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ideology**

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Attitudes to Personal Carbon Allowances: The effect of trust in politicians, perceived fairness and ideology¹

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Abstract

The idea of Personal Carbon Allowances (PCAs) was presented by the British Environment Secretary David Miliband in 2006. Although no state is seriously developing proposals for them, they have been heavily debated within academia, NGOs and policy making circles. PCAs can be seen as a logical extension of market efficiency underpinning emissions trading schemes, so far only applied at the firm level, to individuals. The purpose of this paper is to analyse some critical aspects of *the public's* support for a PCA scheme. We focus on the relations between attitude towards a PCA scheme and *trust in politicians*, *perceived fairness* and *ideology*, respectively. We also analyse the relation between the respective attitudes towards an increase in the current tax rate and towards an implementation of a PCA scheme. We base our study on a mail questionnaire sent out to a random, representative sample in Sweden.

Key words: personal carbon allowances, attitudes, trust, fairness, ideology

JEL: Q54, Q58

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Introduction

The present worldwide creation of carbon markets is emblematic of the marketisation trend in climate policy, which accelerated after Russia ratified the Kyoto Protocol in November 2004 – the crucial moment that made the treaty legally binding (Biermann et al. 2008). With the Kyoto Protocol in force, the inception of the EU Emissions Trading Scheme (EU ETS) in 2005, and the more recent development of regional carbon markets in North America and Australasia, global transactions in emission reductions are rapidly increasing (Capoor and Ambrosi 2008). An increasing number of politicians, environmental NGOs and scholars seem to agree that politically initiated reductions of CO₂ emissions ought to be implemented primarily via market-based policy instruments (see for example Fischer and Newell 2008 for a recent contribution on this topic). Such instruments are considered appropriate, even preferable, not the least because of their assumed – and argued for – cost efficiency. It is apparently better to rely on people's interest in the size of their wallets than hoping for people to change their preferences based on moral reasoning.

The idea of Personal Carbon Allowances (PCAs) was presented by the British Environment Secretary David Miliband in 2006. Although no state has yet seriously developed proposals for them, they have been heavily debated within academia, NGOs and policy-making circles. PCAs can be seen as a logical extension of market emissions trading schemes to individuals. They therefore constitute a 'downstream' trading system since they target consumption of emissions instead of production. The debate on individualised forms of carbon trading has, with very few exceptions, been carried out without knowledge about how individuals actually view these ideas. The aim of this paper is to contribute to a more enlightened discussion on PCAs by presenting the first evidence (to our knowledge) on the public's perception of an implementation of a PCA scheme. We focus on the relations between attitude toward a PCA scheme and *trust in politicians*, *perceived fairness* and *ideology*, respectively. We also analyse the relation between attitudes towards an increase in the current tax rate and towards an implementation of a PCA scheme. We base our study on a mail questionnaire sent out to a random, representative sample in Sweden during the fall and winter of 2007.

While cost efficiency is needless to say an important determinant for the prospects of implementing market-based policy instruments, it is far from the only important factor. In fact, it has been found that there is a poor relationship between cost efficiency and *legitimacy*, indicating that there are other factors affecting the prospects for successfully implementing policy instruments (in fact for making any political decisions) within democratic systems (Jagers and Hammar 2009).⁵ Legitimacy is commonly associated with factors such as accountability, trust, fairness and participation, which means that unless the public considers the authority implementing an instrument to be *trustworthy* to some degree, its support for the implementation tends to be low. The probability of public support also depends on whether the instrument will be *fair* in its procedures and outcome, and on the degree to which the public has had a say in the implementation process (Jagers and Hammar 2009). Appropriateness is another important factor in this context. For a number of reasons, policy instruments can differ in eligibility. For example, market-based instruments might only fit and operate properly in certain contexts because of *ideological* reasons: some agents might prefer legal instruments, e.g. because they are considered ideologically less challenging or more attractive. Furthermore, the problem of general tax aversion may make environmental taxes suit certain contexts better, such as the Swedish, since Swedes are used to taxes (relatively speaking), while other market-based regimes, such as tradable quotas, may be more appropriate in countries with a relatively high tax aversion. All in all, although commonly suggested, many of the conceivable market-based instruments may turn out to have a limited operational scope due to inadequate support among those who will be affected by them.

In the first section we present the philosophical, political and scientific background of the emerging discussions on PCAs within the climate change context. We then describe our data more in-depth. A section then follows that presents and discusses our results. We end the paper by discussing the policy implications of our results.

⁵ Jagers & Hammar (2009) argue that for citizens to accept an increased CO₂ tax, they need to trust that the instrument will have the intended effect to the lowest possible cost. Thus, it is reasonable to assume that the relationship between legitimacy and cost efficiency must not be as poor as often suggested: On the contrary, the uneasiness may vein along with the instrument *being proved* efficient and effective.

Trading emissions: countries, firms and individuals

Carbon markets are rapidly developing around the world in a wide range of jurisdictions. Overall, there are two distinct forms of emission trading schemes: cap and trade and baseline and credit systems (Tietenberg 2003). This distinction reflects the method by which the underlying commodity (the possibility to emit one tonne of CO₂ equivalent) is created. To simplify, a cap and trade market is created when a collective of emitters within a certain jurisdiction receive a ‘cap’ on their emissions. Within that cap, emitters are allowed to trade allowances between them. In a baseline and credit market, the credits are equal to emission reductions vis-à-vis the baseline (business-as-usual). The cap and the baseline are both essential in the commodification process. It is further possible to distinguish between compliance markets, which result from public regulation (e.g. the Kyoto Protocol or a domestic emissions trading scheme, ETS) and voluntary markets, generating demand independently of public regulations.

Table 1. Compliance and voluntary carbon markets.

Carbon markets	Compliance market	Voluntary market
Cap and trade	Kyoto Emissions Trading (IET), EU ETS, New Zealand ETS, Australian ETS, Regional Greenhouse Gas Initiative (RGGI), California Climate Registry (CCAR), Personal Carbon Allowances (PCA)	Chicago Climate Exchange (CCX) Japanese Voluntary ETS Sector No-Lose Targets (SNLTs)
Baseline and credit	Clean Development Mechanism (CDM), Joint Implementation (JI)	Voluntary Carbon Offsetting

Table 1 serves as a starting point for our discussion of PCAs. Obviously, these two types of carbon markets do not exist naturally, but have to be constructed through particular efforts by a range of public and private agencies at different levels. Conceptually, PCAs share many features with other compliance-based cap-and-trade markets. PCAs also share features with other carbon pricing instruments, such as the carbon tax. They both internalise externalities by putting a price on carbon. Although both are cost efficient in theory, PCAs have the advantage that the level of emissions can be precisely determined in advance (provided full observance of and participation in the tradable quota system), while a government has to rely on elasticity calculations to be certain that a particular emission level is reached when setting the level of the tax.

PCAs have an interesting history. The idea became well known when the British Environment Secretary, David Miliband, in July 2006 announced that his government would look more radically at the option of ‘tradable carbon allowances’, and the same year, the Department of Food, Agriculture and Rural Affairs commissioned a report called *A Rough Guide to Individual Carbon Trading: The ideas, the issues and the next steps* (Robert and Thumin 2006). Miliband compared the climate challenge and the need for societal change with another period of societal transformation, i.e. the movement for social welfare in the 19th and 20th centuries. He also provided a thought experiment: ‘Imagine a country where carbon becomes the new currency. We carry bankcards that store both pounds and carbon points. When we buy electricity, gas and fuels we use our carbon points, as well as pounds. To help reduce carbon emissions, the government would set limits on the amount of carbon that could be used’ (Miliband 2006: 4).

The origin of the idea though can be traced even further back. In the UK context, it was developed by David Fleming, who explored the idea in the mid 1990s. In the years to follow, it was additionally popularised by the well-known campaigner Mayer Hillman and in a book entitled *How We Can Save The Planet* (Hillman & Fawcett 2004). In their work, Hillman and Fawcett argue that the only serious and fair way to deal with climate change is to ration carbon emissions: Everyone will start with an equal share of the ‘global commons’, and then those who want to emit more than their allotted share will have to buy extra rations from those emitting less than their share. Fleming and Hillman’s early ideas have recently been developed and refined as ‘Tradeable Energy Quotas’, ‘Domestic Tradeable Quotas’ and ‘Personal Carbon Allowances’ by research teams based in the UK (such as Starkey and Andersson: 2005; Bows et al. 2006). While there are notable differences, these schemes are all quantity-based instruments that, through a logic of cap and trade, work ‘downstream’ to regulate the individual energy user.

The philosophical foundation of these schemes is the view that the atmosphere ought to be seen as a ‘common’ with every individual having an equal right to pollute or to be protected from pollution. Agreements like the Kyoto protocol instead tend to justify disparate claims to the common, thereby violating the fundamental principle that all people have equal rights (Baer et al. 2000). In international climate policy, a great deal of debate has surrounded the application of the per capita principle to the allocation of emission rights among countries. A well-known example

is the ‘contraction and convergence’ scheme (Meyer 1995). The author shows how the trajectory of emissions will travel if we start from a status quo emissions distribution and move towards per capita equality, while gradually reducing the overall level of emissions (which is a politically set goal to achieve climate stability). While addressing inequalities in per capita-based emissions reductions *among* countries, the ‘contraction and convergence’ scheme has been criticised for disregarding the unequal distribution of emissions *within* countries (Paterson and Stripple 2007).

The starting point for PCAs is a common (national) carbon budget⁶ divided into carbon units, which are then allocated to individuals on a per capita basis. As with other emissions trading markets, a series of technical issues must be settled, e.g. rules for allocating permits, rules for trading, penalties for non-compliance, and boundaries of the system (geographical scope, who should participate, and what types of emissions should be included and excluded). After the allocation, individuals can sell (or buy) any available surplus units in the carbon market. Then the overall carbon budget (and hence each ration) decreases yearly until the total amount of CO₂ emissions has reached a desired level. In this sense, carbon units work like any commodity: supply and demand determine the price and excessive use raises the price accordingly. This creates an economic incentive for individuals to lower their carbon output and potentially, low-carbon living can even become financially rewarding. Hence, the current argument for individual carbon trading is similar to the one originally put forward by Michael Grubb (1989) claiming that emissions trading is both fair and efficient.

Contemporary research on PCAs is still at a very early stage. A workshop organised by UK Environmental Research Council (ERC) in 2006 identified major gaps in knowledge concerning, for example, the design of the system (credibility, adaptability, visibility); cost-benefit analysis and comparative assessment of other policy instruments, and its ‘strategic policy fit’ (with EU ETS in particular). The workshop also raised the issue of the need for more knowledge about ‘public acceptability’, i.e. the need to develop a better understanding of what the public might

⁶ Today the atmospheric concentration of CO₂ is 380 parts per million by volume (ppm). If we want to meet the EU 2°C climate target with more than 50% certainty, then the atmospheric greenhouse gas concentrations probably need to be stabilised at 450 ppm CO₂ equivalent (den Elzen 2005). The increase from today’s 380 ppm to 450 ppm corresponds to emissions of approximately 175-315 gigatonnes carbon (GtC). Hence, only 175-315 GtC can be emitted over the next few decades. This amount represents our common carbon budget that must be shared equitably.

think about receiving and trading carbon allowances and of its reaction to such a scheme. It is in the latter area that this article contributes.

Data description

For the purpose of this paper, we have conducted a survey among a representative sample of 2000 Swedes aged 18-75, drawn from the Swedish population in the national register. A questionnaire was sent out in November 2007, which was followed up by two reminders. The respondents were asked to answer 45 questions, of which 14 were directly devoted to a potential PCA scheme.⁷ The response rate was 46.8%, which should be considered rather successful since many of the questions were quite demanding to answer.

To be able to determine the representativeness of the responses, a comparison on key variables, i.e. education, income, gender and political affiliation, was made with data from Statistics Sweden on the population as a whole. Gender and income turned out to be representative, while political affiliation and especially education turned out to be biased: 30% of the total Swedish population has studied at the university level versus 50% in our sample. Hence, a significantly larger share of the respondents are well-educated compared to in the population as a whole. When it comes to political affiliation, the bias again turned out to be significant, but not as strong as with education. In general, a smaller share of our respondents sympathise with the two largest parties (the Moderates and the Social Democrats) compared to in the population as a whole. Accordingly, all small parties are over-represented (except the left-wing party) compared to in the population as a whole. This should of course be kept in mind when interpreting the results.

Attitudes to PCA: trust in politicians, perceived fairness and ideology

Approximately 66 percent of our sample stated that they would prefer the current carbon tax *compared* to a PCA scheme. This is not surprising since people have a tendency to favour the state they are currently in (Shogren et al. 1994; Kahneman & Knetsch 1992; Slovic, Fischhoff & Lichtenstein 1982). Also, given the information in the survey, 47% stated that they are positive to an introduction of a PCA scheme.

⁷ A translated version of the questionnaire is available from the authors upon request.

However, there might be a relationship between the respective attitudes towards an increase in the current carbon tax rate and towards an implementation of a PCA scheme. As can be seen in Table 1, we found that the correlation between the two is positive, significant and even quite large.

Table 1. Correlation matrix.

	Attitude to PCA scheme	Attitude to carbon tax	Attitude to an increase in carbon tax
Attitude to PCA scheme (1-4, where 1 is very negative and 4 is very positive)	1		
Attitude to carbon tax (1-4, where 1 is very negative and 4 is very positive)	0.3325*	1	
Attitude to an increase in carbon tax (1-4, where 1 is very negative and 4 is very positive)	0.3858*	0.7145*	1

*significant at the 1% level.

Furthermore, as can be seen in Table 2, 52% of the respondents who are positive to an increase in the carbon tax rate are also positive to an implementation of a PCA scheme, while only 21% of the respondents who are negative to an increase in the carbon tax rate are positive towards an implementation of a PCA scheme. This difference is statistically significant using a non-parametric statistical test (Chi square test).

Table 2. The relationship between the respective attitudes towards a PCA scheme and an increase in the CO₂ tax.

	Obs	Mean	Std.Dev	Min	Max
Positive to a PCA scheme (dummy variable 1/0, where 1 is positive and 0 is negative) given that positive to an increase in the carbon tax.	420	0.52	0.50	0	1
Positive to a PCA scheme (dummy variable 1/0, where 1 is positive and 0 is negative) given that negative to an increase in the carbon tax.	419	0.21	0.41	0	1

Thus, it is clear that people's attitudes towards a potential PCA scheme and an increase in the existing carbon tax are related.

Trust in politicians

It has been shown that *trust* affects people's attitudes towards more and higher environmental taxes in two ways (Torgler and Garcia-Valinas 2007; Jagers & Hammar 2009) Typically, people tend to be more supportive of an environmental tax if they trust their co-citizens, i.e. if they trust that others pay their share (it could hence be of importance to only implement taxes that are hard to evade, at least if generalised trust is low). People also tend to be more supportive of more and higher taxes if they trust their politicians (Hammar & Jagers 2006). There are two main reasons for the latter. First, to be supportive of environmental taxes, people must trust that the politicians will use the tax revenues in a judicious way. Second, it is important that the public believes that the politicians are convinced that the tax will have its intended effects *and* is considered a sound policy choice. In this paper we are only concerned with how political trust affects the public's attitudes towards PCAs.

In the data, the variable *trust in politicians* is a dummy variable created from a discrete variable ranging from 1 to 5 (where 1 indicates very low trust and 5 very high trust in politicians).⁸ As can be seen in Table A2 in Appendix, trust is positively correlated with attitudes towards a PCA scheme and a carbon tax increase. Using this categorisation, we apply a non-parametric test (a chi-square test) to test whether there is a significant difference in attitudes towards a PCA scheme and an increase in the carbon tax between people who trust politicians and those who do not. We find that people who trust politicians are more positive towards both policy instruments vis-a-vis those who do not trust politicians (this result holds for both the 'low-trust' and the 'high-trust' dummy).⁹

Perceived fairness

⁸ The dummy is equal to one if $\text{trust} > 3$ and equal to zero if $\text{trust} < 4$.

⁹ Comparing individual who trust politicians and those who don't: Pearson $\chi^2(3) = 23.55$ Pr = 0.00 for the increase in carbon tax and Pearson $\chi^2(3) = 17.94$ Pr = 0.00 for the PCA scheme.

Fairness issues have received increasing attention in the climate policy debate, and the inherent aspects of distribution of the costs of climate change, both between countries and generations, should put questions related to fairness in the focus of future climate negotiations and agreements as well. As already touched upon, a PCA scheme could be highly progressive depending on the initial distribution of the permits. In this paper we are able to distinguish between general fairness perceptions (still related to climate change mitigation) and individuals' perception of fairness related to the redistribution associated with a PCA scheme.

Environmental taxes are often considered to be *unfair* (Tindale & Hewett 1999). Since the CO₂ tax makes petrol more expensive and affects both relatively poor groups and groups living in remote areas (that are car dependent) disproportionately, the distributional consequences in terms of economic outcomes are often argued to be unfair (Hammar & Jagers 2007a). A PCA scheme would have other types of distributional effects than a CO₂ tax; they would be intimately connected to the choice of allocation mechanism, i.e. how the carbon rights are distributed to individuals. As discussed above, the basis for a PCA scheme is that individuals have an equal right to pollute and to be protected from pollution. Hence, unlike the EU Emissions Trading Scheme (EU-ETS), where the allocation mechanism has so far been based on historic emissions, the most likely allocation mechanism for a PCA scheme is an equal distribution of carbon rights (as discussed earlier). However, even if this allocation mechanism may seem fair at a first glance, the distributional effects that arise can definitely be seen as unfair to some individuals, e.g. distribution of wealth from people living in the countryside to people living in cities, from men to women, or from home owners to persons living in multifamily dwellings.¹⁰ Whether individuals feel this is fair or not is not only dependent on whether they find the PCA to be a fair or unfair policy, but also on how they are personally affected by the allocation. This is often referred to as self-serving bias, and is discussed further below.

The questionnaire distinguished between the three fairness principles need, equality and equity. Each respondent ranked the principles as not fair to very fair on a 1-5 scale. It turns out that all

¹⁰ Note that these redistributions are artifacts from an equality-based permits allocation mechanism, given consumption patterns today.

three fairness principles are positively correlated with attitudes towards the policy instruments (both PCA and carbon tax). This result is confirmed by chi-square tests (the test results are available upon request). In addition, there are significant differences in attitudes towards the respective policy instruments between the respondents who supported *any* of the fairness principles (need, equality, equity) and those who did not: Individuals who supported *any* of the three fairness principles were more likely to be positive to the PCA scheme and the carbon tax than those who did not support any of the principles. This could reflect the fact that we asked the question in a climate change framework, i.e. individuals who do not support the view that individuals should act to deal with the climate change problem (e.g. to reduce carbon emissions) to a larger extent demonstrate protest answers indicating that they do not support any of the fairness rules. Thus, in other settings the same individuals could support one or even all fairness principles. This hypothesis is supported in the data, where the respondents were asked about their view on the responsibility of individuals to deal with the climate change problem. Individuals who did not support any of the fairness principles to a larger extent responded that individuals are not responsible for dealing with the climate change problem (see Table A1 in Appendix for an example of the need principle; the same pattern holds for the other principles).

Individuals' perceptions of fairness related to the redistributions associated with a PCA scheme are analysed using questions regarding fairness of redistribution among various groups in society.¹¹ These redistributions are dependent on how permits are allocated in a PCA scheme. We have assumed that permits will be distributed equally among citizens in the country. Table A3-A7 in Appendix summarises the results of the questions, which concerned *redistribution from individuals living in single-family houses to individuals living in apartments, redistribution from individuals living on the countryside to individuals living in the city, redistribution from men to women, redistribution from families with children to families without children, redistribution from those with high income to those with low income*. As can be seen, some types of redistribution are seen as more unfair than others. Redistribution from those with high income to those with low income seems to be seen as the most fair redistribution out of the five, while

¹¹ Those redistributions are based on current carbon emissions for each group, for example men in Sweden on average cause more carbon emissions than women, and hence the redistributions are likely effects of a PCA scheme in Sweden given that permits are allocated equally.

redistribution from people living in the countryside to those living in the city and redistribution from families with children to families without children are seen as the most unfair types.

As indicated by Brekke and Johansson-Stenman (2008), there is systematic evidence of *self-serving bias*, or self-interest, i.e. even if people care about fairness, they are affected by how a policy affects their own interests (Hammar & Jagers 2007b). Hence, an interesting aspect of these attitudes is the potential driving force of self-serving bias. For example, do poorer to a larger extent than richer people feel that redistribution between those with high and low income is fair? We will investigate this issue for each type of redistribution.¹²

Redistribution from single-family house to apartments

There is a statistically significant relationship between people living in apartments and their attitude towards the fairness of this type redistribution. The probability that individuals think this is fair increases if they live in apartments. The opposite is true for individuals living in single-family houses; they find this type of redistribution less fair compared to individuals not living in single-family houses. This result is statistically significant.

Table 3. Correlations for ‘How fair do you think redistribution from people living in single-family houses to people living in apartments is?’.

	Fairness ^a	Apartment ^b	Single-family house ^c
Fairness ^a	1.000		
Apartment ^b	0.2918*	1.0000	
Single-family house ^c	-0.2668*	-0.7846*	1.0000

* Correlation significant at the 1% level.

^a Fairness is an ordered variable 1-4, where 1 is very unfair and 4 is very fair.

^b Apartment is a dummy variable =1 if respondent lives in an apartment and=0 otherwise.

^c Single-family House is a dummy variable =1 if respondent lives in a single-family house and=0 otherwise.

Redistribution from countryside to city

The probability that individuals feel this redistribution is fair increases if they live in a city and decreases if they live in the countryside. Both results are statistically significant.

¹² We test the differences between the groups of interest using a non-parametric test (chi2). The tests are available from the authors upon request.

Table 4. Correlations for ‘How fair do you think redistribution from people living in the countryside to people living in the city is?’.

	Fairness ^a	City ^b	Countryside ^c
Fairness ^a	1.0000		
City ^b	0.0958*	1.0000	
Countryside ^c	-0.1540*	-0.4157*	1.0000

* Correlation significant at the 1% level.

^a Fairness is an ordered variable 1-4, where 1 is very unfair and 4 is very fair.

^b City is a dummy variable =1 if you live in a big city (Stockholm, Gothenburg or Malmoe) and=0 otherwise.

^c Countryside is a dummy variable =1 if you live in a small town with less than 20 000 residents and=0 otherwise.

Redistribution from men to women

The difference between men’s and women’s views regarding this type of redistribution is not statistically significant. Hence, being a woman does not affect the perception of fairness of the redistribution from men to women under a PCA scheme. The correlation is significant at the 10% level.

Table 5. Correlation for ‘How fair do you think redistribution from men to women is?’.

	Fairness ^a	Man ^b
Fairness ^a	1.0000	
Man ^b	-0.0817*	1.0000

* Correlation significant at the 10% level.

^a Fairness is an ordered variable 1-4, where 1 is very unfair and 4 is very fair.

^b Man is a dummy variable =1 if man and=0 if woman.

Redistribution from families with children to families with no children

There is, however, a significant difference between families with children and families without children in terms of attitudes regarding the fairness of redistribution from families with children to families without children: Individuals with children think this type of redistribution is more unfair than individuals with no children.

Table 6. Correlation for ‘How fair do you think redistribution from families with children to families without children is?’.

	Fairness ^a	Children ^b
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Fairness ^a	1.0000	
Children ^b	-0.1354*	1.0000

*Correlation significant at the 1% level.

^aFairness is an ordered variable 1-4, where 1 is very unfair and 4 is very fair.

^bChildren is a dummy variable =1 if child and=0 if no child.

Redistribution high income to low income

There is no significant difference between the attitudes of low and high income individuals when it comes to the redistribution from high-income earners to low-income earners. The correlation is negative, however not significant (not even at the 10% level).

Table 7. Correlation between ‘How fair do you think redistribution from those with high income to those with low income is?’.

	Fairness ^a	Income ^b
Fairness ^a	1.0000	
Income ^b	-0.0440	1.0000

^aFairness is an ordered variable 1-4, where 1 is very unfair and 4 is very fair.

^bIncome is an ordered variable 1-12, where 1=lowest income (less than 10 000 SEK/month) and 12=highest income (more than 60 000 SEK/month).

Ideology

From both a legitimacy and a policy maker point of view, it is important to know whether attitudes towards a policy instrument are closely related to political affiliation. Studies have generally shown a positive relationship between left-wing and liberal voters and environmental concern (Torgler and Garcia-Valinas, 2007; Tjernström and Tietenberg, 2008). However, when it comes to the carbon tax and an individual trading scheme of carbon rights, it is less obvious that we should expect any differences between political affiliation and the attitude towards these policies. While it is true that left-wing voters are generally more positive towards taxes, it appears that the carbon tax can be regressive (Poterba 1991).¹³ As already suggested, this means that individuals with lower income may be more affected by a carbon tax increase than individuals with higher income (as a share of total income) and, assuming that right-wing voters generally have higher income than left-wing voters, this indicates that left-wing voters to a larger extent will be negatively affected by a carbon tax increase than right-wing voters. Applying this

¹³An individual in the poorest income quartile in Sweden emits a little more than 3 tonnes each year and an individual belonging to the richest quartile emits about twice as much (Statistics Sweden).

reasoning on the system of tradable permits makes things even more complex since the PCA outlined in the questionnaire is based on equal allocation of permits to each individual in the country. Hence, since people with low income tend to use less carbon than high income people, people with low income could gain money by selling carbon rights. A PCA scheme hence has a *progressive* potential. The correlation matrix in Table A2 (in Appendix) shows that correlations are insignificant for political affiliation, except for those who vote for the environmental party (the Green Party). If we analyse this in more detail by using a chi-square test, we find that attitudes towards PCA and an increase in the existing carbon tax are not significantly different between left-wing and right-wing voters.¹⁴ However, there is a significant difference in these attitudes given that the individual votes for the environmental party: Compared to non-environmentalists, green voters are namely more positive to *both* policy instruments.

Conclusion

In this paper we have analysed some critical aspects of *the public's* support of a personal carbon allowance (PCA) scheme. We can conclude that there is a positive relationship between the respective attitudes towards an increase in the current carbon tax rate and the alternative of implementing a PCA scheme. Furthermore, given the information offered in the survey, 47% of the respondents stated that they are positive to an introduction of a PCA scheme.

As discussed in the introduction of the paper, there are factors in addition to cost efficiency that affect the prospects for successfully implementing policy instruments. We identified three of them: *trust in politicians*, *perceived fairness* and *ideology*. We find that political high-trusters are more positive to an introduction of a PCA scheme compared with those who do not trust politicians. When looking at the perceived fairness aspect of a PCA scheme, individuals who agree to *any* of the three fairness principles equity, equality and need are more likely to be positive towards the PCA scheme than those who do not agree to the principles. However,

¹⁴ Right-wing voters are defined as those who sympathise with 'the Moderate Party' and left-wing voters are defined as those who sympathise with 'the Social Democrats' or 'the Left Party'. Comparing left- and right-wing voters: Pearson $\chi^2(3) = 4.6597$ Pr = 0.198 for the PCA scheme and Pearson $\chi^2(3) = 1.8060$ Pr = 0.614 for an increase in the carbon tax. Comparing voters for the environmental party: Pearson $\chi^2(3) = 20.0291$ Pr = 0.000 for the PCA scheme and Pearson $\chi^2(3) = 69.4363$ Pr = 0.000 an increase in the carbon tax.

analysing more closely the likely redistribution effects of a PCA scheme with equal allocation of permits shows that individuals partly adhere to self-serving bias. Most interestingly, this is only true for particular types of redistributions, namely redistribution from people living in single-family houses to people living in apartments, redistribution from people living in the countryside to people living in the city, and redistribution from families with children to families without children. Redistribution from men to women and redistribution from those with high income to those with low income on the other hand are generally not viewed as unfair, and hence do not support the hypothesis of self-serving bias. *This indicates that self-serving bias is context dependent.*

Regarding ideology, attitudes towards PCA are not significantly different between left-wing and right-wing voters. However, there is a significant difference in the attitudes towards PCA given that the individual votes for the environmental party; these individuals are generally more positive to the PCA scheme.

This paper contributes to the knowledge gap of peoples' attitudes to an introduction of a PCA scheme. We conclude that Swedes do not seem to feel too uneasy about such a scheme, although certain redistribution conditions need to be seriously considered.

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Appendix

Table A1.

Do individuals have a responsibility to deal with the climate change problem? 1=No responsibility at all. 5=Big responsibility.	Fairness principle: "need" 1=don't agree with the principle at all. 5=completely agree with the principle.					
	1	2	3	4	5	Total
1	9	0	2	0	4	15
2	11	12	8	2	15	48
3	34	24	49	43	43	193
4	19	37	51	84	59	250
5	46	28	76	95	131	376
Total	119	101	186	224	252	882

Table A2. Correlation matrix.

	Attitude towards PCA (1-4, 1= very negative and 4= very positive)	Attitude towards CO ₂ tax (1-4, 1= very negative and 4= very positive)	Attitude towards increase in CO ₂ tax (1-4, 1= very negative and 4= very positive)
Political affiliation: Right-wing voter (1=Alliansen and 0=not Alliansen)	-0.0395	0.0376	-0.0219
Political affiliation: Left-wing voter (1=Vänsterblocket and 0=not vänsterblocket)	0.0038	0.0296	0.1005*
Political affiliation: Environmental party (1= env. party and 0=not env. party)	0.1451*	0.1571*	0.2634*
Trust in politicians (1=trust and 0=do not trust)	0.1424*	0.1411*	0.1570*
Fairness principle: Need	0.0965*	0.1032*	0.1038*
Fairness principle: Equity	0.1523*	0.1224*	0.1556*
Fairness principle: Equality	0.1514*	0.0952*	0.1437*

Table A3. Redistribution from people living in single-family houses to people living in apartments.

	Frequency	Percent	Cumulative
Very unfair	250	28.41	28.41
Rather unfair	309	35.11	63.52
Rather fair	270	30.68	94.20
Very fair	51	5.80	100.00
Total	880	100.00	

Table A4. Redistribution from people living in the countryside to people living in the city.

	Frequency	Percent	Cumulative
Very unfair	351	39.53	39.53
Rather unfair	364	40.99	80.52
Rather fair	144	16.22	96.73
Very fair	29	3.27	100.00
Total	888	100.00	

Table A5. Redistribution from men to women.

	Frequency	Percent	Cumulative
Very unfair	275	31.21	31.21
Rather unfair	292	33.14	64.36
Rather fair	253	28.72	93.08
Very fair	61	6.92	100.00
Total	881	100.00	

Table A6. Redistribution from families with children to families without children.

	Frequency	Percent	Cumulative
Very unfair	360	40.63	40.63
Rather unfair	348	39.28	79.91
Rather fair	150	16.93	96.84
Very fair	28	3.16	100.00
Total	886	100.00	

Table A7. Redistribution from those with high income to those with low income.

	Frequency	Percent	Cumulative
Very unfair	166	18.93	18.93
Rather unfair	195	22.23	41.16
Rather fair	343	39.11	80.27
Very fair	173	19.73	100.00
Total	877	100.00	