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Green Taxes in Scandinavia: Do they contribute to (in)equality?

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1. Introduction

The three Scandinavian countries – Denmark, Norway and Sweden – were among OECD's pioneers in introducing green taxes when green taxes gained momentum in several European countries in the 1990's (Andersen et al. 2001; Svendsen et al 2001; Speck et al. 2006). During all years in the period 1994-2010, Denmark has experienced the highest percentage of revenue generated from environmentally related taxes measured as percentage of GDP among OECD countries (OECD 2013, (2010 data)) and although Norway and Sweden are ranked lower on this list, slightly above OECD average, the Scandinavian countries, after more than two decades with green taxes and green tax reforms, have a solid experience in introducing and assessing the effects of green taxes.

Theoretically, the premise behind introduction of environmental policy instruments is the negative environmental externalities which occur in unregulated economies. Contrary to command-and-control regulation, economic instruments create direct price signals for producers and consumers for the costs of pollution (OECD 2001a). By internalising the negative externalities, economic instruments create an incentive for the agents (consumers, households, industries etc.) to reduce pollution. Additionally, green taxes are often considered to be more cost-effective than traditional command-and-control regulation. Furthermore, among the economic instruments, green taxes entail a potential for a double dividend (Pearce 1991); by generating a revenue, green tax reforms can be used to lower or remove distorting taxes in the economy, and by lowering e.g. income taxes, green taxes can induce both a positive environmental effect and additionally generate positive effects on employment, although the magnitude of this effect has been debated (for a discussion on the double dividend debate see e.g. Speck et al. (2006: 226ff)). Besides generating revenues to finance the Scandinavian welfare states, an important element in the Scandinavian tax systems may have been to contribute to a more equal income distribution than generated at an unregulated market (see e.g. Ministry of Finance 2007: 26).

According to Huby (1998: 4ff), it is possible to identify three themes which are common to both social policy and studies of the environment: inequality, sustainability and responsibility. Below, the primary focus is on economic (in)equality among households with regard to the introduction of green taxes, but sustainable development can be said to be part of this, as sustainable development includes to 'equitably meet developmental and environmental needs of present and future generations' (UN General Assembly 1992). Issues of responsibility are important too, as one aspect of 'responsibility' is that the state takes responsibility in areas (e.g. pollution control) where it is difficult for individuals acting alone to achieve effective results (Huby 1998:15). This can be done by e.g. introducing a regulatory framework for pollution control.

Structured inequalities, for instance variation among individuals in their exposure to different levels of pollution, can arise as a result of the way societies are organized (Huby 1998). For instance, low-income households may more often be exposed to pollution (). By lowering (local) pollution levels, green taxes may contribute to more equality in environmental terms, by providing more social benefits (lower pollution

levels), in those areas overrepresented by low-income groups (see e.g. OECD 2006: 135). On the other hand, green taxes are often accused of hitting low-income households harder than other social groups, as taxed products (whether taxed directly or indirectly) traditionally constitute a larger share of the consumption pattern of low-income groups (EEA 2011). In relative terms, green taxes are burdening low-income households harder, is the argument. Consequently, green taxes may contribute to more inequality in economic terms among households. Needless to say, households belonging to same income class can exhibit quite different consumption patterns, and thereby taxation levels too (Speck et al. 2006: 249; EEA 2011).

The Scandinavian welfare states are known to have less inequalities than most other countries (see e.g. Acemoglu et al. 2012) and it is therefore relevant to analyse, whether the many green taxes introduced in Scandinavia over the past two decades have contributed to more inequalities in these societies.

Regarding firms, it can be argued that there are inequalities too, because *competitiveness* is unevenly distributed (Speck et al. 2006: 255). Therefore, competitiveness considerations has led the Nordic governments to design green taxes with exemptions and reduced tax levels for exposed industries (Speck et al. 2006: 260), what can be considered an inequality in itself, as Nordic households and non-exposed industries thereby often e.g. pay higher CO₂ taxes per tonne than companies do. This has been the case in all three Scandinavian countries (Daugbjerg and Pedersen 2004). In Norway for instance, heavily polluting mainland industries have been totally exempted from CO₂ taxation (Daugbjerg and Pedersen 2004), what has led OECD (2011: 3) to recommend Norway to strengthen the incentives for environmental protection in the main economic sectors by removing exemptions to environmentally-related taxes. In Sweden a study (Environmental Protection Agency 2004: 25) showed that private consumption was responsible for 25 pct. of CO₂ emissions in the period 1993-2000, but contributed with 47 pct of the total CO₂ tax revenue. Oppositely, manufacturing industry was responsible for 26 pct of emissions and contributed with only 9 pct of total CO₂ tax revenue. In Denmark, there has been reduced tax levels for industries too (Daugbjerg and Pedersen 2004). Approximately ¾ of the Danish revenue from green taxes is paid by the consumers and ¼ of industries (Danish Economic Councils 2009: 120f). Below we will solely be focusing on inequalities among households though.

Methodologically, the analysis is based on a literature review of literature on distributional impacts of green taxes in Scandinavia. Using search terms including and related to "green taxes and distributional" in journal data bases and in Google (in both English, Danish, Norwegian and Swedish language), we identified key academic articles and reports from public and private policy agencies such as EEA and OECD regarding green taxes and distributional effects in Scandinavia.

Chapter 2 contains a discussion on green taxes and distributional effects. After that, there is a short description of the history of green taxes in Scandinavia (chapter 3), before turning to a presentation of relevant literature addressing the distributional effects of green taxes in Scandinavia (chapter 4) and drawing of the conclusions (chapter 5).

2. Green taxes and distributional effects

A major concern in policy debates about green taxes is that these policy instruments affect low-income households disproportionately. Not least taxes on energy, including transport, have been argued to be

regressive, because energy is an essential component of household consumption (Speck et al. 2006; OECD 2006).

Green taxes may affect the distribution of income among households both directly and indirectly. In fact, taxes may affect equality through at least four different mechanisms the combined effect of which ideally should be examined to assess the distributional effects of green taxes (EEA 2011): 1) the direct effect of price increases on income distribution, 2) the effects of the recycling of the revenues from green taxes on income distribution, 3) the wider socio-economic effects including potential job-creation and 4) the effect of a reduction of environmental problems and related health problems. These four different impacts vary in their distribution across socio-economic groups but also across time. Moreover, an important issue in the debate about green taxes is the concept of income used to calculate distributional effects. The question is whether to use annual disposable income or lifetime income as the basis for measuring the effect (Kosonen 2012: 163). As a proxy for lifetime income economists have used total household expenditures in a given year, arguing that this reflects expected lifetime income while annual income may fluctuate. Several studies have shown that calculating taxes as percentage of household expenditures tends to give a less negative distribution effect compared with calculating taxes as percentage of annual incomes (ibid).

However, they also vary with regards to the complexity of proper and reliable assessments.

Green taxes affect income distribution through their effect on prices. Taxes increase the prices that households must pay for the taxed resources, services or goods, such as energy, water or waste handling. As some of these goods or resources may make up a larger proportion of the consumption of lower income households a price increase will hit these groups harder. The effect on the distribution of incomes would be lessened by behavioural changes, but this depends on the ease of substitution towards e.g. lower energy products or practices (Kosonen 2012). An early study of a carbon tax in the UK found, however, that the mitigating effect of behavioural changes would be limited (Smith 1992 cited in Kosonen 2012). In addition to this direct effect, green taxes, not least taxes on energy and CO₂, may also affect prices indirectly as they affect the cost of production of a wide range of consumer products. (Wier et al. 2005; Speck et al. 2006; Kosonen 2012). The equity impacts depend on whether producers are able to pass on the tax to consumers or whether the tax results in lower profits or salaries, i.e. whether demand or supply is more responsive to prices. To the extent that the environmental tax cannot be passed on to consumers the regressive effect on incomes would be limited, all other things being equal. In fact, it is conceivable and indeed intended that taxes on resources such as energy eventually leads to (energy) efficiency gains which is of benefit to consumers and producers alike.

However, the literature also shows that distributional effects of environmental taxes and charges are not uniform across the taxed activities or resources (Ekins and Dresner 2004), across industrial sectors (Speck et al. 2006) and across geographic location (Ministry of Finance 2003a; Speck et al. 2006: 251). Most studies indicate that energy and carbon taxes, and particularly taxes on domestic heating and electricity, tend to be regressive while taxes on transportation, i.e. fuel and vehicles are more likely to have progressive distributional effects (EEA 2011; Kosonen 2012). Higher income groups tend to have both bigger and more cars and therefore also a higher consumption of fuel. In some countries, fuel taxes tend to constitute a relatively higher share of the incomes of middle-income groups compared with both low and high income groups, and middle income households are therefore hit relatively harder by such taxes (Kosonen 2012, citing several studies including Smith 1992).

Transportation taxes are most likely to affect the geographic distribution of the tax burden. Thus, rural areas tend to be hit harder by fuel taxes than urban areas who may have to travel shorter distances but also are more likely to be able to substitute to public transportation (Kosonen 2012; EEA 2011).

While environmental taxes clearly have distributional effects, these may be mitigated either by design of the tariffs themselves or through targeted compensation schemes. Ekins and Dresner (2004) examined a wide range of mechanisms in a UK setting and concluded that it would be possible to design environmental tariffs and combine them with compensation packages in a manner that made them progressive for the lower 3 income deciles. As for tax design, one way to avert or lessen the regressive effects of environmental taxes would be to tax only activities and products which are used more heavily by higher-income (EEA 2011; Ekins and Dresner 2004). However, this strategy may collide with environmental objectives, which would suggest taxation of those activities that present the greatest environmental challenges. Other ways to counteract the negative distributional impact of green taxes would be to grant tax exemptions to certain income groups or to offer a tax-free allowance of e.g. energy (Ekins and Dresner 2004). In the Netherlands a tax-free allowance on energy consumption offset the negative impact of environmental taxes (Peter 2007 in EEA 2011). As for compensation packages these might be targeted towards benefits for low-income groups, such as means-tested benefits as a way to very directly counteract inequality (ibid). However, Ekins and Dresner also pointed out that their results applied to average households within income groupings. In fact, variations within each socio-economic group regarding energy use are so great that it prevents a tax design that is entirely progressive.

Moreover, as mentioned, the straight impact of tax-induced price changes may be moderated by their interaction with other mechanisms.

Most importantly, perhaps, the use of the collected tax revenue affects the distributive consequences of environmental taxes. Environmental taxes may not be regressive when implemented as part of an overall tax reform where the revenue from green taxes replaces taxes on labour, i.e. income taxes and social security contributions, or capital taxes (EEA 2011; OECD 2006; Speck et al 2006). Lower income taxes would neutralize the price increases incurred by environmental taxes. However, reduced income taxes may actually benefit high-income groups more than low-income groups and thereby increase inequality (see for instance Kosonen 2012). One way to design an environmental tax reform to be less regressive or even progressive would be to direct income tax reductions towards the lower income brackets. Alternatively, environmental tax revenue may be returned to households in the form of equal size lump-sum transfers which would imply that environmental tax revenue could produce less inequality (Kosonen 2012: 165). Thus several model-based studies have estimated that such lump sum returns to households lead to less inequality (Rausch et al. 2011, Cambridge Econometrics 2008, both cited in Kosonen 2012; OECD 2006). Even so, economists tend to argue against such lump sum returns as they compromise the gains in efficiency that may be achieved by reducing other taxes (Ministry of Finance 2003a: 36).

Earmarking of the environmental tax revenue towards specific environmental policy objectives may also directly or indirectly contribute to improved equity. Directly, when revenues are used to fund programmes that allow low-income families to reduce their use of resources, such as energy efficiency installations. Indirectly, earmarking may contribute to greater equity to the extent that it improves to greater policy effectiveness and thereby to a cleaner environment, which may benefit lower income groups more (see

below). Studies suggest that earmarking may improve the effectiveness of environmental taxes (Andersen 1994; see Soares 2012 for a review).

Finally, while this is not typically included in discussions about environmental tax reform, one could argue that revenue generated by environmental taxes could help finance traditional welfare services, including family support or job training programmes which benefit lower income households. The EEA recently has promoted environmental tax reform as a means to address general fiscal problems (see for instance Andersen et al. 2010). Likewise, the targeted compensations schemes mentioned above may also be construed as recycling of part of the revenue.

Beyond revenue recycling, environmental tax reform may have wider economic impacts which could also affect income distribution (EEA 2011). This includes positive effects on employment as the green taxes alter both absolute costs of labour and relative prices of labour compared to energy or other resources, leading to job creation (OECD 2006). Moreover, to the extent that green taxes spur innovation in energy and eco-efficient products and production processes they may spur growth that is decoupled from energy and resource use, again affecting employment positively. A study of the 1999 German tax reform estimated that the job creation effect of switching to environmental taxes amounted to up to 250,000 new jobs a year (EEA 2011: 15). However, Fullerton (2010) points out that if environmental taxes induce companies to invest in expensive abatement technologies, this will increase demand for capital rather than for labour and could therefore put pressure on wages, which typically constitute a larger share of the incomes of low-income families. This underlines that the distributional effects of environmental taxes depends on the ease with which companies can switch among labour, capital and pollution or pollution abatement (OECD 2006: 135). This highlights the contingent nature of the distributional impact of environmental taxes and makes general assessments both complex and tenuous.

Distributional effects not only include income effects but also the distribution of the benefits from reduced pollution (EEA 2011). According to some studies, low-income families are more exposed to pollution (EEA 2011; Kristensen and Larsen 2006; Fullerton 2010) and therefore stand to gain relatively more from a tax-induced reduction of pollution. But, the empirical evidence is mixed (Ministry of Finance 2003a: 13). In other words, the relationship is contingent and diverse. For energy taxes and other carbon-related emissions in particular it may be difficult to establish the specific socio-geographic distribution of benefits as climate change effects tend to be widely distributed (EEA 2011). Fullerton (2010) argues that such taxes may both improve local air quality, reduce global warming and avert rising sea-levels, the distributional effects of which vary. E.g. improvements in local air quality might benefit lower income households, while rising sea levels at least in the Northern hemisphere may benefit high-income families with seafront property (ibid). Yet, other types of environmental taxes, notably taxes aiming to curb emissions from road traffic in at least one study was shown to benefit lower income households in Berlin, as these were more exposed to traffic related emissions (Luhman 2008, cited in EEA 2011: 17). Such beneficial effects are channeled through effects on health.

As outlined in this section, environmental taxes potentially have a negative impact on income distribution and thereby equality. But it also shows that this impact may be avoided or counteracted and that the overall outcome may be progressive. Thus the basic effect is that environmental taxes will increase prices which lead to increased inequality. But this effect may be directly mitigated through tax design and compensation schemes that target low-income groups. Furthermore, the revenue collected through

environmental taxes may be used to offset other taxes, not least of which income taxes, compensating directly for the higher prices, but possibly also creating new jobs. The combined income distribution effect of these mechanisms is not simply predicted. Moreover, the revenues could also be used to shore up public finances ultimately allowing for welfare services or investments in environmental technologies with beneficial environmental effects. Thus, the picture is one of contingent relationships which do not lend themselves to a simple set of hypotheses about cause-effect relations. It follows also that a precise and comprehensive assessment of the distributional impact of environmental taxes and tax reforms is challenging at best. Thus, the following sections will provide an overview of the evidence of the effects on equity of green taxes in the Scandinavian countries, but with the caveat that it will not offer a final answer to the question as to whether green taxes in Scandinavia have compromised equality.

3. Green taxes in Scandinavia

For the last two decades, revenues from environmentally related taxes have been higher than the OECD average in the three Scandinavian countries (see Figure 1).

Figure 1. Revenues from environmentally related taxes, % of GDP

Source: OECD (2013)

However, when the revenue from environmentally related taxes is measured as percentage of total tax revenue, the story is different (figure 2). Here Norway and Sweden are below the OECD average. Denmark is still well above OECD average, although there has been a significant decrease the last decade, but the detailed data (OECD 2013) unveil that Denmark in 2010 were exceeded by Australia, Estonia, Ireland, Israel, Japan, Korea, Netherlands and Turkey on this measure. It is therefore more questionable whether Scandinavia as a whole can be considered a frontrunner in green taxation today. However part of the

reason for the lower percentages in Scandinavia is that the average tax burden in Scandinavia is higher than in most other OECD countries. It may be argued, that this fact has given the Scandinavian countries a potential for more comprehensive tax reforms as the tax base is larger.

Figure 2. Revenues from environmentally related taxes, % of total tax revenue

Source: OECD (2013)

3.1 Green tax reform in Denmark

Measured as percentage of GDP, Danish environmentally related taxes generate the highest revenue in OECD (see figure 1). A large proportion of the revenue (39 pct in 2005) is generated by very high car registration tax and car weight duties (Speck et al. 2006: 84). In total, environmentally taxes related to transport generate 2/3 of total Danish revenues from environmentally related taxes. Approximately ¾ of the revenue is paid by the consumers and ¼ of industries (Danish Economic Councils 2009: 120f). The current Danish system of environmentally-related taxes is for a large part the result of a comprehensive green tax reform agreed upon in 1993 and carried out from 1994. A reform which in particular increased the use of green taxes within three areas: Energy, traffic and water (OECD 2007: 125; Ministry of Taxation 2001; Danish Economic Councils 2009:120). Meanwhile, marginal tax rates were lowered at all income levels. For instance, the bottom-bracket tax was reduced from 14,5 in 1994 pct. to 8 pct in 1998. Another element was that social pensions and social security, which were formerly exempted from taxation, were made liable to taxation, but meanwhile the sum paid out was raised, meaning that people receiving these contributions gained a benefit from the tax reductions (Ministry of Taxation 2001: 47ff). Subsequently, in 1996, a fairly wide-ranging reform - the so-called *Energy Package* - of in particular the CO₂ taxes was introduced, meaning that industrial tax rates were raised (Andersen et al. 2001; Ministry of Taxation 2001). However, a smaller part of the reform involved raising the SO₂ tax for households. Revenue was planned

reimbursed through different arrangements; for instance, through subsidies for investments in greener household heating systems and through lowering of general tax rates (Statsrevisoratet 1998). Denmark is one of the few EU Member States where economic instruments have been implemented in the agricultural sector (Speck et al. 2006), for instance through a pesticide tax on agriculture (Pedersen et al. 2012a+b).

In the 2000's, under the Liberal-Conservative Government (2001-2011), revenue measured as a percentage of GDP and as a percentage of total tax revenue started falling (see Figure 1 and 2 above) due to a *tax freeze* introduced by the Government. In general, introduction of new green taxes slowed down in the 2000's (Lindhjem et al. 2009), although the period experienced some new initiatives too. For instance, a new industrial NO_x tax was implemented from 2010. When a new Government led by the Social Democrats took power in 2011, prospects were that green taxes would gain new momentum, as the Social Democratic led government was based on a government platform, which included a plan to reform taxes and charges to create the right incentives to 'think and act green', by 'making it pay to save energy and reduce consumption of pesticides' (the Danish Government 2011: 27). However, in practice, the government has had a difficult time fulfilling these expectations. A doubling of the existing pesticide tax is currently (April 2013) under approval in EU though, but after a few months in office, the Government dropped its plans of road taxes in Copenhagen. Furthermore, as part of a 2013 Growth Plan, the Government proposed to abolish the industrial CO₂ tax on electricity, abolish the packaging tax, reduce the industrial waste water tax, and drop the planned road taxes on lorries (Ministry of Finance 2013).

3.2 Green tax reform in Norway

Norway has also been a pioneer in introducing economic instruments within the environmental policy and was an early mover (1991) in introducing CO₂ and energy taxes (Andersen et al 2001). Norway has for instance during the 1990's introduced taxes on waste landfilling and incineration, SO₂ emissions, NO_x emissions, non refillable beverage containers and chemical products too (OECD 2001b; 2011). Consumers in the two most northern regions – Nord-Troms and Finnmark – have since 1990 been exempted from electricity tax (Ministry of Finance 2007: 58). Some criticism was raised in the 1990's that many Norwegian mainland energy intensive industries were totally exempt from CO₂ taxation and an expert *Green Tax Commission* proposed in 1996 to remove the exemptions. Consequently, the Norwegian minority government proposed in 1998 a minimum CO₂ tax rate at 100 NOK/ton, but a cross-party opposition majority defeated the proposal (Andersen et al. 2001; OECD 2001b). The Green Tax Commission had very comprehensive proposals for a green tax reform in Norway, but in practice the suggestion led only to 'a very limited reform of the tax system'. Green taxes were increased by approximately 100 million € and part of the revenue was used to increase tax allowances (Ministry of Finance 2003b, chap.5.6.2). According to OECD (2001a: 51), part of the Norwegian green tax revenue has been used to lower income taxes. Since 2000, parallel with the described development in Denmark and the development in Sweden after 2006 (see below), Norway has slowed down on the introduction of green taxes. However, in relative terms, measured against GDP and total tax base, the decline started earlier (see figure 1 and 2 above). During the period after 2000, most tax rates have only been adjusted incrementally from year to year based on the expected increase in general price levels, while new environmental tax initiatives have been few (Lindhjem et al. 2009). As shown in figure 2 (see above), revenue from green taxes now make up about 6 pct. of the total tax revenue in Norway compared with 8 pct. during the 1990s.

70 pct. of Norway's GHG emissions are today either covered by EU's emission trading system or are subject to environmental taxes, but the effects have been small over time due to the industrial exemptions and reduced tax levels (OECD 2011). Since 2003, a tax has been levied on import and production of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), chemicals with a potentially high global warming effects (OECD 2011).

According to Barde (2004), due to a relatively favourable employment situation in Norway, less emphasis has been placed on double dividend effects. It might be added that in general, the Norwegian state does not have the same financial need as the Danish and Swedish state to generate revenue from new taxes and charges due to the huge profits generated from Norway's oil and gas production in the North Sea

3.3 Green tax reform in Sweden

Like Denmark and Norway, Sweden was an early mover in introducing green taxes. In 1996, OECD concluded that during the past decade, Sweden used economic instruments to supplement traditional command-and-control instruments (OECD 1996). Actually, Sweden had since the 1970s made use of environmental taxes and charges and other economic instruments in environmental policy (Speck et al. 2006: 191), but this development accelerated in the 1980's and 1990's. For instance, in 1991, the Swedish energy tax was supplemented by a high CO₂ tax at 250 SEK/ton CO₂, although tax rates for the manufacturing industry was reduced later in the 1990's (Andersen et al. 2001). A number of municipalities in the northern part of Sweden have a reduced electricity tax (Lindhjem et al. 2009: 85-86). The new energy taxes in the early 1990's generated a revenue of 1.8 billion €; meanwhile income taxes were lowered (Speck et al. 2006: 191). Furthermore, in 2001, Sweden started implementation of a green tax shifting programme involving a planned 3.3 billion € of revenue over a ten year period (Speck et al. 2006; Lindhjem et al. 2009). 1.1 billion € was reformed in the first four-year-period (2001-2004). Part of the revenue was used to lower income taxes, lower employers' contribution and raise personal allowances (Rutqvist et al. 2012; Speck et al. 2006: 191). In OECD's second review of Sweden in 2004, it was concluded that in the period 1996-2004, several new green taxes, charges and duties were introduced (e.g. municipal waste charges, landfill tax, gravel tax, annual excavation charge, airplane emission landing charge, oil transport duty, road user charge). Furthermore, several established taxes were modified to better internalise environmental externalities, and for several taxes and charges, levels were raised. According to Rutqvist et al. (2012), Swedish industries were in general not embraced by the new taxes. OECD concluded in 2004 that "with almost 70 market-based instruments, Sweden probably has more economic instruments in use than any other country" (OECD 2004: 45; see also Environmental Protection Agency and Energy Agency 2006). After 2004, the green tax reform continued; for the period 2001-2006, a total of more than 2 billion € have been included in the green tax reform. After the change of Swedish Government in 2006, where the Social Democratic Party lost, after having been in power 1994-2006, the green tax reform was stopped (Rutqvist et al. 2012). In relative terms, Swedish revenue from green taxes has been more stable in the period 1994-2010, than revenues in Denmark and Norway (see figure 1 and 2 above).

4. Do green taxes in Scandinavia create more (in)equality?

Below some evidence regarding the distributional effects of green taxes in Scandinavia will be presented, keeping in mind the four aspects mentioned above: 1) the direct effect of price increases on income distribution, 2) the effects of the recycling of the revenues from green taxes, 3) the wider socio-economic

effects including potential job-creation and 4) the effect of a reduction of environmental problems and related health problems.

4.1 Denmark

The Danish Economic Councils (2009) analysed different equality aspects of current Danish green taxes. Table 1 shows how large a part of total household consumption green taxes account for.

Table 1. Danish Green taxes and distribution measured as pct. of household total consumption

	All green taxes	Electricity	Energy, other	Transport (incl. Gasoline)	Water	Other green taxes	All green taxes
	Billion DKK	Pct. of consumption					
Outside workforce*	0,30	0,94	1,16	2,58	0,23	0,08	4,99
Within workforce:							
1.Income decile	0,31	0,96	1,02	3,01	0,19	0,07	5,24
2.Income decile	0,40	0,81	1,14	4,02	0,18	0,07	6,21
3.Income decile	0,36	0,81	1,06	3,39	0,18	0,07	5,51
4.Income decile	0,45	0,76	0,97	4,17	0,17	0,07	6,13
5.Income decile	0,52	0,78	1,02	4,76	0,18	0,06	6,79
6.Income decile	0,63	0,70	1,04	5,55	0,17	0,07	7,52
7.Income decile	0,52	0,75	0,98	4,42	0,17	0,07	6,40
8.Income decile	0,64	0,69	0,93	5,41	0,16	0,06	7,24
9.Income decile	0,72	0,74	1,07	5,13	0,16	0,07	7,16
10.Income decile	0,74	0,64	1,06	4,33	0,14	0,07	6,24

Source: Danish Economic Councils (2009: 122)**

*The group of citizens outside the workforce is larger than the deciles. Therefore numbers in this category are adjusted to make comparable data.

** Based on the MUSE data base. MUSE is a general equilibrium model.

Unsurprisingly, in absolute terms high-income citizens pay higher taxes than low-income citizens. Citizens in decile 10 pay 0,74 billion DKK in green taxes, while decile 1 pay only 0,31 billion DKK and people outside the workforce 0,30 billion DKK. What might be more surprising is the relative numbers. For the lowest income group – 1. decile – green taxes constitute 5,24 pct. of their consumption (and 4,99 pct. for those outside the workforce), while for the highest income group – 10. decile – green taxes constitute 6,24 pct. of consumption (and 7,52 pct. for the 6. decile). However, if compared with decile 2 (6,21 pct.), the share is almost equal. As evident from table 1, the difference can primarily be explained by transport taxes. High income groups buy more expensive cars (car registration tax varies from 105 pct. for the cheapest cars to 180 pct. for the most expensive cars (Danish Economic Councils 2009: 143) and drive more miles than the lowest income group and those outside the workforce, therefore a higher part of their consumption goes to green taxes within transport. Oppositely for green taxes on water and electricity, which constitutes a larger share of consumption for low-income groups than for high-income groups, but the differences are not as huge as for transport taxes. Measured as percentage of consumption, Danish green taxes seem to have an income levelling effect and thereby contributing to more equality in economic terms (Danish Economic Councils 2009: 122). However, the case might be another if measured against total income (instead of total consumption). High-income groups save more of their earnings than low-income groups and, needless to say, saved income is not subject to green taxes. On the other hand, it might be argued that saved income at

some point of time will be invested in consumption and therefore, over time, will be subject to green taxation too (ibid).

Danish Economic Councils (2008) measured this in another analysis (table 2) and here the tendency is that measured against household income, vehicle taxes and energy taxes contribute to more inequality.

Table 2. Danish Green taxes and distribution measured as pct. of disposable income

	Vehicle taxes	Taxes on energy products
Disposable household income:	4,97	4,34
<100.000 DKK		
100-150.000 DKK	2,43	3,73
150-200.000 DKK	3,59	3,49
200-250.000 DKK	4,71	3,25
250-300.000 DKK	2,44	3,02
>300.000 DKK	2,60	2,35

Source: Extracted from Danish Economic Councils (2008: 340)

Jacobsen et al. (2001: 58; see also Jacobsen et al. 2003; Wier et al. 2005) measured the distributional effects for all green taxes and concluded that in total they have a small regressive effect. The regressive effect is less than e.g. the effect of Danish VAT. Danish petrol and registration duties for cars are progressive, whereas most other environmental taxes are regressive – in particular, taxes on water, retail containers and CO₂ emissions (Jacobsen et al. 2003). Isolated, the Danish CO₂ tax is more regressive than VAT (Wier et al. 2005). Additionally, Jacobsen et al. (2001, 2003) found some residential inequalities, as rural households are more exposed to environmental taxes due to a higher need of transportation, limited access to efficient heating technology and limited access to district heating and natural gas.

However, the total distributional effects are very dependent on, how the revenue from green taxes are used by the state. If it is reimbursed through e.g. lower income tax targeted at lower incomes or (in particular) higher personal allowances, there will be a benefit for low-income groups. It is worth noticing though that if the revenue is reimbursed through higher personal allowances, there will not be as large a positive effect on employment (and therefore higher welfare economic costs) as when reimbursed through lower income taxes (Danish Economic Councils 2009: 173, 180). As mentioned in chapter 2, the 1993 green tax reform lowered income taxes.

In a discussion of (in)equality of green taxes it is relevant to include the benefits of the taxes, the environmental effects, too. There is some evidence that low income groups are more exposed to pollution and therefore might reap more of the benefits from green taxes addressing at least local/regional types of pollution like e.g. air pollution. However, differences do not seem to be very large. E.g. Kristensen and Larsen (2006) found that 10,2 pct. of Danish high income home owners suffer from pollution, while the figure for low income tenants is 14,8 pct. and the average for the Danish population is 11,7 pct. There are a number of analyses of the positive effects of Danish green taxes. For instance, they have contributed to lowering air pollution (CO₂, CO, SO₂, NO_x, particulate matter and VOC) (see e.g. Ministry of Finance 2001; Danish Economic Councils 2012: 127f), but it is very difficult to assess precisely, whether they have contributed to more equality in environmental terms. Some of the Danish green taxes have had more limited effect – e.g. the pesticide tax (Pedersen et al. 2012a+b; Danish Economic Councils 2012).

4.2 Norway

Norway's National Sustainable Development Strategy sets out five key principles against which to judge Norwegian policy action: i) equitable distribution; ii) international solidarity; iii) the precautionary principle; iv) the polluter pays principle; and v) joint efforts (OECD 2011: 34). Based on this, it must be expected beforehand from Norwegian green taxes that they in general don't have very large regressive effects, as this will be in conflict with 'equitable distribution'. However, in general after the mid-1990's Norway has paid relatively little attention to green taxes (Ministry of Finance 2003b; Lindhjem et al. 2009), what may be the reason why the identified assessments of Norwegian green taxes are primarily ex ante analyses.

When the Norwegian expert commission on *Green Taxes – a policy for better environment and high employment* presented the final proposal for a green tax reform in 1996, it focused on distributional effects (Ministry of Finance and Duties 1996). The commission concludes that *if* there are positive employment effects of a reform, the total distributional effects will probably be positive. The distributional effects of changing prices are difficult to model, but in general, taxes on e.g. flight and taxi travels are progressive and will have positive equity effects as these transportation types have a high income elasticity (ibid). Gasoline taxes seem to have a small regressive effect on distribution, while car registration tax has a progressive effect. Furthermore, the commission refers to a Norwegian 1992 study analysing the effects of a fossil fuel tax, which concluded that the effects were relatively equitable distributed among different types of households – there was more differentiation among different *regions* (Ministry of Finance and Duties 1996). Another committee under the Norwegian Ministry of Finance (2007: 181) assessed the distributional effects too (see table 3). Here it is found that fuel taxes and electricity taxes are clearly regressive, while taxes on gasoline and oil are somewhat regressive. Taxes on flight travels are very progressive, while car registration taxes are somewhat progressive.

Table 3. Distributional effects of green taxes in Norway

Product	Change in degree of equity per NOK
Fuel	0,820
Electricity	0,712
Gasoline and oil	0,233
Local road transport	0,092
Road transport, long range	0,000
Car ownership	-0,609
Flight travels	-1,410

Note: Negative numbers indicate a progressive effect; positive numbers indicate a regressive effect.

Source: Ministry of Finance (2007: 184).

Consequently, if a goal of a green tax reform is to limit inequality – isolated - decision-makers should focus on flight travels and car ownership, but again, the total effects are dependable on, how the revenue is used and what environmental effects occur.

As mentioned, due to relatively low unemployment rates, Norway has placed less emphasis on double dividend effects according to Barde (2004). However, the 1996 Norwegian expert commission on *Green Taxes – a policy for better environment and high employment* had comprehensive focus on these aspects. The commission underlined that the potential positive effects of lowered income tax can't be isolated solely to reduced unemployment rates – there can be other efficiency gains in the tax system. The macro-economic analyses performed by the commission indicated that there was a potential for double dividend effects in Norway through a lowering of unemployment rates, but that the effects on employment were relatively modest. However, in the commissions opinion the modest employment effects should not refrain the Norwegian government from introducing more green taxes, because the effects on pollution reduction legitimizes the taxes in itself (Ministry of Finance and Duties 1996: 44).

Regarding the distribution of environmental effects, the Norwegian green tax commission (Ministry of Finance and Duties 1996: 467) found that negative environmental effects are quite unevenly distributed in Norway – e.g. between households in the countryside and in the larger cities, but also among households with different income level. Among households with economic problems, 60 pct. were exposed to environmental problems, while this was the case for only 35-40 pct. of those households which did not experience economic problems. Negative traffic effects are highest for middle and low-income households.

4.3 Sweden

Sweden has for more than two decades been very active in implementing economic instruments in the national environmental policy. In 2003, an expert group made a comprehensive analysis of the distribution of costs and benefits in Swedish environmental policies for the Ministry of Finance (Ministry of Finance 2003a). The main conclusions are that: i) the purpose of 'environmental policy' is to change consumption and production patterns and the environmental policies will therefore inevitably have distributional effects; ii) if decision-makers want to combine environmental aims with aims of regional balance, this will lead to strict demands to regional policies as people living in the countryside are harder hit by the costs of Swedish environmental policies than people living in the cities; iii) if decision-makers want to combine environmental aims with aims of equal distribution of income, there is a need for compensating measures for low-income groups; iv) impact analyses must be performed before decisions are made (Ministry of Finance 2003a: 11).

The 2003 Swedish expert group made an ex ante analysis of a green tax reform involving a non-marginal rise of the Swedish CO₂ tax and combined it with three different reimbursement scenarios: 1) lowering of general VAT; 2) subsidize public transport; 3) lowering of income tax. In general, Swedish low income households and households in sparsely populated areas will carry a heavier burden in relative terms (measured against income level) in scenario 1. Regarding scenario 2 and 3 the results are a bit mixed, but the income group with the highest income (of five groups) is favored in all three scenarios in relative terms, and, in general, households in sparsely populated regions will experience a disadvantage (Ministry of Finance 2003a: 78). Some of the effects are quite comprehensive. For instance, in scenario 1, Stockholm households will experience a 0,2 pct. cost rise (measured as disposable income), while households in the sparsely populated and colder Norrland Region will experience a 0,6 pct. rise. On average, low income households use 15 pct. of disposable income on energy consumption, while the figure for high income households is 7 pct. Stockholm households use 7 pct. of disposable income to energy consumption – Norrland households 10-14 pct. Ministry of Finance (2003a: 163) also found that existing gasoline taxes

have significant regional effects. In sparsely populated municipalities, inhabitants typically contribute with 5000-6000 SEK/per year in gasoline taxes per year, while inhabitants in the large and largest cities only pay approximately half of this amount. Tax allowances for work-related travels does not compensate for the differences to any significant degree.

According to the Swedish Environmental Protection Agency (2004: 9) earlier Swedish model simulations have not given support to any double dividend effect, what according to the agency is unsurprising as these model simulations have not addressed the benefits of environmental improvements and positive effects on employment – the two effects which constitute ‘the double dividend’. The Environmental Protection Agency finds that the Swedish green tax reforms 2001-2003 has involved changing of a revenue of 8 billion SEK primarily through a higher CO₂ tax and a higher electricity tax (manufacturing industry has been exempted from the rises) with positive effects for almost all household groups (on average). The reason for this effect is that while households and the service sector bear the costs (the effects on prices and salaries of the higher costs on the service sector are not calculated though), the revenue is reimbursed solely to households - through raising the personal allowance. In other words, the regressive effects of raising the energy taxes have been levelled out by the change in the personal allowance (Swedish Government 2003: 233ff; Environmental Protection Agency 2004:10-11; Speck et al. 2006:252).

A detailed analysis of the effects conclude that although the reform is revenue neutral, the direct income effect is positive (although the effects are small) for almost all average household groups (both divided after income, family type, region and dwelling type). On average, all family types experience small positive effects of up to 0,3 pct. of disposable income. For most income groups the effects are positive (up to 0,3 pct. of disposable income), but for the lowest and the highest income decile there are small negative effects (0,4 pct. for the lowest income decile, just above 0 for the highest income group). The negative effect in the lowest income group is explained by the fact that a number of business owners are registered with a very low income and a high energy consumption, and therefore can't be considered traditional low income individuals. Furthermore, many social security receivers are registered in this income group - they often don't pay income taxes and therefore don't get the benefits of a lower personal allowance (Swedish Government 2003: 234-235). The regional effects are all positive but very small (highest positive effects in Gothenburg with 0,2 pct.). The largest variation is found among different types of dwellings. Houses without electricity loose on average 0,3 pct. of disposable income, while the group 'other' has a positive effect of 0,6 pct. In other words, on average, people in houses without electricity and people receiving social security contributions seem to be the losers, although the loss is relatively small, while the other groups are net winners. Needless to say, in particular the results for a relatively exposed group like social security receivers, this result may raise some equity concerns.

The Swedish Government (2003: 237) also analysed the distributional effects if there had been no extra revenue from the service sector. Here, the net effects are within the interval of a 0,1 pct. negative effect on disposable income (for the highest income group) and a 0,2 pct. positive effect (for one of the mid income groups) – except for the lowest income group, which experiences a negative effect of 0,9 pct. The analysis did not involve any calculation of employment effects or environmental effects. Furthermore, there has been critique of the 'extremely static' character of the analysis (see Brännlund 2005: 52, our translation). According to Rutqvist et al (2012), Swedish Government (2003) is the only official analysis of the Swedish green tax reforms 2001-2006. Additionally, Rutqvist et al. (2012: 25f) remark that the Swedish Government

haven't had an explicit focus on employment effects, and explains that the reason for this might be that the tax base for environmental taxes is still relatively small and therefore the lowering of income taxes and the possible employment effects are relatively small too.

Sterner (2012) analysed the distributional effects of transport fuels in a comparative study of seven European countries including Sweden. Sterner points to the fact that fuel taxation is one of the few policy instruments that has actually reduced fuel consumption considerably (mainly in Europe and Japan) and thereby reduced CO₂ emissions, but fuel taxation is often met with resistance as this policy instrument is considered to be strongly regressive. One conclusion of the comparison is that in general, measured as share of income, distributional effects are small and in many countries reasonable close to proportionality. There is some regressivity for Sweden and UK, and progressivity for Serbia. However, when expenditures are used as a proxy for *lifetime* income, the result for Sweden is that the taxes are progressive. Measuring against lifetime income results in all seven countries in very small distributional effects close to proportionality (Sterner 2012: 81).

According to Brännlund (2005: 64f) most analyses of green tax reforms show that: there is no double dividend; the environmental effect is often small; green tax reform can collide with other societal aims (income distribution and regional distribution); reimbursement mechanisms are not decisive for double dividend effects; reimbursement mechanism can be decisive for the distributional effects.

Speck et al. (2006) concludes that many of the analyses of distributional consequences in Denmark and Sweden are dependent on modelling approaches with different underlying assumptions, which makes them difficult to compare, but 'one finding which holds for both countries is that the geographical location of households is of great significance as households living in rural areas face a higher tax burden as a result of CO₂ taxation than households living in urban regions' (Speck et al. 2006: 251).

OECD (2004: 46) remarks that more attention should be addressed to measuring the effects and cost-effectiveness of the Swedish measures. Rutqvist et al. (2012) also find that the environmental effects are sparsely analysed for the green tax reforms 2001-2006. However, some environmental policy instruments have been evaluated, regarding their environmental effect; for instance, the Swedish sulphur tax accounts for an estimated 30 pct. of the reduction in Swedish SO₂ emissions in the period 1989 to 1995; and the Swedish NO_x charge is estimated to have contributed both to a reduction in NO_x emissions and to an increase in energy efficiency, due to a refund mechanism where the charge is refunded in proportion to the amount of energy generated and in inverse proportion to emissions (OECD 2004); there are also indications of relatively comprehensive effects of Swedish CO₂ taxes (Andersen et al. 2001; see also Environmental Protection Agency and Energy Agency 2006). In other words, there are benefits of the policies, but knowledge on how the benefits are distributed among different social groups, is lacking.

5. Conclusion

While the pace of green tax reforms has slowed down or even reversed in the last decade, the three Scandinavian countries have a relatively long history of green taxes and all three have had elements of green tax reforms in their policy designs, as part of the revenue collected from green taxes has been used to lower other distorting taxes in the economies. Thus, the Scandinavian countries offer a good opportunity to examine empirically the relationship between environmental taxation and social equity. Hence, this chapter has reviewed available evidence on the distributional effects of environmental taxes on household

incomes in the Scandinavian countries. The question posed was, whether the Scandinavian green taxes contribute to (in)equality among social groups? As predicted, the overview of the evidence of the effects on equity of green taxes in the Scandinavian countries does not provide us with a conclusive answer.

The complex relationships among prices, revenue recycling, tax reform and environmental improvement renders a clear conclusion impossible. Moreover, relatively few studies have examined this question and among these most are model simulations, often carried out ex-ante and employing highly idealized assumptions about human rationality. Solid ex-post analyses of the effects of green taxes in Scandinavia, based on empirical data, are rare. Both regarding environmental effects, employment effects of green tax reforms, effects of refund/reimbursement mechanisms and distributional effects on income. Furthermore, there are no ex post analyses of the total distributional effects of any of the green tax reforms in the Scandinavian countries.

But despite lacking a conclusive answer, we have some indications of the equity impact of environmental taxes.

Regarding environmental effects there is, some evidence that green taxes have generated positive environmental effects, but how the benefits of green taxes are distributed among different social groups in Scandinavia, is largely unknown. There is some evidence, though, that low income groups are more exposed to pollution than high income groups and therefore green taxes may potentially contribute to more equality by curbing emissions. But any conclusion on this aspect requires a more detailed look at the specific forms of pollution and their distribution across socio-economic groups.

Employment effects of green tax reforms in Scandinavia seem to be an almost non-researched empirical field ex post. It can be concluded though that expectations regarding employment effects are apparently not very high among the Scandinavian governments.

The distribution of the costs of green taxes has been the subject of more analyses. There is evidence that some types of green taxes are typically more regressive than others, although there are some differences among the countries. Water and electricity are examples of commodities which normally constitute a larger share of consumption for low income groups than for high income groups and green taxes on these commodities therefore often have a regressive effect. In contrast, car registration taxes typically exhibit progressive effects.

There are distributional effects among different regions within all three countries. In general, rural households are more vulnerable to green taxes, than households in cities.

Inevitably, green taxes in Scandinavia have led to some inequalities both regarding costs and benefits. The good news are that the experience of the Scandinavian countries also shows that governments aiming to avoid inequalities among different income groups, regions etc. regarding the distribution of the costs of green taxes, can do so through careful tax design. If the revenue is reimbursed through lower income taxes or in particular through higher personal allowances, it is possible to make the whole tax package proportional or progressive. In fact, as demonstrated regarding the Swedish green tax reforms 2001-2003, it is possible to provide a net benefit of a green tax reform for all households, if green tax revenue from other sectors of the economy is reimbursed to the households – for instance through a higher personal

allowance. Another design option to level out inequalities is to differentiate the tax levels as demonstrated regarding electricity taxes in Northern Sweden and Norway and thereby avoid geographical inequalities.

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