today, carbon taxes have greater dynamic efficiency. The command and control instruments (Cap and trade) create incentives for reaching a set target, but not any further. **Carbon taxes on the other hand would continually reward successful environmental friendly innovation, something that leads to dynamic efficiency and continual increased innovation (Perman et al., 2011, p. 233-237).**

2.4.2 Motivation for change

Rode et al. (2015) discuss the aspects of motivation when considering the use of economic instruments to change behavior. Economic instruments could either undermine ("crowd out") or reinforce ("crowd in") people's motivation to change behavior. The difference between intrinsic and extrinsic motivation is important to understand when considering environmental concerns. Intrinsic motivation is when individuals act without any external reward, and you are motivated solely by inner motivation. Extrinsic motivation is when individuals actions are motivated by external things, such as monetary incentives.

Rewarding behavior through extrinsic motivation such as monetary incentives, could in some cases undermine intrinsic motivation, and in some cases reinforce them. This depends on the circumstances regarding the extrinsic incentives. (Rode et al, ibid.).

Rode et al (2015) further display evidence for both "crowding out" and "crowding in" effects after an implementation of an economic instrument. Their study remains inconclusive considering when and in what circumstances motivation crowding occurs, but some optimistic evidence considering the CFD model was presented. The evidence in Rode et al (2015) suggest that intrinsic motivated people act up their motivation when non-intrinsic motivated people comply and change behavior (Rode et al., ibid.). Since the CFD model rewards individuals with pro environmental behavior, does the study by Rode et al. (2015) suggest that individuals with both extrinsic and intrinsic motivation would increase their efforts to be more environmentally friendly.

Overall the motivational aspect of the CFD model is very clear. The model is easy to mobilize and understand. With recycling revenue the governmental interference is minimum. With other tax designs, could more taxation indicate decreased purchasing power. Without understanding of the usage of revenue, can this lead to lower motivation. This especially implies for the part of the public that distrust governments and dislike autonomy (Rode, ibid).

However policymakers must consider as economic agents change behavior, the tax base becomes smaller. Further on, the revenue that is channeled back to the citizens becomes smaller. This suggests that, as more individuals that change behavior, the less rewarding it would be to be environmentally friendly. Considering high-income individuals are more flexible, something that could make them change behavior faster, suggests that low-income individuals could be harder affected by this tax. This could mean lower motivation for change for these classes, and more opposition. A response to this issue could be a flat-rate payback or distribution considering "fairness of income".

2.4.3 Distributional effects

Explained in section 2.3.4 "Double Dividend", environmental tax reforms may raise overall welfare. However, policymakers often stand over the trade-off between equity and efficiency, when considering using revenue where it yields most benefits.

Businesses' financial gains and losses are mirrored by the tax income gains for the collector of the tax. However, the consequences regarding the income and distribution in the society as a whole could on the other hand differ. The tax interaction effect can lead to sufficient negative distributional effects. Since, as explained in chapter 2.4.3, the narrower a tax is, the greater the opportunities to adjust behavior and escape it. This suggests that the more flexible part of society (upper-classes), has greater opportunity to escape the tax and put the cost over to the lower classes (Goulder, 2013).

So if distribution effects are not considered, inequalities could increase and further raise oppositions towards the environmental tax (Perman et al., 2011, p. 177-222). The distributional effects of income is therefore very important to regard when implementing a tax.

The distributional concern is often one of the overall goals of environmental policies, since the distributional effect could leave someone worse off than others, and public acceptability is crucial. **Policymakers therefore want to implement policies that increase environmental protection, efficiency and equity all in one.** However, achieving multiple objectives using only one instrument seldom takes place. This follows from the famous Tinbergen proposition (1952) that to secure the achievement of a certain number of objectives, equally many instruments are generally needed.

An example of opposition towards the distributional unfairness is, as also mentioned in the introduction, the 2018 demonstration against fuel taxes in France, where many perceived the tax as unfair. Therefore, to avoid these types of demonstrations and oppositions, the design of an environmental tax is crucial (Carattini et al., 2019). The policy design and different possibilities of revenue usage are mechanisms that could help governments to achieve the optimal environmental taxes, that increases public acceptability towards the environmental taxes.

2.4.4 Competitiveness, international cooperation, and tax evasions

The increased gross prices of fossil fuel products due to the environmental tax would have implications for the relative competitiveness for the given country today (Perman et al., 2011, p. 237). With increased global trading, exporting products have become a big part of many countries' overall income. The initial increased gross prices because of domestic environmental taxes, tend to make exporting products less attractive and imports more attractive. Domestic production and labor supply can decrease due to export of domestic production, especially in the short run. This is called carbon leakage. Overall economic shocks could be huge, especially if the initial country's income depends on the industry that is being taxed (OECD, 2001, p.71-84).

Policymakers need to be aware of the substitution possibilities and initial abatement costs for the involved companies. Without substitution possibilities, the introduction of a tax would not be feasible in the short- to medium-run for the given companies, and could further on lead to bankruptcy. An analysis of the expected and desired outcomes is therefore of big importance. However, identifying the expected outcomes of the competitive disadvantages is difficult, and estimates are very uncertain. Given this, international cooperation considering how to implement environmental taxes is hugely important. The pressure of climate change is affecting us all, and countries need to come together and cooperate to decrease emissions (OECD, ibid.).

As mentioned above, countries that are early adopters through early implementation of environmental policies, could get long-term competitive advantages because it induces domestic producers to innovate new green technologies (Perman et al., 2011; p. 343-352). Since the "green shift" seems inevitable, early introduction of a progressive carbon tax could make the economic shock of a demand decline on fossil fuels products in the future less extensive. This especially implies to countries that are dependent on fossil fuels (OECD, 2001, p. 71-84). This suggest that disadvantages that have been coherent with domestic policies will demolish once countries follow up on the Paris Agreement.

3. A description of the situation

3.1 Climate change as a global problem

Emissions are local, but the effects are global. This is called the collective good principle, and refers to something that is non-exclusive and non-rivalry in consumption. One country's reduction or increase in CO_2 emissions would benefit or harm all countries. This is why we need a global agreement. Countries must collectively find a level of emissions considering all countries' benefits. If countries only considered their own benefits of a decreasing emission, the overall emissions reduction would turn out to be sub-optimal (Heggedal & Rosendahl, 2015). The most efficient emission mitigation would be if each country abated to the point where marginal abatement cost is equal to global marginal benefit (Pearson, 2011, p. 171-202).

Collectively finding an optimal emission reduction and thereafter distributing levels of abatement to each country, could cause a “free rider problem”, since countries get incentives for not following the agreed emission reduction. This is because the geographical origin of emissions is unimportant, and countries are tempted to let other countries take the cost of lowering emissions, at the same time they would enjoy the benefits of global emission reduction. This is one of the main issues regarding getting global binding agreements (Heggedal & Rosendahl, 2015). However, global recognition of being early adapters to a “green economy” is increasing, something that could discard the “free rider problem” (OECD, 2001, p. 71-84).

Nevertheless, since the green shift could eventually shift the big market powers of today, do some countries have bigger incentives for transitioning to a green economy, as some have for not transitioning. For some countries, a green shift could eventually benefit their economy. This especially applies to countries that have big potential in renewables such as wind, solar and hydro power. In these countries there would be larger incentives for domestic policies, with the hope for a possible bettering their global position, gaining competitive advantage and potential for a new segment of income.

However, some countries would desire the opposite. This especially applies to countries that have a big share of their economy dependent on fossil fuels, and where the “green shift” could harm their global position and economy. This is the reason for Norway's global cost-effective approach, something Norway has been promoting for decades (Boasson & Lahn, 2017). Norway realized there are big market powers that have incentives for not transitioning to renewables. This made them understand that domestic measures only make sense if they can ensure global binding agreements. Domestic measures without global agreements, especially as Norway is highly dependent on fossil fuels, would then just potentially harm the Norwegian economy and an efficient transaction to a green economy (Bye & Fæhn, 2010).

The dynamic aspects or “historic responsibilities” of emissions is also something that have made it difficult to implement effective green deals. Developed countries such as the US, The UK and Germany, have over several decades contributed to the stock effects of emissions. Developing countries such as China and India, who emit the most and third most today (see figure 3.1), have therefore argued that their efforts to reduce emissions should be lower than those of long term high emitting countries. This argument was considered in the Kyoto protocol from 1997, where developing countries like China and India got a “free pass” considering emission reduction.

Basically all emissions reductions were to be paid for by developed countries. This contributed to the US not agreeing to the deal. As you see in figure 3.1, without the world's three largest polluters included in the treaty, the treaty only covered a fraction of total global emissions (Denchak, 2018).

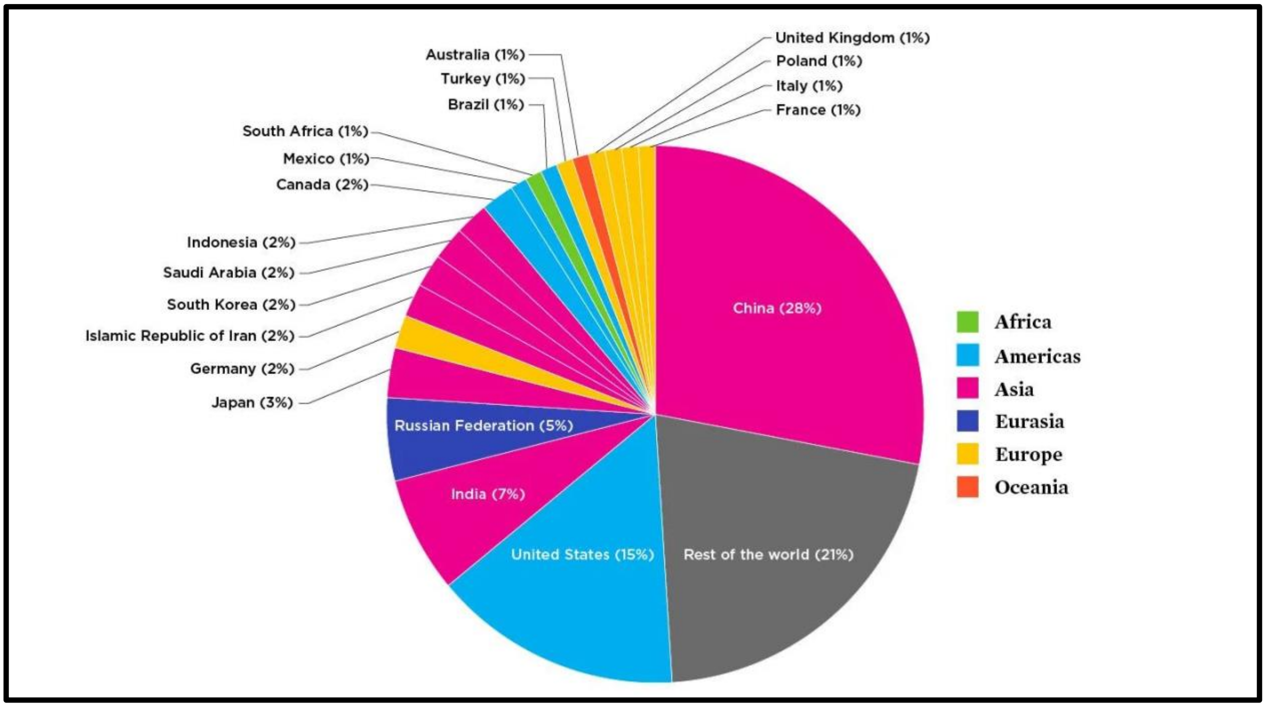

Figure 3.1: *Emission based on countries, 2018 (Union of Concerned Scientist, 2020)*

An important difference between the Paris Agreement and Kyoto Protocol is that nobody gets a "free-pass". Most importantly both China and India have agreed to concrete and ambitious climate commitments (UNFCCC, 2018). With all countries formally agreeing (The US withdrawal from the treaty is expected to be cancelled after Mr. Biden won the election) and contributing with lowering overall emissions, the deal is expected to be far more effective than the Kyoto agreement (Denchak, 2018).

3.2 The case of Norway

The government in Norway aims to be a low carbon society with a decrease of 90-95 % of their emissions before 2050. The government seeks to achieve this through implementation of efficient policies. One of them being dynamically increasing carbon taxes (Klima og miljødepartementet, 2020).

Norway was one of the first adapters of carbon taxes, and their experience up to now would provide them with a great practical experience. There is also a general low resistance to taxation and governmental intervention in the economy in Norway. This is seemingly because of high trust in government (Kallbekken & Aasen, 2010). Considering high political trust and the practical experience makes Norway an exceptional case study for the potential implementation of the CFD model.

3.2.1 Public support

Despite Norway's dependence on fossil fuels, they have been a front runner in international climate diplomacy. Already in 1989, 40 % of the polled voters stated that they were "very concerned" about climate change (Tjernhaugen, Aardal and Gullberg, 2011). A new report from 2019, showed that the majority of the population see themselves responsible for cutting emissions (Aasen et al., 2019). However, further studies from Aasen et al. (2019) showed that over 50 % of the study group was against increased prices on fossil fuels. This is evidence that the general public has had an incremental focus on environmental protection for decades, however that they lack the understanding of how to most efficiently reduce emissions. Because economic analyses have for a long time recommended carbon prices as the most efficient way for reducing greenhouse gas emissions (Klenert et al., 2018). The results from Aasen et al. (2019) therefore indicate some major issues considering policymakers flexibility in terms of implementing effective policies, since the general public do not want their own welfare to be affected by the transaction to a green economy.

A study done by Kallbekken & Aasen in 2010 outlined the Norwegian public attitude towards environmental taxes. The focus group had a strong preference towards earmarking revenue for environmental measures. The first reason for this is that many believe that an environmental tax can only have a positive environmental effect if the revenue is used for environmental measures. The second is the fear of the revenue just disappearing in the big drain (Kallbekken & Aasen, ibid.)

The "double dividend" hypothesis is debated, but there is a consensus between economists that in a first-best world it is inefficient to earmark the revenues, compared to using revenue to reduce other ineffective taxes in the market. In theory the revenue should be used where it yields the highest welfare, but at the same time public acceptance is crucial (Sandmo, 2004; Kallbekken & Aasen, 2010).

Still after providing information about problems considering earmarking, some participants still maintained their support for it. The reason for this result can be viewed as the public wanting policies that they understand and that are easy to mobilize for. Other more complex revenue redistribution could be difficult to understand. However, after providing more information surrounding the benefits of different usage of revenue, more support was provided towards different tax distribution design, such as lump-sum transfers and revenue recycling (Kallbekken & Aasen, 2010).

The study provides a clear conclusion that the general public is concerned about environmental issues, but also provides a clear picture of how the public lack information and understanding about the incentives and benefits taxes could provide. Especially in how governments could use revenue for beneficial effects (Kallbekken & Aasen, 2010). This is the same result James Hansen (2015) provides in his arguments of the CFD design, where he states the public acceptance increases if the policies are easy to understand and to mobilize for.

3.2.2 Politics

Climate issues have been included in most political party programs. Both conservative and labour parties have been similar in regard to climate change policy solutions (Boasson & Lahn, 2017). They both value the global cost-effectiveness model and the international cooperation to ensure least-costly mitigation options are realized first (Schoenefeld, 2016).

Implementing global cost-effective environmental policies, have received opposition within a small group of parties who promote more national measures, such as direct regulations of large emitters and state aid for renewable energy. The need for alliances in the political scene has made both conservative and labour party alliance with these parties, something that has resulted in more domestic actions in recent years, and less cost-effective measures (Boasson & Lahn, 2017).

Overall conclusion is that Norway supports and understands the importance of an international cost-effective approach through binding global commitments. They have for decades tried to get international binding commitments, as they only see domestic measures make sense if they can ensure global cost-efficient CO2 mitigation. **This makes sense when considering Norway has a very small percent of total global emissions, and aggressive domestic actions could eventually only harm the national economy, and have minor impacts on global emissions.**

This has made Norway focus less on domestic emission reductions, and more on being a front-runner in promoting environmental cost-efficient policies globally through ambitious financing initiatives and leadership (Boasson & Lahn, 2017). Norway, as well as being a non-member of the EU, is a small country that does not have the market power to pursue its own interest as countries such as the US, China or Russia has. However, being a non-member of the EU gives Norway more flexibility and freedom in policymaking to launch its own initiatives considering alliance building (Boasson & Lahn, 2017). This has made it possible for Norway to implement some recognizable domestic incentives that have received international attention. For example, the “subsidizing” or tax exemptions of electrical cars has made Norway one of the largest markets for electrical vehicles in Europe (Boasson & Lahn, ibid.). This has contributed to electric cars amounting for 9,2 percent of total registered cars in 2020 (SSB, 2020a). This result has lowered short-term cost effectiveness, but the scheme has created incentives for infrastructure changes that could be important in the long run perspective considering a futuristic low-carbon society (Heggedal & Rosendahl, 2015). However, Boasson & Lahn (2017) concludes that domestic measures like these, could undermine the Norwegian global approach of cost-efficiency, and weaken Norway's global climate diplomacy position internationally.

Norway has been and is investing considerable resources in promoting a global cost-efficient approach to handle climate change. Their ambitious REDD+ financing initiative, aiming to spur a global regime that can facilitate the founding of low-cost mitigation options, has been strengthening their international position (Boasson & Lahn, 2017). Their consistent long-term objectives in the global political areas have made Norway one of the unexpected transformational leaders globally. Their independent and active role is contributed by their interdependence as a highly competent actor outside the EU. However, the overall conclusion would be that, due to Norway's modest size, the country lacks the position and size to have the power to be transformative leaders (Boasson & Lahn, 2017).

The Paris Agreement in 2015 indicates that international commitments are surely starting to materialize. This is also a deal Norway fully seeks to integrate. The question arises whether Norway's continual dissonance between domestic climate policies and a global cost-efficient approach will continue or reconcile. **However, if Norway wants to reach their climate goals for 2030, it would be reasonable to assume that effective domestic environmental measures are going to be implemented, and therefore reconcile the domestic and global approach.** As mentioned earlier, domestic policies increasingly make more sense, considering global cooperation in emission reductions seems to materialize.

As argued in chapter 3.2.1, the high public acceptance and somewhat low political disagreements towards environmental policies, could make the implementation of a new and effective policy uncomplicated (Kallbekken & Aasen, 2010). However, earlier examples of a rising carbon tax have shown great public reactions and political disagreement (Lin & Li, 2011) The incremental focus of policymakers should therefore be to implement policies that makes it possible to reach the environmental objective, and as well are equitable for everyone, to minimize oppositions towards a rising tax.

3.2.3 Introduction of existing environmental policies - Trading scheme and taxes

The current level of emissions is 2,3 % under the 1990 level (SSB, 2020b). Even with an implementation of a carbon tax already in 1991, the overall emissions have not decreased to a level coherent with long term sustainability. This is due to the substantial growth in the extraction of oil and gas (Boasson & Lahn, 2017). Norway exports five times more energy than it consumes, and it is the tenth largest exporter of oil and third largest exporter of natural gas (Ministry of Petroleum and Energy, 2014). Increased energy prices together with tax exemptions for exported energy, have therefore made the relative carbon taxes to some degree ineffective (Lin and Li, 2011). However, Norway is among those countries with the highest levels of greenhouse gas efficiency, or in other words the country with the lowest emission per unit GDP (Klima og miljødepartementet, 2020). The CO2 equivalent per krone produced has decreased 50,4 % from 1990-levels (SSB, 2020c). The UNFCCC estimates that greenhouse gas emissions were about 13-15 million tonnes CO2 eq. lower than it would be without any governmental regulation (Regjeringen, 2016). This suggests that the carbon taxes have worked to increase production efficiency, and that the industry has acknowledged the increased costs in their production, but not to the degree that it created an energy shift in the market. The level of overall emission is still at a critical level, and the current level and policy design is failing to make the incentives for change.

The overall conclusion is that the mitigation effects of the carbon tax in Norway is non significant (Lin & Li, 2011). Finland, which has a lower nominal tax rate than Norway, has a significant overall effect of their carbon tax. The reason for this is that Finland has a flat tax rate for all emitters, with non exemptions. Norway on the other hand has provided tax exemptions for relatively energy intensive industries, considering the fear of losing industrial competitiveness (Lin & Li, ibid.). This is enough to suggest that the effectiveness of a carbon tax relies on tax rates and different scopes of tax exemption.

In 2005, the Norwegian quota system was introduced and further on implemented within the EU ETS. From 2008, the system has regulated about half of the Norwegian total emissions, mainly from petroleum and industry (Regjeringen, 2020a). More than 80 % of the emissions today are either covered by the ETS sector or subject to the carbon tax (Regjeringen, 2020b).

Some sectors like agriculture , which stands for almost 10 % of total emissions and that in 2015 stood for under 0,4 % of total BNP, have a climate tax exemption (Regjeringen, 2020a: Syverud et al., 2020). The possibility for increased production efficiency is major, but since they have tax exemptions, the incentives for change are not present. A small incentive in this segment, could lead to better production efficiency and major cuts in emissions. However, considering public support, putting a tax on agriculture would be difficult. This is a great example of the difficulties policymakers have to consider, and could help us understand why policymakers' lack of implementing effective policies. In 2019 however, the agriculture community signed a letter of intent to reduce emissions to an efficient level (Regjeringen, 2019b). This is something that suggests progress and industrial as well as governmental understanding of the importance of lowering emissions in segments that have huge potential for efficiency.

On the other hand, the oil and gas industries have double fees. The oil and gas sector pays carbon tax as well as being regulated by the quota system. The reason for a “Double fee” is the insufficient level of the quota prices. A growing problem with introducing an extra fee on sectors that are already included by the quota market, is that the emissions only shift to other countries, since the cap is already set. The same problem occurs when incentives for production efficiency, for example in the oil industry, are implemented. The overall effect could be that Norwegian companies need less quotas, and further on sell them to other companies within the EU. This "carbon leakage" could only be hindered if the government buys quotas and "deletes" them (Heggedal & Rosendahl, 2015). The "double fees" seems to be a non-effective policy to reduce overall emissions, but if Norway wants to advance a competitive advantage and be early adopters towards a renewable energy future, the "double fee" could be seen as effective.

The issue of carbon leakage is the main reason for EUs non-aggressive policies and somewhat ineffective policies. An introduction of a carbon tax or quota price would statistically lead to a carbon leakage of 10-30 %, that means that the carbon emissions internationally would increase 0,1-0,3 tons, for each ton reduced domestically (Bye & Rosendahl, 2012). This has made the EU ETS system allocate free quotas to the most exposed industries, and made the overall price of the quotas insufficient in terms of setting incentives for green technological progress.

The fear of "carbon leakage" and public opposition have made their overall policies insufficient. However, Norway has a huge potential to increase their efficiency in environmental policies with introducing a flat and growing tax on all industries.

3.2.4 New goals and "a green deal"

In 2020, Norway announced a reinforced climate goal , announcing that they want to decrease emissions by 50 to 55 % before 2030, compared to 1990-level. (Regjeringen, 2020b). Also, the EU announced in 2020 the same initial goal (European Commission, 2020).

First, it is important to differentiate the industry under the quota system and the industry that are under domestic policies:

- The EU ETS covers almost 50 % of all emissions in Norway (Regjeringen, 2020a).
- Almost 70 % of the emissions not included in the EU ETS falls under domestic environmental policies, such as fee and taxes (Regjeringen, ibid).
- This suggests that almost 20 % of all emissions are not subject to any tax or fee (Regjeringen, 2020b).

Emissions that are under the EU ETS will be under the influence of EUs decisions makers, however Norway could influence the effectiveness of the ETS through double fees. Emissions that are not under the EU ETS, could be reduced through other economic instruments such as taxes, direct regulations, standards, agreements and grants for emission reduction measures. This is mainly emissions from transport, agriculture, construction and waste, as well as some parts of the industry and petroleum industry that are not included in the EU ETS (Energi og Klima, 2020). The next decade is crucial for Norway if they want to reach their comprehensive climate goals for 2030.

“The Green Tax Commission” of 2015 gave an overview over potential expansions of existing fees such as carbon taxes and removal of tax exemption. Their report proposed an implementation of new and more aggressive fees that correspond more closely to the given environmental impacts (pigouvian approach) (NOU, 2015: 15, 2015). The government has since 2013 increased the general tax level on emission from 400 NOK to the level of today of 544 NOK per CO2-equivalent (Finansdepartementet, 2020).

The new “State budget” for 2021 proposed to reduce and repeal tax-exemptions furthermore than the report from 2015 (Klima- og miljødepertementet, 2020, p.278). As mentioned before, the potential for increased production efficiency is huge in numerous industries (Regjeringen, 2019a). The government suggests to increase the environmental tax by 5 % yearly until 2025 for all sectors (Regjeringen, ibid.). The increased revenue is suggested to be used to reduce taxes on affected groups to reduce the burden of adaptation (Klima og miljødepartementet, 2020, p. 278).

The new “State budget” new environmental goals are calculated to give around 19 % reduction by 2030. This is far from what the “Granavolden platform” suggests, and the proposal has received immense criticism for its lack of ambition to reach the 2030 sustainable goals of 50-55 % emission reduction (Solvang et al. 2020). This suggests that the current government lacks the determination of implementing new effective policies in the fear of oppositions. This verifies my argument in the introduction that politicians do not prioritize long term policies (such as environmental policies) that involve near-term cost with only a promise of benefits far away in the future, without huge public support. **Therefore must Norway policymakers focus on implementing a policy design that makes it possible to gain public acceptance towards increasing carbon prices and other environmental policies.**

3.2.6 Other public measures

Direct regulations, standards, deals, and subsidies are other measures used as well as the quotas and taxes. Since the taxes and quotas should in theory represent the cost of externalities, we should in a perfect system not need any of these other measures. Since the level of taxes fails to represent the real shadow cost of emissions, together with the barriers created by the industry, there are market failures that have hindered cost-efficient environmental actions being conducted. This has further led to the government needing to intervene through these other measures (Klima- og miljø, 2020, p.279).

Norway is dependent on the fossil fuel industry, and since this industry is on the decline, we need to find new sources of income. The knowledge and research done considering renewable and green technology are overall low, and therefore the potensial enormous. Through governmental investments in technological development, could Norway become a front-runner in green technology. This could further help international emission reductions, and create a new segment of income for Norway (Klima og miljødepartementet, 2020, p.279). Considering this, many public support schemes have been created, such as the state enterprise (SF) “Enova", through “Innovasjon Norge” and “Noregs Forskingsråd”, where all aim to spur green technology, innovation and help overall green technological progress. Since 2013, the public investments in green innovation and technology has increased by NOK 3 billion (Klima og miljødepartementet, 2020, p. 279).

The increased subsidies and public investments have overall been seen as less effective than market-based instruments such as quotas and taxes. However, the presence of other market failures suggests that public investments are needed to change the overall energy-infrastructure and technological change until it will reach a commercial phase. Subsidising and earmarking are also, as mentioned above in chapter 3.2.1, is the preferred instrument by the public, something that makes these measures more bureaucratic and therefore overall easier to implement (Saksvikrønning, 2015, p. 94).

4. Methodology

4.1 Data

All collection of background information is based on a literature review of scientific and grey literature, policy documents and media coverage. My thesis is based on James Hansen “Imperative of a Carbon Fee and Dividend” from 2015, an scientific article that has received much attention and recognition for its simplicity and coherence approach for implementing effective environmental taxes.

One of the first steps of my thesis was to read the book of Pearson (2011), something that gave me an overview of the complex matter of global warming. This gave the foundation for understanding the scientific literature in a more abstract way, and to understand why both Norwegian and global governments have failed to implement effective policies. After noting down key concepts and understanding the complexity of policies, I searched in scientific journals and scholarly data based on my understanding of the topic, and further on built the fundament of my theoretical framework based on these findings. I build my claim that the CFD design is the best acquitted design on reducing emission on the well established scientific articles by Bovenberg (1999) and Goulder (1995).

After outlining different theoretical aspects of environmental policies, I tried to link these findings with grey literature and policy documents that consisted of reports and articles made by different levels of governments, organisations, think tanks and businesses, to formulate an overview of the situation. In the situation part, I used a state budget proposal such as the Prop. 1S (Klima og miljødepartementet, 2020) and the scientific paper from Boasson & Lahn (2017) to get an understanding of how they view their efforts and how they plan to reach the 2030 sustainable goals. With the help of critical NGO reports from both Saksvikrønning (2015), IPCC (2018; 2014) and Naturvernforbundet (2018), I tried to get another perspective of the Norwegian and global governmental efforts and potential considering effectively lowering emissions. Further studies by Kallbekken & Aasen (2010), Aasen et al. (2019), and economic analysis of previous environmental policies by Bye & Fæhn (2009), outlined the public attitude towards environmental protection and potential for implementing more effective policies.

4.2 Limitations

My thesis has limitations considering I only use secondary data. The time limitations of the thesis prevented me from generating an "General equilibrium analysis" and interviews, something that could have made my thesis more reliable. There are some limitations considering the premature nature tax design, something that makes the discussion and conclusion part based much on speculations and hypotheses. However, examples from Canada's implementation, as well as the multiple established scientific literature, provides evidence for the effectiveness of such tax designs and suggest great indications. Also, the simplicity of the tax design makes the intuitions and hypothetical discussion more reliable.

4.3 Reliability and validity

Validity can be clarified as the "ethical obligations to minimize misrepresentation and misunderstanding", especially considering qualitative data (Stake, 1995). Increasing validity could be done by providing multiple sources of data, something that could be referred to as triangulations. In my thesis I analysed multiple scientific articles as well using government documents, NGO reports and media coverage, to provide a spectrum of perspective and as well limit the room for biases. This has increased the validity of my thesis.

Reliability is referred to as the possibility to replicate the results, if it was conducted by a different person in a different time, using the same materials (Bryman, 2016). Logical sequence of steps taken throughout the research process will increase reliability and the possibility of same results. My thesis fundamental is to simplify the complex matter of tackling climate change. This provides a logical sequence of conclusions without too much complexity, and further on increases the reliability and possibility of replications if conducted by a different researcher.

Considering climate change and economic theories is based on much speculation and hypotheses, relying on multiple sources of data, applying a concrete theoretical approach and criteria's to analyze policies in a standardized way help to provide results of quality despite the necessity for speculation.

4.4 Ethical Considerations

My thesis is built somewhat on ethical considerations. Outlining the importance of effective policies to reduce emissions for the safety of our future is based on my moral and ethical responsibility of not leaving the world more scattered than when I was brought into this world. As an economist, it is important to realize that not all are numbers and figures. We are talking about lives and livelihood, and finding the “trade-off” could mean someone is worse off than someone else. Calculating how much emissions is “beneficial” is an abnormal thing to do, since my ethics consider all emissions as harmful and destructive. Scientists have for decades outlined the importance of environmental protection and including nature in the costs of products. However, the society as a whole has paid for the externalities of the usage of fossil fuels. The ethical thing here, in my view is clearly just to include externalities on the price of fossil fuels. However, doing so has not been as easy as previously assumed.

A comprehensive and fast cut on all fossil fuels today, could reduce emissions to an efficient level that makes us reach the 1,5 degree Celsius target. Thinking about how much our previous generation and we have destroyed the world and how much our future generation has to suffer from our actions, one could argue that the ethical thing to do and further undertake the economic consequences of that action. However, this will not happen. Most humans lack the ethical grounds of sacrificing their wellbeing and prosperity for the case of future generations. Therefore must policymakers and economists find the optimal strategy that both consider the present and future generation, and the intertemporal dimension of our emissions. These calculations do as previously explained, often include a trade-off. Economists must therefore try to find the optimal actions that yield the most benefits. However, since the future lacks a voice in today's policymaking, they have a clear disadvantage in terms of arguing for their case. This will eventually lead to unfair policies for future generations, something we have witnessed for decades. **My ethical responsibility is therefore with the future generation.**

5. Discussion and results

The evidence for human caused climate change is clear (IPCC, 2018). Our future is jeopardized and our whole ecosystem is unbalanced. The primary driver behind this is our version of the neoclassical growth model which has no scarcity in natural capital (Solow, 1974). For decades, big international corporations have gotten a free pass to pollute and allocate the social costs over to the public. This crucial market failure of not representing external costs in products has led us on an unsustainable path, considering an overconsumption of non-renewable energy and further on environmental destruction (Ripple et al., 2017). Sustainable growth can therefore only be achieved if policymakers use political instruments to raise the market price on pollution towards the real shadow cost of environmental degradation (Nicolaisen et al., 1991). This indicates that economic growth depends on the green shift, and the emerging of renewable energy sources.

As explained in chapter 3.1, market power concentration may work against the “green shift”. Before prices on fossil fuels increase and trigger reduced climate gas emissions, there is a substantial risk that climate gas emissions will not be significantly lowered. Policymakers therefore need to implement appropriate climate policies to effectively start lowering climate gas emissions.

The Paris Agreement from 2015, gave us hope for global cooperation to tackle climate change, but the necessary measures are not yet implemented. The largest reasons for this are public and political disagreements, and the short-term perspectives of many politicians. Hansen (2010) argues for a possible leadership from China, where the leaders seem to make decisions based on best technical information and science, with a more long-term perspective. This theory is reinforced through China's recent global leadership in renewable energy investments and reinforced environmental goals for 2030 and 2060 (Climate Action Tracker, 2020b).

Democracy seems to have its costs in terms of slower implementation of climate policies. This triggers the following key question given that environmental scientists stress the urgency of implementing effective measures: How to increase the rate of adoption of necessary climate policies?

Economic analyses have for a long time recommended carbon prices as the most efficient way for reducing greenhouse gas emissions (Klenert et al., 2018). However, the EU has been holding on to their “Cap and Trade” design, which has not been as effective as hoped due to the political failure of lowering the emission cap. An efficient auction of permits and a price that represents the social costs would yield the same result as taxes (Pearson, 2011, p.133). However, allocation of free quotas, as well as the cap being set too high, have made the CAT model overall inefficient. The allocation of free quotas is a crucial fault of the system. In comparison to a tax, where emitters are both liable for their abatement costs as well as paying taxes for residual emissions, the overall difference in incentives and costs is major when giving out free quotas (Pearson, 2011, p.135).

Moreover, in allocating free quotas, firms still have the opportunity to sell the permits, something that creates an opportunity cost when sales revenue forgone. This revenue forgone is reflected in the prices, and efficiency is promoted. This cost would vary depending on total quotas and how much of the quotas that is allocated freely (Pearson, 2011, p.134). Also, recent indications from the EU suggest that they will start to significantly lower the cap each year (European Commission, nd; Regjeringen, 2020a). Something that suggests higher quota prices and more efficient emission reduction.

Another aspect is the “Double Dividend” question. When allocating free quotas, the revenue raised may not offset other taxes with undesirable distortion elsewhere in the economy. The studies done regarding the second dividend are inconclusive, mostly because of the interaction effect, as explained in chapter 2.3.4 “Double Dividend”. However, revenue recycling the collected revenue from either taxes or selling permits, could offset much of the costs associated with higher taxes.

As long as the EU ETS system fails to significantly lower the cap and as well give out free quotas, 50 % of Norwegian emissions could in theory not be sufficiently reduced through Norway’s participation in the quota system. However, as mentioned in chapter 3.2.3, Norway recognizes the insufficient prices of the quotas, as they set carbon tax on part of the oil and gas sector, despite them being regulated by the quota system. This indicates that Norway could through domestic policies effectively reduce emissions in huge emitting industries, either way if the EU ETS system fails to deliver.

Further on in the analysis I am going to focus on the domestic measures Norway can do to reach the climate goals for 2030. For Norway to reach their goals, they need to impose measures to reduce emissions on industries that today have tax exemptions, such as the transport sector and agriculture. To simplify, I will however suggest that the CFD tax first and foremost will be implemented only on fossil fuels, and on top of the existing carbon tax. After reconciling and understanding the effects of the tax, the tax could be imposed to other segments in the economy.

Lin and Li (2011) conclude that Norway's carbon tax has been overall ineffective in lowering emissions, mostly because of tax exemptions and somewhat public resistance over increasing taxes. However, studies implies that both politicians and the public agree that more aggressive measures have to be introduced to reach our climate goals for 2030 (Kallbekken & Aasen, 2010; Aasen et al., 2019).

Norway was one of the first countries that implemented a carbon tax in 1991, and has for decades been a global leader in promoting cost-effective global measures to tackle climate change (Lin & Li, 2011; Boasson & Lahn, 2017). Already in 1989, 40 % of the voters stated that they were “very concerned” about climate change, something that has further increased the last decades (Aasen et al., 2019). The long-term relation to the climate issue, could suggest public acceptance towards increased carbon taxes. However, the studies done by Aasen et al. (2019) shows that the majority of the public do not want their own economy affected by increased prices on fossil fuels.

Evidence from Boasson and Lahn (2017) suggests that both conservative and labour parties value policies that have a cost-effective approach to ensure the least-costly mitigation option is realized first. However, as they must form alliances with smaller parties and handle public opposition towards increased prices, policymakers have implemented less cost-effective measures (Boasson & Lahn, ibid.).

Norway has invested a great amount in subsidizing climate friendly solutions, with different results. The negative aspects of subsidizing is that it does not suppress climate damaging actions (Saksvikrønning, 2015, p. 37). So, for example, if the subsidizing of electric-cars only leads to more cars and more people driving, much of the environmental benefits would descend (the so-called *rebound effect*). The mainstream objection to subsidies is that it is an ineffective way of reducing emissions as entry-exit incentives become misaligned. However, subsidies could be a well suited tool for fast infrastructural changes and pushing innovations, as well as being easier to implement than other policies (Kallbekken & Aasen, 2010).

The increasing governmental investments in green solutions suggest that political and public disagreement have hindered implementation of a policy that ensures the least-costly mitigation option being realized first. This has led to political discussions about how to gain public acceptance over increased prices with the usage of different tax designs.

Some specific options are (Baranzini et al, 2000):
1) Revenue recycling where the revenue goes to reduce other ineffective taxes.
2) Earmarking the revenue for improving technological progress.
3) Revenue is used to compensate or distribute revenue back to the population to compensate for negative impacts (CFD).

Earmarking climate tax revenues may not be the most welfare enhancing element in policies to reduce climate gas emissions, however earmarking is often used as a tool because it is easy to understand and it reduces political resistance. The study done by Kallbekken and Aasen from 2010 states that the general public in Norway displays a strong preference towards earmarking revenue for environmental measures. However, this could change when more information about revenue usage and the overall effectiveness of different tax-design are presented (Kallbekken & Aasen, ibid; Carattini, 2017b).

The studies by Kallbekken and Aasen (2010) and Aasen (2019) provides a clear indication that the majority of the public is concerned about environmental issues, as well a clear picture of how the public lack understanding of the different environmental tax designs. Studies by Sandmo (2004) suggest that using the revenues to reduce ineffective taxes in society would yield the highest benefits. However, since the public lacks this understanding, do they prefer something they could understand goes to something meaningful, and not just into the governmental drain (Kallbekken & Aasen, 2010). Therefore, earmarking is often used and a preferred tool because it is easy to understand and further reduces public and political opposition. This implies that the simplicity of the CFD design would be beneficial in terms of gaining acceptance of the design.

The general resistance towards increasing environmental taxes in Norway, is also understandable when the revenue has been used to decrease taxes such as wealth and inheritage taxes. Something that would only benefit the upper-classes of society, suggesting an unfair distribution of cost. The government has done this based on the theory that these taxes were ineffective for the economy, and by reducing these taxes would it create more stimuli for the economy (Finansdepartementet, 2020). As stated in chapter 2.3.4, using revenue to correct other ineffective taxes in the economy is based on the “double dividend” hypothesis, where total social benefits depend on which other taxes that are reduced. Here, I note that the first dividend (environmental benefits) is undisputed.

An introduction of a “Carbon Fee Dividend”, where the revenue is recycled back to the population breaks with the social benefit arguments forwarded by Sandmo (2004) and other economists for general inclusion into public funds, but has a clear benefit considering easier implementation. A coherent analysis of social benefits needs to compare these benefits to find the optimal trade-off between general benefits and faster implementation, in particular given the concerns raised by environmental scientists of insufficient climate gas emission reductions.

The government suggests increasing the carbon tax by 5 % until 2025 (Klima og miljødepartementet, 2020). The majority of the public wants more environmental policies, but at the same time they do not want their own personal economy to be affected. Both sides of the political scene want more effective environmental policies, however they have different perspectives in how to reach the environmental goal. With the present tax design, as discussed throughout the thesis, these public and political opposition could make it nearly impossible to increase carbon tax levels to an efficient level.

Policymakers must therefore implement a revenue-neutral tax design such as the CFD, where the environmental objectives are achievable in a more cost-effective way than earmarking. The design does not provide personal welfare decline, and it makes prices on fossil fuels higher. Klenert et al (2018) argue that increasing prices on fossil fuels is the most efficient way for reducing greenhouse gas emissions. Also, as pointed out throughout the thesis, increasing prices on fossil fuels often ensures the least-costly mitigation option to be realized first (Perman et al., 2011, p. 233-237, Weitzman, 1974). Therefore, public acceptance of increased prices must be a priority for policymakers.

As explained above, Aasen et al. (2019) show that the majority of the public see climate change as a huge problem, as well as they do not want their own economy affected by increased prices on fossil fuels. This indicates that CFD design could gain modest public

opposition, considering personal welfare on average is not affected by the increased prices, as well as the design could ensure the environmental objective being reached.

As pointed out in “Box 1: Results of Canada’s implementation of the CFD design”, the model has been applied in practice. The study done by Elgie and McClay (2013) did not prove any causality between the introduction of the tax and the rapid emission reduction in the province. However, the experiences from British Columbia, gave us a demonstration of the tax design effects of increasing political and public acceptance towards a carbon tax (Nuccitelli, 2018).

Further I am going to reason my research question: **“How Norway should implement “Carbon fee Dividend” for reaching their 2030 sustainable goals.”**

5.1 Proposed actions: Implementation process, hurdles and level of tax

In 3.2.2, I discuss the political approach of Norway regarding environmental protection. For decades Norway has tried to get international binding commitments as Norwegians see aggressive domestic measures only makes sense if they could ensure global commitments. However, considering the Paris Agreement in 2015, there are reasons to believe that international commitments are materializing and domestic measures are starting to make more sense. Studies indicate that both politicians and the public agree that new innovative measures have to be introduced to reach our climate goals for 2030 (Kallbekken & Aasen, 2010; Aasen et al., 2019). This implies that politicians and the public could be open to the idea of implementing the CFD design, even though it breaks with the traditional tax design.

As argued above, the simplicity and potensial for more aggressive tax rates than other policy designs, makes the CFD design most adequate to reach the goal by 2030. The introduction of the CFD model should start at a suboptimal level at first and then increase over time, until fossil fuels are phased out. People will then have time for adjusting. To hinder possibilities of shifting emission reduction between time periods, as also discussed in the introduction, policymakers need to contemplate **dynamic cost effectiveness**. This entails a price path that follows Hotelling’s rule as emission levels can be adjusted so that Hotelling’s rule holds.

Dynamic efficiency is more complicated. Following a Hotelling price path could hinder setting statically optimal emissions levels in each time period, given that static optimality and Hotelling’s rarely are jointly met. This implies that benefits from being on a Hotelling price path must be compared to the costs of deviating from a sequence of static optima, and a potential trade-off between reducing deadweight losses and being off the Hotelling price path. **Dynamic efficiency** therefore requires to jointly minimize overall the expected joint costs of not following the Hotelling Price path, and minimizes the deadweight losses caused by deviating from the static optimal emissions (Romstad, 2016).

To simplify: It is a trade off between contemplating with future costs and present costs. If policymakers had implemented effective environmental policies already in the 1990s, when environmental scientists first presented global emissions degradation of the environment, then our cost of changing behavior today would be much lower. This is because of the stock effects of emissions, as well as the incentives environmental policies give in technological progress considering substitutions and energy efficiency. The marginal damage is constantly changing upward with the more pollution that is emitted to the atmosphere, and our abatement costs are constantly becoming cheaper the more environmental policies are implemented. **This suggests that we need to consider the dynamic market when introducing the tax and that it is a tradeoff between future emission cuts and costs of changing behavior today. This is the reason for the importance of dynamic efficiency.**

5.1.2 Former political oppositions towards the CFD model

In 2016 the parties MDG and SV presented the CFD design in "The Storting", and discussed an potential implementation of the CFD design. The different political parties had varying arguments for why they oppose the model. However, the consensus was not all negative.

Political parties on the middle/ right argued that the model is a contrast to the traditional, well established present tax system, and could therefore weaken the support for this tax system. They also argued that the model **could be socially unfair, as well as it could raise some geographical issues.** Moreover, they claimed that a comprehensive implementation of a new tax design will take time.

The more left wing parties argued for the need for new policy designs, but they also acknowledged some of the same hurdles as the other political parties. However, some of the parties more on the left side seemed more positive considering the effectiveness of the tax, but would rather implement policies that were in their own program, such as distributing revenue to the industry for more green solutions instead of distributing back to the population. **This proposal of distributing revenue to the industry, actually has gained much more acceptance in "Stortinget", something that seems strange when this model would even more so increase the social unfairness and geographical challenges (Stortinget, 2016).**

To sum up the 2016 discussion in Stortinget, it seems like the politicians are looking for the negative aspects of the policy, instead of listening and outlining its positive aspects including the overall effectiveness in emission reduction. The politicians are falsely promising emission reductions, and effective measures to reduce emissions have still not been introduced. If we want to reach our goals for 2030, we need to look at the overall effectiveness of emission reduction as the primary goal.

The environmental party (MDG) criticized the other parties for being hypocrites as they were claiming that they wanted emission reduction through innovative solutions, but lacked the determination to implement such solutions. **The Socialistic left party (SV) argued that a CFD design would make it possible to implement aggressive and effective taxes, something that is needed to reach the 2030 environmental goals.** They also criticized the argument that the traditional environmental tax system could be weakened, since the only thing the traditional environmental taxes have contributed to is non-effective emission reduction and false promises (Stortinget, 2016).

The politicians' resistance towards the CFD design could have something to do with the fact that tax refunds would decrease their room for budget maneuvering. Later in my discussion, I am going to debunk some of the arguments stated by the oppositions of the tax design. I will do so with looking for solutions for the potential hurdles, as well as comparing the potential overall effectiveness of the CFD model with the present tax design.

5.1.3 Policy criteria: My comparison between CFD and present tax design

On the next page, I formulate my own elaboration of the different designs and how they meet the given policy criterions:

Policies criterion	CFD-design	Present tax design
Cost-effectiveness	**High**: *Could reach the target at minimum cost.*	**High**: *Could reach the target at minimum cost*
Long-run effects	**High:** *Would gain more acceptance over time, as people understand that if they change behavior, they would profit from the tax. This will create a continual decrease in demand for "high-polluting industries"', and more demand for "green industry". This will further increase investments, renewable technology and green infrastructure.*	**Medium:** *Depends. Influence of the tax would probably gain more acceptance over time, if the tax reduces emission and environmental damage. However, this means that the level of the tax must be at a level that creates incentives for change, but not at a too high level, so opposition increases. So the level of tax must be balanced between these two issues.*
Dynamic efficiency	**High**: *Could reach optimal tax levels and change the tax levels following the Hotelling price path, without much public disputes. The faster one reaches the optimal tax as they entail dynamic aspects of the tax, the most incentives the tax creates. Increases initial prices on fossil fuels creates more incentives to improve products and search for new innovative options to reduce emissions.*	**Medium**: *Hard to reach optimal tax level, and change tax levels without political and public disputes. Therefore would it over time be hard to get the continual incentives needed for reaching climate targets.*
Ancillary benefits	**Medium-High**: *Could lead to a second benefit such as better distribution of wealth.*	**High**: *Could lead to second benefits when considering using the revenue on reducing ineffective taxes.*
Equity	**High**: *Distributing revenue following "Fairness of income" is important since the upper-class have better opportunity to change behavior. However, income-elasticity is 1, something that means people with more income pollute more. This implies the upper-class will be affected more than the lower-class, before the change in behavior.*	**Medium**: *Revenue has in the last years been used to decrease inheritage and wealth taxes. However, it would be possible to use the revenue to increase equality.*
Dependability	**High**: *One could more certainly reach the optimal tax, something that suggests the optimal outcomes.*	**Low**: *Studies and earlier examples of a rising tax, suggest it would be nearly impossible to reach the optimal tax in time to reach the climate goals for 2030.*
Flexibility	**High**: *Assumingly high acceptance over increased taxes, because most of the public will probably benefit.*	**Low**: *Hard to change levels of taxes without disputes.*
Costs of use under uncertainty	**Low**: *Assumes some administrative costs, but not any costs besides this.*	**Low:** Interaction cost could be zero out if revenue is used to reduce inefficient taxes.
Information requirements	**Low**: *Not much information is needed if one implements the tax only on fossil fuels.*	**Low**: *Not much information is needed if one implements the tax only on fossil fuels.*

Table 5.1: *My summary of the political debate and the literature on policy criteria's in comparison to present tax design. Policy criteria outlined by Perman et al. criteria's (2011, p. 178).*

In summary, comparing those two designs indicates that the CFD design is much better acquitted in meeting the criteria's outlined by Perman et al. (2011, p. 178).

5.1.3 International affects:

As pointed out in section 2.4.4, there are many issues arising when implementing a domestic policy. International competitiveness could be shackled, and economic decline could be foreseen. However, there are measures to reduce or even remove such consequences. A solution for not reducing international competitiveness would be to introduce tolls or taxes on imported products that are not subject to any fee or tax, as well as extract the given tax from exporting products so they will be able to compete in the global market. This could lead to some complications, because it is hard to calculate the exact amount of pollution for each given product. Therefore, to simplify the introduction and hinder potensial hurdles, it could be reasonable to introduce a carbon tax only on carbon-intensive products such as coal, oil, gas, steel, and concrete (cement).

Nevertheless, there is a potential for carbon leakage when people could drive to Sweden to buy fuel, when assuming Sweden does not implement higher carbon taxes. However, the introduction of a carbon tax in Canada showed that carbon leakage by people driving to the US to fill their fuel, did not make any significant difference in emission reduction (Saksvikrønning, 2015, p. 64).

The increase in fuel prices could more so affect the Norwegian transport sector's competitiveness. This is already an issue for this sector as trucks from East-European countries fill their fuel in countries with much lower prices. This indicates that the Norwegian transport sector has much higher costs than their competitors. Measures to hinder this competitiveness-decline have been done as trucks legally can not have more than 600 liters in their tank when crossing the borders (Sakviksrønning, 2015, p.57). However, with an even higher initial fuel price, the competitive advantage of foreign transport sector could increase even more. A solution for these issues could be by introducing stricter border control where cars are required to leave the country with the same amount of fuel as they arrive, and vice versa. This has been done in Singapore with positive results (Sakviksrønning, 2018).

As pointed out throughout the thesis, global recognition of climate change is surely increasing. The Paris Agreement from 2015 indicates, as mentioned before, that every country must introduce domestic incentives to reduce their emissions. This suggests that potential negative effects of domestic policies can be less extensive than assumed. There is an increasing global recognition of becoming a leader in development of energy efficiency, renewable energies and other "green technologies" (Hansen, 2015). This indicates that domestic measures could be beneficial in terms of gaining international competitiveness in the long-run, considering this will push development in "green-industry". These potential advantages of being an early adopter of environmental policies will spur implementation globally, and further increase the arguments for implementing effective domestic policies (Hansen, ibid.). This especially implies for Norway as they are highly dependent on fossil fuels (Norsk Petroleum, 2020). Since increasing prices though taxes will, to the least-costly way, spur innovation and induce a "green industry". The reason for this is that economists see taxes as the planning instruments that "profit maximization" automatically guarantees total output will be efficiently produced (Weitzman, 1974).

5.1.4 National affects:

The price elasticity of fossil fuels in Europe is in the short run between 0,1 - 0,25, and increases to 0,6-0,8 on the long run (Edenhofer et al., 2014). Let us suggest a price elasticity of 0,2. If we increase the price on fossil fuels from NOK 15 to NOK 16, the consumption would decrease by 1,3 %. This suggests that an increased tax of NOK 1, would in theory only imply a social cost of NOK 0,2, because NOK 0,8 of the tax revenue would be recycled back to the consumers. This is a very low investment for emissions reductions.

If the revenues are used to subsidize climate friendly solutions, something that would imply a social cost of NOK 1, the overall effects considering environmental benefits of the tax would initially increase. **However, comparing recycled revenue to earmarking, the revenue to subsidizing climate-friendly industries, suggests that policymakers could increase taxes 4 to 5 times more, for the same initial social cost.** If the price elasticity is fairly constant along the demand curve, a NOK 4 tax increase with revenue recycle, would cause the same costs as if you increase taxes with NOK 1 and use revenue to subsidize the "green industry". This suggests that policymakers could increase the taxes to a much higher level without seemingly creating too much costs to the society and potential oppositions towards the tax. Note that this argument relies heavily on the assumption of a constant price elasticity for the suggested price change that is too large to be termed marginal.

The long-term perspective of a carbon tax proposes a gradual decrease of consumption, as people adjust over time. The Edenhofer et al. report (2014) indicates a price elasticity of 0,6-0,8 in the long run. Hence a tax implementation of NOK 1 today would gradually decrease emissions for many years. However, it also suggests that total revenue would initially decrease over time together with the decrease in consumption of fossil fuels and hence a declining tax base over time. This could eventually lead to a necessary downward adjustment of the refund, which would decrease the potential welfare effects and in some cases increase inequalities. This could contemplate matters.

5.1.5 Overcoming potential hurdles

5.1.5.1 Distributional effects

Initially, lower fossil fuel tax revenues in the future would suggest an decreased consumption of fossil fuels, something that indicates less emissions. However, this may create opposition towards the tax, and the acknowledgement of a smaller revenue in the future must be considered when redistribution structure is implemented. If the revenue is distributed evenly across the population, the flexible part of society (upper-class) has an advantage. They could initially change behavior faster, and eventually shift the costs over to the inflexible part of society (lower classes). This could increase inequality in society, and is an argument that the payments should be redistributed following **a fairness of income** criterion. Low-income people should get more of the "cake" from the beginning, so they have resources and time to change behavior. This distribution model could increase equality, and potentially also increase the second dividend, the indirect general benefits on the economy from more fair distribution of wealth. This will discard the oppositional arguments against the tax and increase general acceptance for the tax.

This is also an argument for gradually increasing the tax. An introduction of a too aggressive tax, could lead to subsequent negative welfare effects, as people and the industry do not have time for adjusting. So considering both the possibility of economic decline, and the fact that the lower classes are always hardest affected, institutions must phase in the tax so all classes have time for adjusting. Therefore, a gradually increasing tax, together with distributing revenue following fairness of income, suggest to be the best design in contemplating all effects of the tax. This approach could provide overall efficiency gains and increase potential profitability of innovation in green energy (Nicolaisen et al, 1991).

Reinem and Johnsen's master thesis (2018) suggests that the relationship between consumption and emission in Norway is quite linear. This implies that there is the same amount of emission linked to every extra NOK spent, no matter the level of initial consumption. Initially, people with high incomes pollute the most. Since the marginal emission tax is constant, the tax would not be regressive. This makes the CFD model more politically attractive, since the tax does not impose lower classes with higher initial costs. More so, it imposes that the upper-class will pay more as they are likely to cause more carbon emissions due to their higher consumption. This result makes the tax more attractive for people with low incomes and initially low consumption, since they will probably benefit from the tax refunds . However, as expressed above, the upper-classes have better opportunity to change behavior faster, and eventually shift the costs over to the lower-classes. This is something we have experienced considering the subsiding of electrical cars. Therefore, the distribution of revenue must still follow "fairness of income", even though the relationship between consumption and emission is assumed linear.

However, one must also consider that the present environmental tax revenue in Norway has indirectly been used to lower other taxes such as wealth and inheritance taxes, something that has initially increased inequality. The reason for the decline in wealth and inheritance taxes was based on the arguments that they were ineffective taxes. This use of revenue is based on the "Double Dividend" hypothesis, however do not consider the effect on equity. (Finansdepartementet, 2020).

As explained above, the welfare benefits of the tax would decline after some time as environmental taxes are supposed to change behavior. Studies done by Håkonsen and Mathiesen (1997), and Bye (2000b) imply the same result. As the revenue for distribution would fade away, some will lose initial income. For many would this be an insignificant change, while for some could this be a remarkable change in income. Especially for newly established families, big families or single parents, that hardly get ends to meet from the start. This income decrease in the future could signify some potential increased opposition towards the tax.

However, to meet the given emissions reduction target for 2030, Norway either way needs to implement higher environmental taxes. So if policymakers increase environmental taxes using the present tax design, would the decreased revenue in the future mean decrease in government income. The governmental response would then be to generate higher initial taxes. This is something that probably would create more political and public opposition.

One could probably debunk these arising issues considering revenue decrease, since once emissions drop, the social costs contributed by pollution is also going to decrease. This will lead to less public spending, and could further lead to a reduction of other taxes with undesirable distortions. One must also consider the aspects that implementing incentives for technological progress in renewable energy sources could lead to cheaper energy (Kretchmer, 2020). This could initially cause smaller expenses for the public.

5.1.5.2 Geographical issues

Kristensen (2018) studies the introduction of a CFD design. His study suggests that the rural areas actually will profit from the introduction of the CFD model as people drive more in urban areas. However, these calculations miss that people living in urban areas have more opportunities to change their behavior. They will have better public transportation opportunities, infrastructure for electrical cars and overall more investments in green transport solutions. Therefore, politicians must put in place policies for increased investment in alternatives in rural areas, before an aggressive and excessive tax implementation.

5.1.5.3 Tax interactions effects

Bovenberg and Goulder (1996) argue that setting a tax following the pigouvian principle is difficult once other distortionary taxes are present. Given the revenue neutrality of the CFD-design, the tax will not interact with other taxes and the present tax system. However, this is only the case if the “CFD-tax” is introduced on top of existing taxes. This reduces the extent of the interaction effects, and hence lowers the need to increase other taxes, and more so the possibility of oppositions towards the tax.

6. Conclusion

The sudden urgency of climate change is in the shadow of what environmentalists have been expressing for decades: Excluding externalities on fossil fuels prices will increasingly accumulate the problem of climate change. Policymakers’ inaction has therefore led us on an unsustainable path and more comprehensive issue, that we and the future generations need to undertake. The Paris Climate Agreement gave hope that governments were going to implement more comprehensive and effective policies. However, policymakers’ efforts have been shackled by political and public opposition.

Obtaining dynamic efficiency and consequently reaching the optimal level of emissions, is more feasible through price instruments (Romstad, 2016; Klenert et al., 2018). Norway must therefore continue to use environmental taxes as an instrument to reduce its emissions. Bye (2000a) suggests that Norway has a potential for a second dividend with the present tax design. However, previous attempts of increasing the carbon tax have generated political and public opposition. Considering politicians' short-term view, would the implementation of an optimal tax be unachievable without public support. Therefore, as argued throughout this thesis, implementation of optimal tax levels depends on the tax design, and further public acceptance towards this design.

Most environmental tax reforms include some sort of redistribution because of implementation acceptance, possibility of higher cost-effectiveness and a non-environmental benefit (double dividend) (Baranzini et al, 2000). Sandmo (2004) argues that including revenue in the governmental funds would yield the most social benefits. However, this increases the complexity of the design and further political and public opposition (Bovenberg, 1999).

So regardless that Norway has a potential for a second dividend if revenue is included in the general budget, a coherent analysis needs to find the optimal trade-off between general benefits and faster implementation of optimal tax levels. Given increased concerns over insufficient climate gas emission reduction, must policymakers implement a tax design that provides the environmental objective being reached to the least costs.

The purpose of this thesis was therefore to introduce a tax-design that could increase prices on fossil fuels, without gaining political and public opposition. My research suggests that the implementation of a revenue neutral tax such as the “Carbon Fee Dividend” would eliminate many of the implementation hurdles that have been consistent with other policy designs.

My arguments for the CFD design is further reinforced by the study of Aasen et al. (2019). She presents a clear picture of how the majority of the population see the climate issue as a major threat, however that they do not want their own economy to be affected. **This indicates small oppositions towards the CFD design, given that the environmental objective could be reached without personal welfare being affected.**

The Carbon Tax Dividend Design has huge implementation benefits considering:

1) The simplicity of the design.
2) The possibility of high cost-saving.
3) The environmental dividend is almost always achieved.
4) Will have net-zero welfare effects on the population.
5) Motivational aspects of the possibility of profiting from the tax.
6) The social equitable profile.

As outlined in table 5.1, I believe the CFD-design could achieve more of the policy criteria’s given by Perman et al. (2011, p.178), compared to the present tax design. The design will therefore also be more superior in terms of reaching the environmental objective most efficiently.

CFD design has an appreciable social equitable profile because upper classes emit more than lower classes (Reinem & Johnsen, 2018). However, the upper-classes could change behavior faster and eventually shift the cost over to the lower classes of society. Therefore, a suggestion is that distribution of revenue should follow the “fairness of income” criterion. This could increase complexity, and further make it more difficult to get political agreements. However it could introduce clarity on a main issue and could further increase equity in society.

Moreover, the experiences from British Columbia indicate how effective the tax could be, considering gaining public and political acceptance over environmental taxes (Nuccitelli, 2018).

As the government is somewhat dependent on the present carbon tax revenue, would I suggest that they implement “CFD-tax” on top of the existing carbon tax for not causing other taxes to increase and potentially increase opposition towards the new tax.

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