Supplementary material

# A. Survey (translation of the Swedish original)

## Page: Survey to support future climate policy in Sweden

Climate change is driven by the emissions of greenhouse gases (CO2 in particular), which are caused by various activities, such as the combustion of fossil fuels in cars, air planes and power plants, as well as the production of food, clothes, electronics etc. These activities are directly connected to our consumption and lifestyles.

The planet has just one atmosphere that cannot be exchanged and there are no large scale technologies, yet, that allow us to remove greenhouse gases from the atmosphere. Emissions reduction is the only available option to reduce future impacts of climate change.

Sweden has committed to a steep reduction of CO2 emissions in order to keep global warming below 2°C until the end of the century. This requires policy interventions that go beyond existing taxes, regulations and subsidies.

The results of this survey are meant to inform policy reforms.

The survey takes 8-10 minutes to fill out. Thank you for your participation!

## Page: Who are you?

First we need some data from you. Please be assured that the data we collect will only be used to compare results between groups of participants. We will not publish any individual data of participants!

1. What is your gender?

* Male
* Female
* Other

2. How old are you?

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3. How many people live in your household?

* 1
* 2
* 3
* 4
* 5
* More than 5

4. What is your approximate monthly income (gross salary/pension/allowance)?

* Less than 10.000 SEK
* 10.000 to 19.999 SEK
* 20.000 to 29.999 SEK
* 30.000 to 39.999 SEK
* 40.000 to 49.999 SEK
* 50.000 to 59.999 SEK
* 60.000 to 69.999 SEK
* 70.000 SEK and up

5. What is the highest level of education you have completed?

* Less than high school
* Graduated high school
* Graduated trade/technical school
* Bachelor's or Master's degree
* Licentiate or Ph.D. degree

6. Where, on a scale from left to right, would you place yourself politically?

* Clearly to the left
* Somewhat to the left
* Neither left, nor right
* Somewhat to the right
* Clearly to the right
* Do not know/Do not want to answer

7. In Sweden the average CO2 emissions per person are about 8 tons (including the emissions connected to the import of food and consumer goods). What do you think are the CO2 emissions associated to your lifestyle?

* Below average (this is most likely the case if you live in a flat, don't own a car, fly not more than once per year, and don't consume much)
* Average
* Above average (this is most likely the case if you fly more than once per year, drive a car, live in a large flat or house and consume much)

8. Do you have access to car?

* Yes, I have my own car
* Yes, I have access to a car in my household
* Yes, I am a member of car sharing scheme and/or use car rentals
* No, I do not have access to a car

9. How much do you use the car **an average week**?

* More than 4 days
* 2-4 days
* max. 1 day

10. Do you travel by air plane? (consider only private flights, not flights for business purposes)

* No, never
* Yes, but not more than one return flight per year
* Yes, several times per year

## Page: Note!

We ask you to assess the following situations as if your decisions have real consequences. So please don't agree to costly policies if you think you cannot afford it or if you feel that there are more important things for you to spend your money on.

Moreover, please state only what **you personally are willing to pay** for CO2 emissions reduction, not what you consider to be a reasonable CO2 price (tax level etc.) in general.

Note that the different suggestions are not meant to be implemented together, but should be seen as different options to price CO2 emissions.

## Page: Air travel

Imagine that the government plans to reduce CO2 emissions from aviation and introduces **a new climate surcharge on flight tickets**. The revenues generated by this flight ticket surcharge will go to 100% into the reduction of CO2 emissions (e.g. to investments in renewable energy).

CONDITIONAL MESSAGE FOR SOME RESPONDENTS:

We are aware of that you previously answered that you do not fly. However, we ask you to imagine that you are in a situation where you, for one reason or another, have to fly.

11. Would you be willing to pay such a climate surcharge on flight tickets in principle to compensate for your CO2 emissions?

* Yes
* No

12. You have indicated that you are not willing to pay a climate surcharge on air travel. What is the main reason for this?

* I don't believe in climate change
* My income is too low
* Climate change does not affect me
* I don't believe that the climate surcharge on air travel will have any real impact
* I prefer to spend my money on other things

## Page: Air travel – short distance

What is the highest climate surcharge on flight tickets that you would be willing to pay for a **short one-way flight** of about 1,500 to 2,000 km (e.g. Stockholm - Barcelona or Malmö - Kiruna via Stockholm)?

*(the following question was repeated according to a fixed bid structure)*

13. Would you be willing to pay XXX SEK?

* Yes
* Uncertain
* No

14. You have stated that you would be willing to pay 300 SEK on top of the ticket price for a short distance flight. This was the highest amount offered. If you can imagine paying even more, please indicate the value you are willing to pay in the field below (max. 1200 SEK). If you are not willing to pay more than 300 SEK, please write "300".

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## Page: Air travel - long distance

What is the highest climate surcharge on flight tickets that you would be willing to pay for a **long one-way flight** of about 8,000 to 10,000 km (e.g. Stockholm - Phuket or Stockholm - Los Angeles)?

*(the following question was repeated according to a fixed bid structure)*

15. Would you be willing to pay XXX SEK?

* Yes
* Uncertain
* No

16. You have stated that you would be willing to pay 1200 SEK on top of the ticket price for a long distance flight. This was the highest amount offered. If you can imagine paying even more, please indicate the value you are willing to pay in the field below (max. 4800 SEK). If you are not willing to pay more than 1200 SEK, please write "1200".

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*We will now move on to a different situation. Consider the new situation as an alternative to the previous one rather than something that is added on top of it.*

## Page: Driving a car

Imagine that the government plans to introduce **an additional climate surcharge on petrol and diesel fuels**. Current energy and carbon taxes go into the general budget and are not used to mitigate climate change. In contrast, the revenues generated by this additional fuel charge will go to 100% into the most cost effective measures for reduction of CO2 emissions (e.g. to investments in renewable energy). This is meant to offset the emissions that are caused by burning petrol and diesel when you drive by car.

CONDITIONAL MESSAGE FOR SOME RESPONDENTS:

We are aware of that you previously answered that you do not have access to a car. However, we ask you to imagine that you, for one reason or another, pay for petrol or diesel.

17. Would you be willing to pay such an additional climate surcharge on petrol and diesel in principle to compensate for your CO2 emissions?

* Yes
* No

18. You have indicated that you are not willing to pay an additional surcharge on fuels. What is the main reason for this?

* I don't believe in climate change
* Climate change does not affect me
* I prefer to spend my money on other things
* My income is too low
* I don't believe that the climate surcharge on fuels will have any real impact
* The current carbon tax on fuels and the CO2 based vehicle tax are enough.

## Page: Driving a car

What is the highest climate surcharge on diesel and petrol fuel that you would be willing to pay?

*(the following question was repeated according to a fixed bid structure)*

19. Would you be willing to pay x.xx SEK/ liter?

* Yes
* Uncertain
* No

20. You have stated that you would be willing to pay 2.50 SEK/liter on top of the current fuel price. This was the highest amount offered. If you can imagine paying even more, please indicate the value you are willing to pay in the field below (max.10 SEK/liter). If you are not willing to pay more than 2.50 SEK/liter, please write "2.50".

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*We will now move on to a third situation. Consider the new situation as an alternative to the previous two rather than something that is added on top of them.*

## Page: Voluntary offset of CO2 emissions

Imagine a situation in which no additional policy measures are introduced, but you still have the opportunity to **offset your CO2 emissions from car and air travel** by buying certificates from the European Emissions Trading System.

This system limits the CO2 emissions of industrial companies and power plants in Europe. The total emissions of these companies have to decrease by a certain amount every year. By the end of each year each company has to have emission certificates for the emissions it caused. If you decide to also buy emission certificates -which is possible in reality - these certificates are not available to the companies any longer, which then have to reduce emissions even further. In Sweden the Nature Conservation Association ('Naturskyddsföreningen') offers EU emission certificates to individuals and organizations, who want to compensate for their CO2 emissions. The price for these certificates varies over time, which depends on the demand for allowances and the ambition of EU's climate targets.

21. Have you heard about this option to buy emission certificates to offset your private CO2 emissions before?

* Yes
* No

22. Have you ever purchased offsets in order to compensate for your private CO2 emissions?

* Yes
* No

23. Would you be willing – within the next six months – to buy emission certificates to compensate for your CO2 emissions?

* Yes
* No

24. You have indicated that you are not willing to buy emission certificates to offset your private CO2 emissions. What is the main reason for this?

* I have just recently purchased emissions certificates
* I don't believe that offsetting emissions with emission certificates will have any real impact
* I prefer to spend my money on other things
* I don't believe in climate change
* Climate change does not affect me
* My income is too low

## Page: Voluntary offset of CO2 emissions

What is the highest amount that you would be willing to pay for one emission certificate in order to compensate 1t (one ton) of CO2 emissions from your private car and air travel?

*(the following question was repeated according to a fixed bid structure)*

25. Would you be willing to pay xxx SEK to compensate one ton CO2 ?

* Yes
* Uncertain
* No

26. You have stated that you would be willing to pay 1000 SEK for one EU emission allowance (1 t CO2). This was the highest amount offered. If you can imagine paying even more, please indicate the value you are willing to pay in the field below (max. 4000 SEK works). If you are not willing to pay more than 1000 SEK, please write "1000".

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## Page: Policy preferences

27. Please rank the different strategies to price and reduce personal carbon emission (1 = largest approval, 3 = lowest approval)

* Additional climate surcharge on petrol and diesel fuels
* Climate surcharge on flight tickets
* Status quo (voluntary offsetting)

28. Please rank which actors, according to your opinion, that holds the largest responsibility for decreasing CO2 emissions from private air travel (1=the most responsible)?

* EU or another international organization
* The Swedish government
* The airlines
* The air travelers
* The airplane producers

29. Please rank which actors, according to your opinion, that holds the largest responsibility for decreasing CO2 emissions from car travel (1=the most responsible)?

* EU or another international organization
* The car producers
* The car owners
* The Swedish government

30. Does it matter to you for what the money is used that could be collected with a climate surcharge on air tickets or an additional fuel surcharge?

* Yes
* No

31. What should from your perspective be done with the money that the state could collect from the climate surcharge on flight tickets or the additional surcharge on fuels? (1 = best use; 4 = worst use)

* It should be used to make clean transportation alternatives available
* It should be used to mitigate global climate change
* It should be returned to Swedish tax payers (e.g. via income tax reductions)
* It should go to the general budget without any dedicated purpose

32. If you have any reflections or opinions about the questions in this survey, please write them here.

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## Page: Thank you!

Thank you for taking our survey! Please contact us (EMAIL) if you have questions about the survey.

You will be redirected in 10 seconds.

# B. Statistical population, sampling and response rate

* Statistical population of this study: adult population of Sweden, aged 25 to 74 (6.2 million people)
* Sampling frame: The Swedish online panel “panel.se” with 67 500 active panellists (panellists get points for their participation in surveys which they can exchange for various non-cash benefits)
* Sampling: random sampling from the sample frame (representative with respect to age, gender and geographical region of the statistical population; see also Table 1 below)
* Response: 1507 panel members were invited which resulted in 500 completed surveys, 48 incomplete ones, 37 were screened out (19 due to age and 18 due to short response times) and 89 that were started after the quota of 500 was reached. This implies a response rate of 42% if incomplete but started surveys are left out.
* Statistical power: with a sample of 500 mean differences in WTP of 50 SEK/t CO2 can be detected with a statistical power of 0.8 (assuming a SD of 400 SEK/t CO2 and a confidence level of 0.95).

Table : Socio-demographic overview of population and study respondents

|  |  |  |
| --- | --- | --- |
|  | **Population (age 25-74)** | **Respondents** |
| Number | 6 200 688 | 500 |
| Share of women  | 0.49 | 0.49 |
| Age (mean) | 48.48 | 50.54 |
| Age (median) | 48 | 51 |
| People per household (mean) | 2.2\* | 2.45 |
| Median income per month (before tax) | 29 100\*\* | 28 500 |

\* mean for the whole Swedish population

\*\* assuming a tax rate of 30%; for the age group 25 to 64

# C. The carbon intensity of flying

In this study carbon intensities of 171g/ pkm for a 1 750km flight and 133g/ pkm for a 9 000 km flight were used. These specific values were chosen for three reasons. First, they are in the range of carbon intensities that can be found in literature and by using ICAO’s official carbon emissions calculator (see Figure 2). Second, the ambition was not to overstate WTP for a ton of CO2 caused by a fixed distance flight. Hence, within the range of carbon intensities a high value was chosen. Moreover, a high carbon intensity reflects to some degree that CO2 equivalent (CO2 eq) emissions from flying, i.e. emissions including also NOx, particles and high altitude emissions of water vapour that also contribute to global warming, can be higher by a factor of about 1.9 (Lee et al., 2010) as is shown in the study by Åkerman (2012). Third, round figures were needed for the bids that were presented in the contingent valuation survey in order to reduce cognitive effort. Hence, the very specific values mentioned above were chosen, which lead to round bid values (e.g. 9 000km \* 133g/pkm \* 100 SEK/t = 120SEK).

Figure 2: Carbon intensity of flying in and from Sweden (airports: ARN = Stockholm, BCN = Barcelona, HKT = Phuket, KRN = Kiruna, LAX = Los Angeles, MMX = Malmö)

# D. Strategies to deal with potential biases

Table : Overview of potential biases and how they were dealt with

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| --- | --- | --- |
| **Bias** | **Response strategy** | **References** |
| **Non-response bias** | *Use of incentives*The panel-provider gave survey participants points which they could – at a certain threshold – exchange against goods and vouchers. *Cognitive ease*Pre-testing of the survey, short duration, comprehensive response options and simple language were used to increase the cognitive ease for respondents.*Response validation*Most questions of the survey were mandatory, and for all questions validation rules were implemented to avoid nonsensical responses.  | (Singer & Ye, 2013)(Collins, 2003) |
| **Extreme satisficing** | *Response-time filter*A minimum response time was required for surveys to be accepted. All complete responses below the time limit were screened out.  | (Malhotra, 2008) |
| **Hypothetical bias** | *Consequentiality design* Participants were reminded that results will be used to inform ‘future policy development and design’, and thus, might affect respondents’ future utility. Moreover, respondents were told that they should not agree to expensive measures if they cannot afford them or there are more important things to spend their money on. *Uncertainty recoding* ‘Uncertain’ was included as response option to valuation bids, which was later recoded as a ‘no’ response to reduce potential upwards bias of maximum WTP. Uncertainty recoding is particularly appropriate for the valuation of goods like a stable climate, which respondents have never thought of in monetary terms. | (Loomis, 2014) (Loomis, 2014; Moore, Bishop, Provencher, & Champ, 2010) |
| **Strategic bias** | *Stressing individual choice* Respondents were explicitly reminded that they are asked what they are personally willing to pay and not what they consider the right price level for a carbon pricing policy.  | (Bateman, 2002) |
| **Anchoring** | *Repetitive bidding process* The first bid was the same for all respondents, so that anchoring was a risk. However, this was followed by additional bids, both higher and lower than the initial bid.  | (Bateman, 2002) |
| **Tax-aversion** | *Framing the tax as a ‘surcharge’*In the survey the air ticket tax was not actually called a tax but a ‘climate surcharges’ on air tickets. This framing was chosen to avoid systematic bias that is merely associated with the term ‘tax’.  | (Brannlund & Persson, 2012; Hardisty, Johnson, & Weber, 2010; Kallbekken, Sælen, & Hermansen, 2012) |

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