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Green ways of financing the welfare state?

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Abstract

This paper discusses whether and if so how two major contemporary problems, climate change and financial pressures on welfare states, should be tackled in conjunction. It compares different climate change mitigation instruments and argues that policies which share out the revenue that they raise on an equal per capita basis to all citizens are both effective in reducing CO_2 emissions and capable of preventing regressive effects that other emission reduction policies often generate. However, such schemes are not a long-term solution to general pressures on welfare state finances. They are perhaps best seen as temporary measures to enable a managed transition to a low carbon society, a process which might well be essential to maintain social stability, and therefore for the continued existence of the welfare state.

1. Introduction

This paper addresses the question of whether two immensely significant problems that today's welfare states face can be tackled in conjunction and if so how. The two problems that we are referring to are imminent financial pressures on welfare states and the urgency of mitigating catastrophic climate change. At first sight, these two sets of problems may seem unrelated. However, we will argue in this paper that tackling these problems together may be necessary and will definitely be advantageous. In short, mitigating climate change can generate new sources of government revenue which can be "recycled" in ways that have redistributive effects. In fact, if climate change

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mitigation policies are adopted without taking their potentially regressive effects into account, they will harm some of the most vulnerable groups in society. This might make them politically unworkable. This paper will particularly focus on proposals for climate change mitigation instruments that would share out the revenue that they generate to the population on an equal per capita basis. We will discuss a range of questions to investigate the adequacy of those proposals to address the issues of both the imminent financial crisis of the welfare state as well as climate change. First, a brief overview will be provided of different climate change mitigation policies' design principles and potential effectiveness. Second, we review the literature on the distributional effects of existing and hypothetical climate mitigation policies.

Within the scientific community, there is now a consensus that anthropogenic climate change is a reality and that if we do not act very rapidly, we may not be able to prevent catastrophic and potential abrupt climate change which would inflict immense economic and social cost. The main cause of climate change is the emission of "greenhouse gases" (GHGs), including *inter alia* carbon dioxide (CO_2), methane, nitrous oxide, and the refrigerant gases CFCs and HFCs, from human activities. Such emissions can be regarded as negative externalities of market behaviour. This means that economic actors have powerful incentives to emit – as the pricing mechanisms does not reflect the damage that the emissions cause –, even though collectively everyone suffers adverse consequences. Moreover, greenhouse gas emissions are a global externality or uniform pollutant (OECD 2001). That is, no matter where emissions occur, their impact will be felt globally – however in different ways and to varying degrees across the globe – and for a considerable time into the future as GHGs remain in the atmosphere for up to 100 years. Given the long term nature of the impacts the problem can also be seen as an ethical generational issue, with the present generation profiting at the expense of the life chances of future generations.

However, the scientific evidence provided by one of the major players in the area of climate change, the Intergovernmental Panel on Climate

Change[2] is not disputed by any scientific body of national or international standing, and within the sciences themselves there is a remarkable degree of consensus on the reality of anthropogenic global warming (Oreskes 2004) which is based on physics-based knowledge of the so-called "greenhouse effect". This is the mechanism through which GHGs act to trap incident radiation from the sun, warming the earth's surface, an insulating effect without which the planet would be too cold to support life (Houghton 2004). Scientific evidence includes data on manifest changes in the climate such as rising surface temperatures and sea levels, accelerated melting of ice caps and permafrost as well as more frequent occurrence of severe weather phenomena such as flooding, hurricanes and droughts. Evidence that climate change is mostly due to human emissions of GHGs derives from its close correlation to rising emissions from fossil fuel use since the Industrial Revolution (IPCC 2007; McKay 2008: 5ff.).

Research based on more recent data suggests that the IPCC's assumptions about the scale and pace of climate change as well as the targets for atmospheric greenhouse gas concentrations that it endorsed were understated (Anderson and Bows 2008; Hansen, Mki. Sato et al. 2008), increasing the urgency to act. In addition, whilst there is still considerable uncertainty regarding the question of how the atmospheric concentration of GHGs and its increase translate into rising global average temperatures, there is a growing number of scientists warning that the target endorsed by the IPCC of a concentration of 450 parts per million (ppm) CO_2 equivalent (e) is too high and that to prevent dangerous climate change and an average global temperature rise by more than 2 degrees Celsius[3] we should aim to bring the atmospheric concentration of GHGs down to at least 350 ppm CO_2e, very likely even less than that (Hansen, Mki. Sato et al. 2008).[4] It has also been estimated that targets of emission reductions of 80% in developed countries

[2] The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). More than 620 experts contributed to and more than 620 scientists reviewed its Fourth Assessment Report 2007. The IPCC was awarded the Nobel Peace Price in 2007 for its work on climate change.

[3] This is generally seen as the limit that the world's ecosystem and therefore humanity is able to cope with at a tolerable "cost" (amongst many: IPCC 2007).

[4] The current concentration of greenhouse gases in the atmosphere is 467ppm CO2e, the concentration of CO2 alone is ca. 387ppm.

by 2050[5] in comparison to the 1990 baseline is unlikely to reduce the atmospheric concentration of GHGs to 450ppm (PIRC 2008: 15).[6]

We therefore assume that drastic action to reduce CO_2 emissions is required, as the policies currently in place which will not suffice to stabilise the global climate. At the same time, it must be acknowledged that carbon reduction policies potentially have considerable regressive effects as they tend to increase the cost of energy – and therefore of other goods and services – on which low income households spend a higher proportion of their income than high income households. Indeed, this is a general feature of taxes on non-luxury consumer goods or policies that generate price increases of those items.

However, mitigating such regressive effects implies additional government expenditure at a time during which European welfare states find themselves under increasing financial pressure. According to Eurostat data, governments within the EU-27 (EU-15) spent on average 26.9 (27.5) per cent of GDP on social benefits and services. Whilst this figure has remained fairly stable during the last decade, welfare state scholars assume that there will be an increasing demand for welfare spending in the time to come (e.g. Pierson 2001; Starke 2006). This is firstly due to „ageing societies" in which both the ratio of the population above retirement age to the working-age population as well as average life-expectancy are rising. These developments generate higher demands for pension payments as well as health and long-term care provisions whilst the basis of welfare funding is decreasing due to the shrinking proportion of the working-age population that provides the main source of revenue through its tax and social security contribution payments. In addition, the current economic recession and related increasing

[5] For example, this target has been adopted for the UK in the 2008 Climate Change Act.

[6] The social and economic challenges that these emissions reductions pose can be illustrated by the following considerations. Andersen & Bows, for example, modelled different GHG emissions reduction scenarios and estimate that if an atmospheric concentration of 450ppm CO2e is to be achieved and if global GHG emissions peak by 2020, annual post-peak reduction rates of between 8 and 33 per cent are required (Anderson and Bows 2008: 3877). They regard this option as politically unacceptable, however, the scenario in which emissions peak in 2015, requiring post-peak annual emission reductions of at least 4 per cent is still hugely demanding (ibid.). The scale of this challenge becomes apparent by the fact that GHG emissions in Russia decreased by 5 per cent per year for a decade in the aftermath of the Soviet Union's collapse (ibid: 3878).

unemployment within the EU will drive expenditure for working-age related benefits upwards, at least in the near future.

This rising demand for expenditure is however confronted with several limitations to increasing welfare state resources. According to Eurostat, total state revenues within the EU-15 have remained fairly stable during the last decade, having decreased slightly from 46.6 per cent of GDP in 1996 to 45.3 per cent in 2006. Within the EU-15, 58.9 per cent (in 2006) of public social expenditure was financed by social security contributions paid by employers and employees. There appears to be little scope for increasing social security contributions as many EU and OECD governments, also following the advice from those organisations, sought to decrease these non-wage labour costs which are perceived as detrimental to their businesses' competitiveness in comparison to those in the US or Japan. Taxes are another important source of welfare state funding. However, increasing certain types of taxes is also considered problematic from a competitiveness point of view. For instance, raising tax rates on corporate income and profits, capital or capital transactions is often regarded as diminishing businesses' competitiveness within internationalised economies. Alternatively, businesses might be able to evade such tax increases by re-locating their operations into countries with lower tax rates. Difficulties are also attached to increasing taxes on personal income as this potentially reduces work incentives, particularly in the low-wage sector. These pressures may be partly responsible for recent trends in taxing structures according to which the rates on corporate and high level personal income have decreased considerably during the last decade whilst indirect taxes (such as VAT and excise duties) have increased (European Commission 2009). However, the disadvantage of increasing indirect taxes is that they are regressive.

Rising demands for social expenditure could in principle be financed through public deficits. However, monetarist macro-economic approaches have largely replaced neo-Keynesianism since the 1980s, de-legitimising deficit spending as a macro-economic instrument. In addition, the European Monetary Union (EMU) has set clear limits to annual (3% of GDP) and overall (60% of GDP) public deficits for members of the Euro area. Whilst the EMU has often been criticised as ineffective, actual public deficits have decreased from 73.8 (69.9) per cent in 1997, the year in which the Stability and Growth Pact was adopted, to 66.4 (60.4) per cent in 2007 within the Euro area[7] (EU-15). Currently deficit financing is undergoing something of a renaissance in response to the current banking and economic crisis, but this is being presented as a temporary emergency measure to be matched by future spending cuts.

This brief review of two major contemporary problems, climate change and increasing financial pressures on welfare states, demonstrates that whilst urgent action is required to reduce CO_2 emissions, there is little room in current welfare budgets to address likely regressive effects of those policies. However, could sufficient revenue be raised through CO_2 reduction policies that can be used to avoid regressive effects? Could the revenue even be used to tackle increasing financial pressures on welfare states? To be able to discuss these questions we will briefly review different design principles of climate mitigation policies in the following section.

2. Climate mitigation policies

The literature identifies different policy tools to tackle climate change. First of all, one can distinguish regulation from economic instruments, whilst economic instruments comprise measures such as subsidies, taxation and cap and trade schemes (Helm 2005; Stern 2007).

The main feature of traditional command-and-control regulation, is a prescribed level of pollution abatement. It makes use of "institutional measures aimed at directly influencing the environmental performance of polluters by regulating processes or products used, by abandoning or limiting the discharge of certain pollutants, and/or by restricting activities to certain times, areas, etc." (OECD 1994). This leaves the polluter with no alternative other than to comply with the regulation or face penalties for non-compliance. Because of the equal burden put on all polluters irrespective of their specific abatement costs, environmental regulation is considered to be cost-inefficient. For this reason, economic instruments have gained prominence in the field of environmental policy.

[7] Here I am referring to the Euro area consisting of 12 "old" member states, i.e. it excludes the four new members of the Euro area, Slovenia, Malta, Cyprus and Slovakia.

Economic instruments “affect estimates of the costs and benefits of alternative actions open to economic agents” (OECD 1994). They differ from traditional regulation in so far as they work through the market mechanism rather than through a distinct mechanism. Four types of economic instruments can be distinguished: taxes, subsidies, tradable emissions permits, and deposit refund schemes (OECD 1994). The main debates in this area concern the question of whether carbon taxes or tradable emission permits are the more suitable policy tool.

“A carbon tax is a fee imposed on fossil fuels, and other primary products (e.g., refrigerants), based on the amount of greenhouse gases they emit” (WRI 2008). Hence, it establishes a constant price for carbon emissions which contributes to cost security for producers. Carbon taxes as well as other “green” taxes can be characterised as a Pigovian tax “that is, a tax designed to internalize negative externalities into the price system” (Herber and Raga 1995).[8] A carbon tax would therefore introduce a charge for the pollution of the atmosphere and the potential damage caused by climate change into the price of energy. However, carbon taxes do not provide environmental security because the level of emission reduction depends on economic actors' responses to the tax. If demand is price inelastic, the level of emissions reduction will be limited.[9] The fact that price elasticity of oil demand is relatively low and therefore inelastic (Cooper 2003; Hamilton 2009), particularly in the short run, indicates that price elasticity of demand related to a carbon tax would also be inelastic as such a tax primarily increases the price of fossil fuels such as petroleum products and gas.

Scholars within tax policy and labour economics nonetheless typically argue that Pigouvian taxes generate a “double dividend”: Whilst the tax sets incentives to reduce the activities which give rise to externalities, the revenue can be recycled for any other social purpose and also be used to reduce taxes on income or capital. From a neo-classical perspective, this would reduce market distortions that those taxes might imply, for example

[8] The concept of the Pigouvian tax is named after the English economist Arthur Cecil Pigou, who developed it in 1920.
[9] This may indicate that, if one takes the achievement of a given level of emissions reduction as an imperative set by climate science, the conceptual underpinning of Pigovian taxes is undercut, since it is then a physical constraint that sets the optimal tax level rather than a notional external monetary cost of pollution.

restraining work incentives. These principles have been followed through the introduction of the “eco tax” in Germany in 1999 and the 2001 UK Climate Change Levy. The “eco tax” taxes electricity and petroleum, whilst the Climate Change Levy is a tax on a range of energy commodities only payable by businesses in different sectors. In Germany, the revenue from the “Eco Tax” is partially used to decrease the social security contributions for old-age pensions; in the UK, employers’ national insurance contributions have been cut by 0.3 per cent to compensate them for the higher energy cost.

In contrast to carbon taxes, emissions trading or “cap and trade” schemes achieve environmental certainty because the overall volume of emissions is capped at a certain level which ideally decreases over time. (Henceforth we shall call these cap and trade schemes, since it is the cap aspect that drives their environmental impact, and the trading is a secondary, efficiency consideration.) However, they may entail economic uncertainty as the price of emission permits is determined by the market. Under a cap and trade scheme, participating entities (e.g. companies, organisations, individuals) require emission permits to cover their emissions. As emission permits can be traded, entities can buy additional permits if their emissions exceed their initial allocation or sell permits if they remain below their “budget”. If emissions occur that are not covered by a permit, substantial financial sanctions apply. This allows for a competitive market of permits to develop. Companies that have the lowest abatement costs will reduce their emissions in order to sell their assigned permits to companies with higher abatement costs. Design options such as banking, borrowing and price-caps can be used to fine-tune cap and trade schemes to economic circumstances. Emissions will therefore be reduced to the required level at lowest possible cost.

Carbon taxes and cap and trade schemes have various similarities. Importantly both aim to correct for the market failure caused by negative externalities. They include the costs of emitting GHG into prices in order to avoid excessive pollution. They do so by creating a price for carbon which generates incentives to promote more environmental-friendly behaviour and processes. With regard to the question of this paper it is central that in contrast to traditional regulation both instruments (can)[10] generate revenue. "How such revenues are used becomes an important issue in both systems" (PEW Centre 2009). Both tools can be implemented at any point in the production chain from fossil fuel production (upstream) to ultimate fuel combustion (downstream). An upstream approach would reduce the administrative burden of a smaller target group and increase efficiency because it would include most emitters. "In contrast, downstream programs necessarily exclude small sources (as does the EU Emissions Trading Scheme, or EU ETS)" (Parry and Pizer 2007: 81).[11] Regardless of the design, both a carbon tax and a cap and trade scheme require monitoring, reporting and verification to ensure enforcement if companies do not comply with the rules.

The main difference is that the carbon tax ensures cost certainty whereas cap and trade ensures environmental certainty (PEW Centre 2009). "(T)radeable permit programs would reduce CO_2 emissions to a specific level with the control cost handled efficiently, but not at a specific cost level. Carbon taxes would effectively cap marginal control costs at the specific tax level, but the precise level of CO_2 reduction achieved would be less certain" (Parker 2004). This partly explains why many environmentalists prefer cap-and-trade schemes over taxes. Most politicians also prefer emission trading because they fear public uproar caused by implementing a new and potentially regressive tax. Nevertheless, the permit price varies with economic boom-bust cycles while the tax rate remains constant over time. Whilst national governments have so far favoured (their versions of) cap and trade schemes over carbon taxation – also because it seemed more attractive to them to link different trading schemes gradually from the bottom up to address the global nature of climate change than to implement regional (e.g. within the EU) or global carbon taxes – an effective global scheme will eventually be needed to achieve the required reductions of CO_2 emissions.

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[10] As we will discuss below, cap and trade schemes only generate revenue if the emission permits are not given away for free.

[11] Confusingly, "upstream" may mean simply upstream of the consumer, and "downstream" may mean downstream of a fossil fuel compant. We use upstream to denote schemes that operate at the level of fossil fuel production, midstream to denote schemes that operate at the level of energy producers, and downstream to refer to schemes that operate on individual consumers and businesses.

The design of a well-functioning cap and trade scheme is a hot topic of debate. As a rather new tool, only few lessons can be drawn from real-world experiences.[12] Several questions are at the centre of attention. First, policy makers must decide which industries and emissions to target. This choice depends on available data and the technical skills to measure emissions from different sources and will directly influence the compliance cost for industry. The next step is to settle on a mechanism of how the permits are distributed. "Allocation of allowances is clearly the most complex and politically charged element of the emission trading design, whether domestic or international"(OECD/IEA 2002). Permits can be either given away for free (so-called grandfathering), auctioned off, updated (in this procedure the number of allocated permits is reconsidered over time), or a combination of those. Policy makers will seek to find the best trade-off between competitiveness and inter-industry cost burden sharing. In contrast to a carbon tax, revenue will be only raised through cap and trade if at least a partial auctioning of permits takes place. The allocation mechanism has lasting effects on the redistributive effects of the trading scheme.

The permits can be held by private companies, the state/government or citizens (Haas and Barnes 2007: 5). Under the European Union Emissions Trading Scheme (EU ETS), the largest currently existing trading scheme worldwide, the permits are mainly given away for free[13] to polluting companies, generating immense windfall profits for them. For instance, German energy facilities reaped 35.5 bn Euros from 2008 to 2012 alone (Matthes 2008). If governments opt to auction off the permits they generate additional state revenue. Whilst the state would generally be free to use this revenue for various purposes, one possibility would be to ring-fence the revenue for investment in measures that assist a transition to a zero carbon economy and society through energy efficiency, renewables, zero-carbon public transport, reforestation, etc. (Tickell 2008).

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[12] However, see the literature on the 1990 Clean Air Act in the United States, which implemented an SO2 cap and trade scheme as well as the literature on the European Union Emissinon Trading Scheme.

[13] In the first (2005-7) and second trading period (2008-12), member states were/are only allowed to auction off 5 or 10% respectively of the permits if they wish to do so. Whilst the volume of auctioning will increase in the third trading period (2013-), it will only reach 100% by 2027.

The drawback of allocating the revenue to the government is that the government cannot necessarily be trusted to spend resource income wisely (Haas and Barnes 2007). The example of Alaska demonstrates this very well. The Alaska Permanent Fund, an independent body that issues part of the revenue from Alaska's oil resources directly back to the citizens, was introduced because the first windfall profits from 1969 to 1977 were not used efficiently by the government (Fitzpatrick 1999: 148).

This third major option, allocating the revenue amongst citizens on an equal per capita basis, would perform three functions: "it would reflect a common ownership of resource, it would promote third-sector non-state, non-market social economies and it would compensate for the regressive effects of ecotaxes" (Fitzpatrick 1999: 193).

Recently, various proposals for CO_2 reduction policies have been put forward that rebate citizens with equal per capita shares of the revenue that these policies generate. The first is a proposal for a tax and share scheme, whilst the second and third are essentially upstream trading schemes with minor differences in design, called Cap and Share (FEASTA 2008) and Cap and Dividend (Barnes 2003). A tax and dividend scheme for the USA is currently promoted (amongst others) by James Hansen, a climate scientist from the National Aeronautics and Space Administration (NASA). Hansen proposes to levy a tax on the CO_2 content of all fossil fuels at the point of production or first sale at a level that is sufficient to significantly reduce CO_2 emissions. The revenue would be fully reallocated to the citizens on an equal per capita basis (Hansen 2009).

In contrast, both Cap and Share and Cap and Dividend are upstream trading schemes. A cap would be set on the introduction of fossil fuels into the economy at a level such that overall CO_2 emissions are reduced to a required level. The cap could be set once or twice a year and would be reduced step by step to eventually reach the required long-term reduction target. This target would be set by an independent scientific commission. In both schemes, the share from selling the carbon allowances to the fossil fuel providers would be redistributed to the citizens on an equal per capita basis.

The difference between the two schemes is the way in which the share is handed back to the citizens. Within Cap and Dividend, an independent trust would sell the carbon permits to the fossil fuel companies and then share out the revenue to the public. Within Cap and Share, each citizen would be given a certificate, entitling them to sell an equal per capita emission allowance via banks or post offices to the fossil fuel providers. The advantage of Cap and Dividend is that it would involve fewer transactions by individual citizens whilst Cap and Share's advantage is that there is less involvement of an independent trust whose democratic legitimacy and accountability may be weak and that individual citizens can further reduce the amount of emission permits issued by refraining from selling them.[14] Within both schemes, the independent trust could retain part of the certificates/revenue to spend it on additional climate mitigation, energy efficiency or redistributive measures. In addition, both, Cap and Dividend and Cap and Share are in principle scalable, in other words they can be applied globally, nationally or just within a specific economic sector (for example transport, as recently considered by the Irish government (AEA Energy & Environment and Cambridge Econometrics 2008)).

Whilst all three approaches, Tax and Share, Cap and Share and Cap and Dividend would have similar distributional effects, the latter two are preferable from an environmental point of view as they provide certainty over the level of emission reduction by defining an emissions cap, a feature that does not exist within tax schemes.

Finally, Personal Carbon Allowance (PCAs) schemes are similar to Cap and Share/Dividend in that they also set a cap on CO_2 emissions and allocate equal per capita carbon budgets to each individual citizen. The carbon permits are tradable so that those how who are able to use fewer permits than their overall budget can sell them on and those who require more need to buy additional permits. Whilst the distributional effects will be similar to Tax/Cap and Share/Dividend schemes, PCAs are a downstream approach that generates transaction costs that are an order of magnitude higher. In addition, as it is still very difficult to verify embedded emissions from general consumption, caps within PCAs usually do not cover emissions from the whole economy but only certain areas such as home energy or personal

[14] As mentioned above, an independent trust would still administer the Cap and Share scheme, to reduce interference from government.

transport. They would therefore be far less effective from an environmental point of view than the upstream schemes.

To sum up, from an environmental and social point of view, climate mitigation instruments that auction off tradable emission permits would be more effective than a carbon tax. Trading schemes that issue (part of) the revenue directly to the citizens such as Cap and Share or Cap and Dividend also seem to be preferable from a social perspective. This point will be further discussed in the following section.

3. Distributional effects of climate mitigation policies

In the previous section we argued that sharing out the revenue from climate mitigation policies to the citizens is preferable to giving it to companies or the government for a number of reasons. For example, we simply assumed that giving them to citizens on an equal per capita basis has progressive effects. Is this really the case and if so why? To examine this question we will analyse the distributional effects of CO_2 reduction policies that do not share out the revenue to the public and investigate further details of potential distributional effects from Tax/Cap and Share/Dividend Schemes.

First of all, however, let us estimate what volume of revenue climate mitigation policies might yield and what it would add to the current level of revenue from environmental taxes and levies. According to Eurostat, revenue from environmental taxes (energy, transport, pollution) has slightly decreased within the EU-25 (EU-15) as a percentage of overall revenue from 6.98 (7.71) in 1995 to 6.16 (6.79) in 2007. This might partly be due to the unpopularity of taxes on transport fuels and home energy as well as to a reduction in energy use induced by environmental taxes. What volume of revenue could be added to this if all the EU ETS CO_2 emission permits (EU Allowance Unit, EAU) were auctioned at a price of €30/t CO_2? It is estimated that the EU will issue approximately 2.1 (1.6) billion EAUs annually, each of which equivalent to one tonne of CO_2, within the second trading period (2008-12) within the EU-27 (EU-15) (EEA 2008: 86). If all the allowances were auctioned during the second trading period at a price of €30 per tonne of CO_2, this would yield an annual revenue of €63 (€48) billion within the whole EU-27 which would provide an additional 1.13 (0.93) per cent of total state revenue within the EU-

27 (EU-15) in 2008 – or 2.0 (1.6) per cent of total social expenditure in 2006 within the EU-27 (EU-15).

However, only a small fraction of EAUs will be auctioned within the second trading period and the price per EAU is currently far below €30 – at ca. €13 in July 2009. In addition, the EU ETS does not cover the total amount of CO_2 emissions within the EU economy but only about 40-50%. Total CO_2 emissions within the EU-27 amounted to about 4.3 billion tonnes of CO_2 in 2006.[15] If emission permits for all CO_2 emissions were auctioned at €30 per tonne or if a carbon tax of the same price would be introduced, this would yield a revenue of €129 billion which would have been about 2.32 per cent of total average government revenue or 4.11 per cent of social expenditure within the EU-27 in 2006.

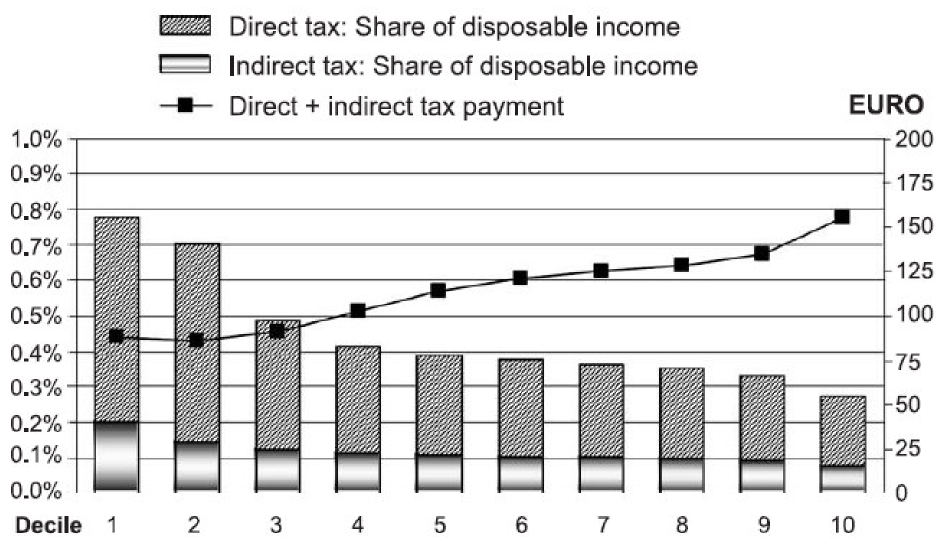
The distributional effects of CO_2 reduction policies depend on various factors. First of all, it will be highly significant whether those who have to pay for the emissions are able to pass on the extra cost to their customers and ultimately citizens. In theory this depends on the elasticities of demand and supply in the various markets affected. Second, it will make a difference whether the policy only applies to the transport or home energy sector or whether all CO_2 emissions are covered by "taxing" them at source. Third, the distributional effects will depend on whether or not compensatory packages will be offered to the citizens. It also depends crucially, as we shall illustrate, on the level of the cap.

Whilst the literature on the distributive effects of carbon reduction policies is usually based on hypothetical econometric models, it clearly suggests that schemes that cover total CO_2 emissions and that do not provide any compensation to citizens, have regressive effects. For example, a study on a hypothetical carbon tax of €20/t CO_2 applied to energy use in Ireland found that such a tax would cost the poorest households just under €3 a week and the richest household just under €4 a week. It would therefore be regressive as the richest households would pay a considerably smaller proportion of their income than the poorest households (Callan, Lyons et al. 2009). This confirms results of previous simulation studies on carbon taxes in

[15] Total CO2 emissions were ca. 4269 MtCO2 (5143 CO2e of which 83% are CO2) in 2006 in EU-27 (EEA 2008).

various EU countries (Symons, Proops et al. 1994; Speck 1999; Symons, Speck et al. 2002), including one study on existing CO_2, home energy and transport taxes in Denmark (Wier, Birr-Pedersen et al. 2005) (see figure 1).

Figure 1: Direct and indirect household tax payments by income deciles (1996)



Source: Wier, Pedersen et al 2005: 245. The left hand scale is for the bar chart.

These results are due to patterns of consumption – and related CO_2 emissions – within society. While household CO_2 emissions augment with rising income, its increase is less rapid than the increase in household income. Therefore, low income households spend on average a higher proportion of their income on energy than rich households and any proportional increase of energy expenses will be a greater relative financial burden on low income households than on high income households.

This pattern is particularly evident if one excludes transport and examines home energy separately. For example, Dresner & Ekins (2006) modelled the distributional effect of a hypothetical carbon tax on home energy of £10/t CO_2 and found that whilst it meant an extra expense of £66.56 per year for a household in the highest income decile in comparison to £36.92 for a household in the lowest income decile, this represented only 0.12 per cent of the high income households in comparison to 0.51 per cent of the low income households (see table 1).

Table 1: Effect of a carbon tax on all households

Decile	Annual change (£)	Percentage of income	Percentage losing	Percentage losing >£2 p.w.
1	–36.92	0.51	81.7	2.7
2	–43.73	0.40	84.8	3.4
3	–40.25	0.31	86.6	2.9
4	–42.59	0.29	87.5	3.6
5	–48.20	0.27	91.7	5.5
6	–48.52	0.23	88.0	4.1
7	–53.46	0.22	90.9	5.8
8	–57.46	0.20	92.5	10.2
9	–58.03	0.17	92.8	8.1
10	–66.56	0.12	97.0	14.7
All	–49.56	0.22	89.4	6.1

Note: N = 29.944 million; n = 6,613.

Source: Dresner/Ekins 2006: 55

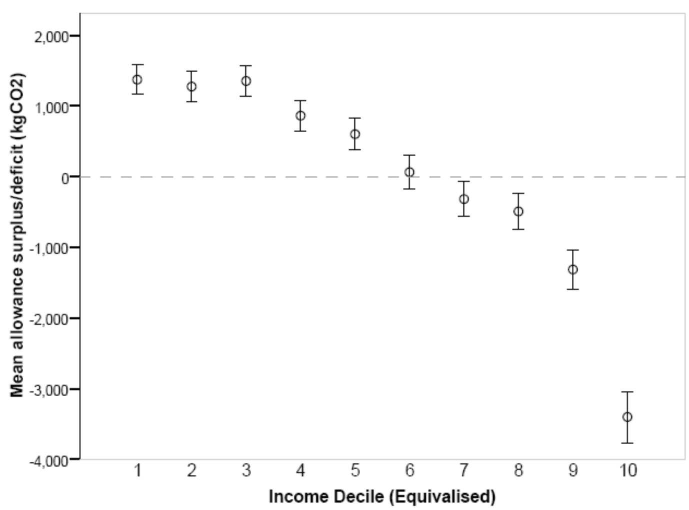
However, the picture is likely to look different if a carbon or energy tax is only applied to transport fuels. For instance, Dresner & Ekins (2004) have argued that a petrol tax would tend to be progressive if all households are included because low-income households are less likely to have a car than high-come households. However, they estimate that a petrol tax would still be regressive amongst motorists (ibid: 2). An earlier study by Barker & Köhler (1998: 384) also demonstrated that low income households in 11 EU member states spent a smaller proportion of their income on transport than high income households – exactly the opposite picture in comparison to home energy expenditure.

Whilst more research in this area is required to determine the different distributional effects of CO_2 reduction policies in different areas of consumption, the studies quoted in the beginning of this section suggest that the progressive effects in the area of transport are outweighed by the regressive effects of home energy and embedded CO_2 so that a general CO_2 tax is still likely to have a regressive effect.

What does this imply for CO_2 reduction policies that allocate equal per capital emission allowances to each individual adult citizen or rebate the revenue from a carbon tax or emission permits on an equal per capita basis to them? If an equal CO_2 emission allowance (or the money arising from selling the equivalent emission permit) is given to each citizen, it follows that all households/citizens that emit less than the volume of emissions covered by the allowance will gain through such a scheme whilst all those who emit more will lose. If low-income households on average emit less CO_2 than covered by the allowance whilst high income households on average emit more, it follows that such a scheme would be progressive.

This assumption is confirmed by a recent study of the British Department for Environment, Food and Rural Affairs (DEFRA) that estimated the distributional effect of a Personal Carbon Allowance scheme according to which emissions were capped at the current level and 40 per cent of carbon permits given to individuals for free (DEFRA 2008: 8f.). The DEFRA study found that, on average, low income households would be able to retain a surplus of allowances (which they would the be able to sell) whilst high-income households would need to buy additional permits as their lifestyle would leave them with an allowance deficit (see figure 2). A recent study that modelled potential effects of a Cap and Share scheme in Ireland generated similar results in terms of its distributional impact (AEA Energy & Environment and Cambridge Econometrics 2008: 129).

Figure 2: Allowance surplus/deficit and income



Source: DEFRA 2008: 25

However, the literature on distributional effects of CO_2 reduction policies also argues that the relationship between emissions and income is actually relatively weak because there is a considerable variation of emissions *within* income deciles. For instance, Dresner & Ekins (2006) only found a correlation of 0.131 between income and CO_2 emissions from home energy use. In other words, income only explained 13.1 per cent of the variation in emissions. In fact they maintained that variation in emissions was smaller *between* income deciles than *within* income deciles (ibid: 52).

This is also confirmed by the DEFRA study on Personal Carbon Allowances that found that whilst on average low-income households would gain from such a scheme, there is still a considerable proportion of low-income households who would have to pay for an allowance deficit (see table 2).

Table 2: Distribution of gain and loss by equivalised income decile

	Income deciles (equivalised)	% of group winning/losing	% of all HH's	Mean credit/deficit	% of all winners/losers
WINNERS	1 to 3	71%	21%	3,577	36%
	4 to 7	60%	24%	3,530	41%
	8 to 10	45%	13%	3,398	23%
LOSERS	1 to 3	29%	9%	-4,170	21%
	4 to 7	40%	16%	-4,532	39%
	8 to 10	55%	17%	-5,930	40%

Source: DEFRA 2008: p. 3

These results must be due partly to the fact that a range of variables other than income determine household CO_2 emissions.[16] In fact, the DEFRA (2008) study also provides insight into the role of other variables such as household size, size of the home, type of dwelling and rural/urban location. On average, larger households tend to have an allowance surplus. Large households emit less CO_2 per person than smaller households, due to economies of scale. However, each adult within the household would still receive an equal emission allowance, therefore putting larger households at an advantage in comparison to smaller households (ibid: 5).

[16] There are also methodological problems arising from the data collection process in consumption surveys. It is well-known, for example, that infrequency of purchase of motor fuel will lead to over dispersion of the estimated distribution when figures from a consumption diary period are extrapolated to estimates of annual consumption.

CO_2 emissions also tend to rise with the number of rooms within a home as they require higher energy use for heating. This puts small households who live in large homes (under-occupying) at a disadvantage. The type of dwelling also had a considerable impact on permit allowances/deficits. On average, people living in flats had the highest surplus, followed by people living in terraced or semi-detached houses respectively. People living in detached houses had on average an allowance deficit (ibid: 28). This is related to the energy environment of different types of dwelling, with flats being more energy efficient than detached houses.

Finally, geographical location seems to be of high relevance in relation to household CO_2 emissions. As one might expect, households in urban areas had, on average, allowance surpluses whilst households in fringe areas, villages and isolated areas had increasing allowance deficits in the order mentioned (ibid: 30). Interestingly, the DEFRA study found that this was largely related to home energy – due to less efficient heating infrastructure and less access to gas in rural areas – rather than transport emissions. However, the DEFRA study does not take aviation and public transport into account which might change this picture, nor are indirect emissions included in these estimates.

Another dimension that needs to be taken into account in examining potential distributive effects of schemes that provide each individual citizen with equal per capita rebates or emission allowances is whether the scheme is introduced at the national or global level. Whether or not such schemes are progressive in developed countries depends on the size of the per capita permit in relation to average emissions from low income households. If the per capita allowance was lower than average emissions from low income households, such schemes are likely to be regressive in developed countries as even the poor would have emission deficits and needed to pay more for them as a proportion of their income than rich households. Let us, for example, imagine that a global Cap and Share/Dividend scheme was introduced tomorrow which set the per capita allowance at 3.3 tonnes per person – slightly lower than the current estimated per capita emission of 3.5 to 4 tonnes per personal worldwide. This per capita allowance is considerably lower than the current average emissions in developed countries like the UK (9.8 tonnes per person) or the US (20.6 tonnes per person) (UN 2007: table 24)[17]. The money resulting from selling the CO_2 permits would not cover the increased cost that even low income households had to bear from their CO_2 emissions and would therefore be regressive. Of course, such a scheme would result in an immense redistribution from developed to developing countries (cf. Sharan 2008; Wakeford 2008, for estimated distributional effects of a global Cap and Share scheme on India and South Africa respectively).

However, potential regressive effects of such global schemes can probably be avoided by differentiating an overall global cap into “regionalised” or even national caps which could still allow developing countries a rise in per capita emissions and a per capita reduction of emissions in rich countries, but not at such extreme levels that would be achieved by an immediate move towards a globally equal per capita allowance.

In addition, there is a range of additional compensatory measures that could, if designed appropriately, help to reduce regressive effects or target low-income losers within overall progressive schemes. Subsidies or loans for home insulation and micro-generation of renewable energy or lower electricity and gas tariffs for low income households, as well as subsidies for public transport are possible examples that require further investigation. There is a clear synergy between emissions reduction policies and energy efficiency measures. On the one hand, without action to curb emissions, efficiency measures are likely to ‘backfire.’[18] This is because the price of energy services decreases, generating a substitution effect favouring higher consumption of those services, and secondly any savings may be spent elsewhere in the economy, an income effect resulting in increased energy use in the economy as a whole (Polimeni, Mayumi et al. 2009). On the other hand, without such efficiency measures the rapid reduction in emissions that the

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[17] These figures reflect emission levels in 2004 and do not include emissions from imported goods and services.

[18] “Backfiring” is a more extreme case than the probably more well-known concept of the “rebound effect”. “Rebound” exists if the reduction in energy use due to energy efficiency measures is partly, but not completely compensated by increases in consumption. Within “backfiring”, no net energy savings are generated as rising consumption fully eliminates or even exceeds any energy efficiency savings.

climate scientists are calling for might result in unacceptably low standards of living.

Discussion and conclusion

This paper posed the question of whether climate mitigation schemes that share out the revenue that they generate to the population on an equal per capita basis could be a new source of financing the welfare state. To discuss this issue it is worth to review the general proposition that combining climate and social policies will reap benefits. Here, two aspects can be distinguished. First one needs to elaborate whether the revenue from climate mitigation policies could and should be used to fill increasing gaps in financing the welfare state. Second, it is a separate issue to ask whether the revenue should be used to avoid regressive effects.

Regarding the first aspect, governments would generally be free to use part or all of the revenue from selling emission permits or levying carbon taxes to increase funding for the welfare state, for example to finance pension and long term care schemes, top up means-tested benefits or child benefit. The drawback here is that if this link is made explicit, critics can easily accuse those climate mitigation policies to be just a means of expanding the welfare state through the backdoor. This is likely to generate political opposition to policies that are desperately required. Conversely, if it is not made explicit that the revenue from climate mitigation policies is used for redistributive purposes, these policies' regressiveness will be at the forefront of public perception, potentially generating public resistance, as the more indirect recycling of the revenue for social purposes is less directly visible.

In addition, one might argue that rather than using the revenue from climate change mitigation policies to finance the welfare state, it should be ring-fenced and re-invested into energy efficiency measures, renewables, public transport infrastructure, etc. (e.g. Tickell 2008). From this perspective, environmental and social policies should be kept separate.

However, from a social policy perspective, there are strong arguments to design climate change mitigation policies in ways that do not entail regressive effects. Generally, decision-makers in the field of social policy must be aware that the current practice of giving emission permits to (energy) companies for free runs counter to the intentions of the welfare state. Increases in energy prices hit low-income households hardest. Hence, it is them who pay for the windfall profits reaped by the energy companies. From this perspective, "recycling" the revenue from CO_2 reduction schemes and, for instance, redistributing an equal per capita share could just be regarded as an adjacent measure that compensates the population for increasing prices of energy and other goods and services, based on the assumption that every citizen has the same right to use (pollute) the atmosphere which is a common good (Barnes 2003). The government could still use part of this revenue to provide low-income households with free insulation, loans for micro electricity-generation and free public transport tokens. Whilst the latter are not social policy measures in the stricter sense, they may have redistributive effects and might be required to help less well-off people to move towards low carbon lifestyles.

A more specific question is whether a tax/cap and share/dividend scheme would be an appropriate measure to link climate change mitigation with social policies. Again, it is useful to distinguish the purpose of filling emerging gaps in financing the welfare state more generally from the mitigation of regressive effects.

Regarding the former, it is likely that such schemes would not be a long-term solution to fill gaps in welfare state resources. First of all, it is difficult to determine the exact size of the revenue from either a carbon tax or a cap and share/dividend scheme. Whilst the price that a carbon tax puts on CO_2 emissions is fixed and therefore calculable for individuals or companies, the resulting revenue depends on the scale of behaviour change (determined by price elasticities of demand and the rate by which high carbon activities are replaced by low/zero carbon activities) that such a tax invokes. Obviously, the greater the environmental benefit, i.e. the greater the reduction of carbon emissions, the smaller will be the revenue. Also within a cap and share/dividend scheme, it is difficult to determine the exact revenue that might be raised. Whilst the volume of emissions that will occur during the period for which the cap was set will be known (assuming that there is sufficient demand so that all issued permits will be used), the price of each permit will be determined through the market, mainly depending on the balance between supply and demand of allowances. If demand for permits is low, for example during a time of recession, the price of allowances will fall and therefore diminish the resulting revenue. However, this problem could be tackled by introducing a “floor” price for carbon permits.

Whilst both, carbon taxes and cap and trade schemes are likely to raise significant volumes of revenue in the short run, both aim, in the long run, at reducing the scale of activities which are the source for this revenue. The revenue from a carbon tax will fall over time if carbon intensive activities are replaced by low carbon activities. Assuming that there will be a move towards a low carbon economy, this would equally involve a falling demand for carbon permits under a cap and trade scheme so that even though the traded volume of permits decreases year on year, the price would not necessarily increase due to falling demand. Within this scenario, the revenue from cap and trade schemes would also fall over time. In other words, carbon mitigation policies are designed such that if they work properly, the resulting revenue would decline in the long run, and thus would not provide a basis for ongoing finance of increasing welfare state demands.[19]

This leaves us with the question of whether sharing out the revenue from CO_2 reduction policies on an equal per capita basis is an appropriate measure to mitigate regressive effects of necessary climate policies. Suffice it here to summarise two main points that have been discussed in section three. The first is that whilst equal per capita shares would be progressive on average, there would still be a considerable number of low-income “losers” from such schemes. Whilst more research is required to identify the factors that determine the likelihood of low income households losing out under such schemes, a plausible initial assumption is that low income households in rural areas, living in poorly insulated, isolated homes, without access to gas (i.e. more dependent on oil for heating which has a greater CO_2 intensity per kWh) and limited access to public transport, as well as low-income elderly people who “over-occupy” large houses will be particularly vulnerable. Such

[19] The other side of the coin is that those who profit from auctioning off emission permits or from emissions trading have an interest in a more gradual reduction of the cap – once the cap is set to zero, this source of revenue or profit would dry up. This issue may be an additional justification for the cap to be set by an independent commission.

inequalities can be addressed by ring-fencing part of the revenue for specific measures, targeting those vulnerable groups.

The second issue is that if cap and share/dividend schemes are introduced at a global scale, they are likely to have regressive effects in all those countries in which the carbon footprint of even the lowest income deciles is above world average – or any amount just below world average to which the overall cap will be set. This could be mitigated through redistributive measures financed from national government budgets, however, it would add additional pressure on already tight welfare resources. Alternatively, the global cap within cap and share/dividend schemes could be scaled nationally or regionally, setting different per capita allowances/shares in these different areas on the basis of previous emissions and moving much more slowly to an equal per capita share globally. Whilst this considerably reduces the scale of global redistribution and violates the principle that every world citizen should have the same right to use (pollute) the atmosphere, it might be a preferable option as it is more likely to win public support and to be financially viable. Our overall conclusion therefore is that whilst it might be more problematic to explicitly or implicitly use the revenue from climate change mitigation to fill gaps in financing the welfare state, it is necessary to design climate change mitigation policies such that they do not put already vulnerable groups in society at a disadvantage. Whilst cap and share/dividend schemes do not provide perfect solutions as they need to be carefully designed to avoid unjustified disadvantages (low-income "losers") or public opposition (due to regressive effects if a global equal per capita share is introduced right at the start), there are ways in which these negative effects can be prevented. This makes them a promising tool for designing equitable and effective climate change mitigation policies.

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