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The case for a heavy carbon emissions tax from a neoclassical perspective

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1. Introduction

Norway was one of the first countries to implement a carbon tax. A considerably heavy tax was introduced in 1991 (Bruvoll & Larsen, 2004, p. 493). Carbon tax is now a commonly used policy to reduce emissions and mitigate climate change (Fischer & Newell, 2008, p. 160). It is arguably an effective government tool in providing market mechanisms for green development (Lin & Li, 2011, p. 5137).

This paper argues the case for a heavy tax on carbon emission using neoclassical economics. In the next part, the theoretical framework will be explained, along with the relevant terminology and assumptions. After that, the issue is discussed with the help of a simplified free competition model, backing the argument up with some relevant literature. Effects of price increases on the economy is also discussed in short. Some empirics from Nordic European countries are presented after this.

The main argument of this paper is that a carbon emission tax would raise the consumer price and lead to less demand for carbon, resulting in carbon emissions reduction. This is backed up by a simplified microeconomical model and some relevant literature. The empirics section also shows that a uniform carbon tax would greatly reduce carbon emissions, although the policy is often implemented with exemptions that limit its effect (Bruvoll & Larsen, 2004; Lin & Li, 2011).

2. Theory

There are many theoretical perspectives that can be used to argue the case for or against a heavy carbon tax. Despite this, I have limited this paper to the theoretical framework of neoclassical economics to be able to go more in depth on this, at the cost of getting limited perspectives on the issue.

2.1 Neoclassical economics

Neoclassical economics developed in the end of the 1800s with books such as *The theory of political economy* by Jevons (1879), and *Principles of economics* by Marshall (1890). In contrast to the classical economics of the 1800s, neoclassical economics was characterised by

an emphasis on mathematical analysis, introducing equilibrium and marginal analysis, and a utility theory of value (Steedman, 1997, pp. 46-47).

Relevant theories for this discussion in neoclassical economics include marginal analysis, the concept of market failure and externalities, and market equilibriums. In the following discussion, I will be following definitions, models and terminology for a market with perfect competition and negative externalities, as given in Riis and Moen (2018, pp. 204-215). I will also be using some common assumptions about individuals, companies, and markets as described in Riis and Moen (2018, pp. 24, 204-215, 287-288). To derive an illustrative model, I will assume:

- Rational actors with perfect information.
    - Consumers will always choose the cheaper product, and producers will always choose the cheapest production process.
- A linear diminishing marginal willingness to pay.
    - Consumers want less of goods that are more expensive
- A linear increasing marginal cost of production.
    - Bottlenecks in production makes the cost of each product higher the more you make.
- Perfect competition in the carbon market.
    - There are many consumers and producers, no single person or company can affect the price.
- No entry and exit barriers.
    - New companies can enter and shut down as pleased.

These assumptions make it possible to create a simplified model of the carbon market for illustration, even though they are mostly unrealistic. This will be discussed further in part 3.

3. Discussion

This paper argues the case for a *heavy* carbon tax. There will naturally be a lot of similarity in arguments for carbon tax in general. The difference will be that the case for a *heavy* carbon tax pushes the limits of e.g. pricing and scope of the tax further, for the benefit of a more heavy hitting effect of it on pollution. Pushing the limits like this have the downside of *more*

heavily increased costs and product prices, which could hurt consumption and potentially well-being to a greater extent. Do the benefits outweigh the costs?

3.1 Neoclassical arguments: externalities

The neoclassical focus on microeconomics gives way to the discussion of the behaviour of individuals, companies and markets. As stated earlier, certain assumptions are used.

With the focus on market equilibrium, pollution is an externality that decreases the social marginal willingness to pay. As illustrated in figure 1, this would imply that the optimal social market equilibrium of carbon is at a lower quantity than in each equilibrium without carbon tax. With a perfectly set carbon tax, the price of carbon would rise, which would make the social equilibrium quantity possible to reach.

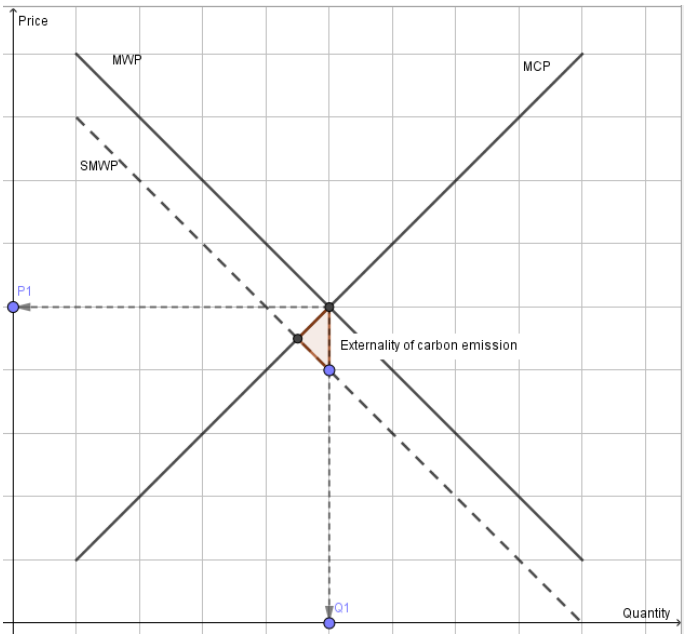

Figure 1: Negative externality of carbon emission in a carbon market with perfect competition. MWP: Marginal Willingness to Pay, MCP: Marginal Cost of Production, SMWP: Social Marginal Willingness to Pay.

Figure 1 shows the negative externality of carbon emissions. The demand curve is indicated by the marginal willingness to pay (MWP), and slopes downward to illustrate a sinking demand as the price rises. The supply curve is indicated by the marginal cost of production (MCP), and slopes upwards as the cost of producing one more product rises with each product you produce. Both curves are linear for the sake of simplicity. The equilibrium is in this case is the point where the two curves cross. The marginal selling price is at the marginal cost of production because of the abundance of individuals and companies, and free competition. Both consumers and companies must accept this price. The price P1 illustrates the price of a given amount of carbon (e.g. 1 tonne), and the quantity Q1 gives the amount of carbon sold in the market. The dotted line is the social marginal willingness to pay (SMWP). That is the amount of carbon that would be acceptable to produce while preventing global warming and other externalities.

In figure 2 you can see the case of a perfectly implemented carbon tax. The tax (T) is added to the marginal cost of production, shifting the equilibrium from E1 to E2. The price is now

higher (P2), which leads to a lower quantity produced (Q2). Note that the two red triangles are equally as large, one illustrating the externality, and one the compensatory effects of the tax.

The neoclassical framework that is used here functions well as a descriptive tool, but there is also a normative argument to be shown here. As illustrated in the model, a carbon tax would compensate for the externalities of carbon emission and bring consumption down to a sustainable level. This argument rests on the assumptions, as well as the ability to make accurate measures of externalities. Even though these assumptions are somewhat unrealistic, the argument still stands. While assumptions such as perfectly rational actors are unrealistic, even having somewhat rational actors supports the argument. As the model is a simplification of reality, the degree to which the assumptions are realised only limits the degree to how accurately a carbon tax would be implemented. The case for a carbon tax still stands.

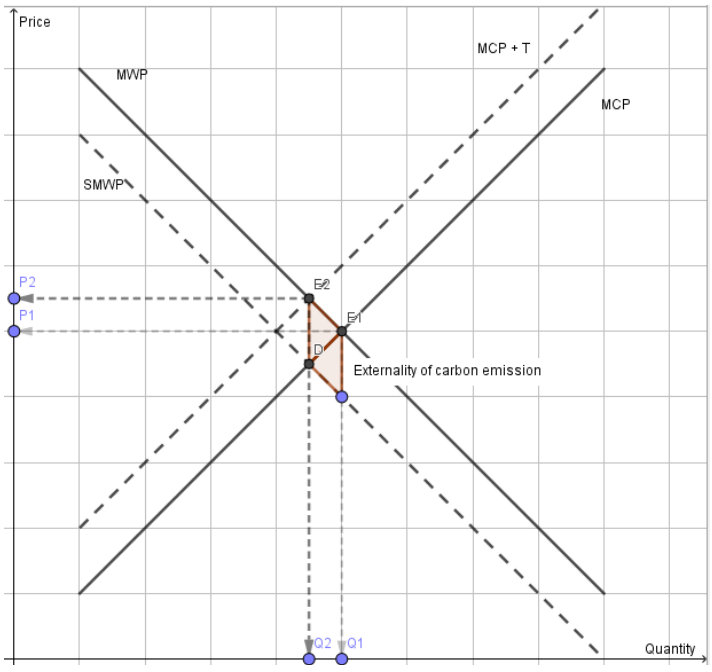

Figure 2: How a perfect carbon tax would result in the equilibrium E2, which is compatible with the Social Marginal Willingness to Pay and corrects for the negative externalities of carbon emission. The necessary tax is equal to the line from D to E2.

Such a carbon tax would arguably have to be at a relatively high level to have the desired effect. Natural sciences agree that manmade climate change is a fact, leading to increased temperatures and rapid changes in the atmosphere, ocean, north and south pole and the biosphere (IPCC, 2021, p. 4). This is a big externality, and it would require a large tax to completely offset the effect. The tax would have to hurt companies and consumers enough that they use different production methods, invest in green research and development, or consume alternative, greener products.

I have purposefully not talked about the potential effects of the resulting price rises on consumer purchasing power, and of business shutdowns on unemployment and economic activity. This is more in the scope of macroeconomics. To minimise such effects, governments could implement a gradually heavier carbon tax, or inform the public about the tax a while before it is implemented, to give producers time to adapt. The EU emissions trading system implements different phases with a gradually smaller amount of emissions trading units. According to the European Commission (n.d.), this system cut emissions by

35% between 2005 and 2019. Despite this, critics of the system say that the system is not strict enough, and the price of emissions is not high enough (Koch et al., 2014, pp. 683-684).

Golosov et al. (2014, p. 41) uses a dynamic stochastic general-equilibrium model to show that an optimal tax would need to be higher than the most quoted tax proposals in literature. In contrast, there is a case to be made for a carbon tax in combination with other policies, such as R&D subsidies. Fischer and Newell (2008, p. 160) argues that such a carbon tax does not need to be as high to achieve set goals of innovation and mitigation, if they are combined with R&D subsidies. Regardless, they rank carbon emission tax as the most efficient and important single policy option (Fischer & Newell, 2008, p. 160).

3.2 Empirics

Bruvoll and Larsen (2004) analyses and categorizes emissions in Norway from 1990 – 1999, to show how much of emission reductions can be attributed to carbon taxes. Their findings indicate that despite having one of the highest carbon taxes in the world, the taxes themselves amount to the small amount of a 2.3% reduction of emissions (Bruvoll & Larsen, 2004, p. 501). During the period, emissions per GDP were reduced by 12 percent, but most of the effect is attributed to unrelated energy efficiency and carbon use improvement. The low effect of carbon taxes in Norway is argued to be a result of extensive carbon tax exemptions, and the necessity of the products from industries that are covered by the tax, leading to inelastic demand (Bruvoll & Larsen, 2004, pp. 501-502). They quote Jorgenson and Wilcoxen (1993) in saying that the average Norwegian carbon tax, implemented neutrally, would lead to the great reduction in carbon emissions of 14% (Bruvoll & Larsen, 2004, p. 502).

Lin and Li (2011, p. 5137) "comprehensively estimate the real mitigation effects of the five north European countries". They show that Norway, with its heavy energy sector and vast tax exemptions, get a minimal effect of carbon tax. This also applies to the countries of Denmark, Sweden and Netherlands. In Finland, the carbon tax gives a significant reduction in carbon emissions. (Lin & Li, 2011, pp. 5141-5142).

The results of these to studies indicates that a carbon tax policy would have to be implemented neutrally, without given industry exemptions. Although such an implementation would be costly, hurtful and potentially unpopular, this supports the main argument in the discussion part of this paper.

4. Conclusions

The case for a *heavy* carbon emissions tax have been made from a neoclassical perspective, arguing that a heavy carbon emissions tax would increase the price and lower the demand, resulting in reduced emissions. The tax would need to be *heavy* to reduce emissions enough to prevent further environmental degradation.

Some literature and empirics have been provided to back this argument up. Empirics from Nordic European countries showed that countries implementing a carbon tax without vast exemptions managed to reduce carbon emission per GDP, but countries with exemptions had a limited effect of the policy.

The scope of this paper is limited as it only takes on a neoclassical perspective. Other economics traditions might look at the issue in another way, whether being for or against a carbon emissions tax. That is a paper for another day. It would perhaps be interesting to look at green innovation induced by a carbon emission tax as a part of Schumpeter's "gale of creative destruction".

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