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# Public acceptance and willingness to pay cost-effective taxes

## on red meat and road traffic in Norway<sup>1</sup>

By

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### Abstract

The Norwegian high-level Green Tax Commission proposes inter alia cost-effective taxes on red meat and road traffic to reduce greenhouse gas emissions and local air pollution. Implementation requires public support, but the acceptance of such taxes is not known. We conducted a national survey of the public's acceptance of the two taxes. The survey instrument showed dynamically the reduction in emissions/pollution for each tax level. Despite survey information about the purpose of the taxes, only 25 percent, on average, were in favour of their introduction, the rest did not know, had zero willingness to pay, or opposed the tax. In this respect, preferences for the two taxes are similar. However, on average people are willing to pay approximately 90 percent of the optimal tax for red meat, but only about 25-35 percent for tax on road traffic depending on fuel type. Earmarking the tax revenue for environmentally friendly technology increased acceptable tax level, but only for red meat. Earmarking tax revenues for reduced income tax did not increase the acceptable tax level.

**Keywords:** Environmental taxes; red meat; road traffic; acceptance; willingness to pay.

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## **1. Introduction**

According to the Paris agreement, Norway is to cut emissions of greenhouse gases (GHG) by 40 percent by 2030 compared with 1990. A large share of the GHG emissions are currently regulated, but there are still some major sources of emissions that are not, such as the most important emissions from agriculture (methane and nitrous oxide). Thus, the Norwegian Green Tax Commission (NOU 2015: 15) argued that there is a need for both harmonising and increasing taxes on GHG emissions if the climate targets are to be achieved. The commission also recommended increasing taxes in other environmental areas, such as road taxes, to reduce local air pollution in the cities. Air pollution in Norwegian cities is often higher than targets set by the EU and Norway.

Although the measures proposed by the Green Tax Commission are cost-effective means of reducing emissions (NOU 2015:15), it is difficult for the authorities to introduce instruments without support in the population. This article reports the results of a study of people's preferences for climate and environmental policy in general, and tax levels in the agricultural and transport sectors in particular. In light of the Green Tax Commission's proposal, we investigate whether there is acceptance in the population for: (1) a climate tax on red meat, (2) an environmental tax on road traffic in densely populated areas, and (3) what tax levels the population is willing to accept. We also investigate how the degree of acceptance is affected by earmarking of tax revenue for selected purposes, and how it varies across socio-economic groups. The data were collected in a national representative Internet survey conducted by Kantar TNS, in spring 2017. To strengthen respondents' understanding of the proposed taxes, we develop and use a novel survey element whereby respondents are shown dynamically in the survey the estimated impacts of tax levels on emissions.

We discuss some recent studies that have looked at similar questions before describing key parts of our survey. We then present the general public's attitudes towards climate and environmental policy, and subsequently their acceptance of taxes before drawing conclusions.

## **2. Literature on preferences for environmental policy and willingness to pay taxes**

### **2.1 Preferences for environmental policy**

To gain acceptance for environmental policy, it is crucial that the population considers the environmental problems to be real. Air pollution in Norwegian cities is visible to those who live there, but opinions differ on how serious it is. One previous study found that 79 percent of respondents believe that climate change is real and largely or partially man-made (Gellein et al., 2015). Although the population considers the climate and environmental challenges to be real, it is also important that these are political issues that have priority among people. TNS Gallup (2016) collects data for the so-called Climate Barometer, which measures what the population regards as Norway's biggest challenges. In this survey, six different challenges are ranked from highest to lowest priority. The ranking varies from year to year, but based on the latest figures from 2016, climate was considered a priority. Gellein et al. (2015) reached the same conclusion in their study, finding that 45 percent of the population thought Norwegian emissions reductions could have a real impact on climate change.

### **2.2 Taxes are seldom welcome**

Even when there is popular agreement on important environmental and resource policy questions, there may be disagreement about the most appropriate policy measure. Kotchen et al. (2013) investigated what the US population is willing to pay annually for a 17 percent reduction in GHG emissions. The willingness to pay was greatest for direct regulation, at USD 89 per year.

Environmental taxes were the second most popular, with a willingness to pay of USD 85 per year, while the quota market had a willingness to pay of USD 79 per year (Kotchen et al. 2013). A more recent study by the same authors show a significantly higher willingness to pay of USD 177 on average per year and household for a carbon tax (Kotchen et al. 2017). Bannon et al. (2007) also found that US respondents are more positive to direct regulations than to taxes. Their study mapped attitudes to fuel price changes, when the price changes were a result of climate policy. Tvinnereim and Steinshamn (2016) looked at the preferences for environmental policy measures in Norway and found that here, too, direct regulations were regarded more favourably than taxes. On the other hand, Cherry et al. (2012) came to the opposite result in a lab experiment, where quantity regulation was supported significantly less than taxes.

The Green Tax Commission (NOU 2015:15) recommended a climate tax on red meat and increased taxes on road traffic in cities and other densely population areas <sup>2</sup>. It is therefore of interest to investigate the preferences of the population for new and increased climate and environmental taxes. The need to map the preferences for environmental policy measures is underpinned by the negative attitudes to environmental taxes that were observed in the UK by Dresner et al. (2006). Respondents in this study expressed negative attitudes to taxes in general and considered the tax level to be more than high enough already. This is a common reason stated in survey questionnaires when respondents refuse to pay for environmental goods via a tax (Lindhjem et al. 2013). That Norwegians also prefer lower tax levels was confirmed in the study by Sælen and Kallbekken (2011). The Swiss were found to be more accepting of environmental taxes than the citizens of other countries (Baranzini and Carattini 2016). 49 percent were positive to a CO<sub>2</sub> tax, and the most

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<sup>2</sup> The Green Tax Commission did not state whether the tax should be on production or consumption of red meat. This study considers a consumption tax on red meat, which is also considered in Caro et al. (2017) for Denmark.

supportive were respondents who said they trusted the government and those who were most worried about climate change. Several Norwegian studies have tried to identify the reasons that people oppose taxes and fees (Tvinnereim and Steinshamn 2016; Kallbekken et al. 2009). These studies find that acceptance depends on the verbal description of the tax change. For example, Tvinnereim and Steinshamn (2016) found that the verbal description “reduction of tax benefits” has larger support in the population than “tightening the tax rules.” Acceptance for a “fee” is found to be greater than acceptance for a “tax” (Kallbekken et al. 2009).

### **2.3 Earmarking may help**

The government revenue from environmental taxes may end up being used for a variety of purposes. One option is to earmark revenue from environmental taxes so that it is used for environmental purposes. Another is to reduce other taxes, which could result in a so-called double dividend: welfare is increased both through reduced environmental problems and through reduced efficiency losses due to lower tax distortions. However, the double dividend is not found to be well-known (Dresner et al. 2006). A Norwegian study explored survey respondents’ understanding of the double dividend (Sælen and Kallbekken 2011). The study tested the hypotheses that the general population does not understand how incentives for behavioural change may be created through taxes, and that earmarking taxes for environmental purposes increases support for the tax because the benefits of the tax for the environment become clearer. Their findings supported their hypotheses and showed that the respondents both notice and value the effect of earmarking for environmental purposes. Respondents did not, however, seem to realise that taxes can change behaviour (Sælen and Kallbekken 2011). There are mixed results in this research area, too. In a Norwegian study using a focus group, over half of the interviewees understood that the tax was introduced to increase the price of environmentally harmful products, to induce consumers to

purchase alternative products (Kallbekken and Aasen 2010). The respondents stressed that such a tax would only produce the intended results if the alternative products were available at a reasonable price. Although the respondents tended to recognise the incentive effect, they were convinced that earmarking tax income for environmental policy is necessary if the tax is to benefit the environment. This finding is also supported by Baranzini and Carattini (2016) and seems to be a consistent finding in the literature.

One may further wonder whether the effect of earmarking is due to lack of confidence in the authorities, in that the general population is uncertain that tax revenue will be managed properly unless it is earmarked. Sælen and Kallbekken (2011) tested this hypothesis but did not find any significant results. Several researchers in this area, such as Rivlin (1989) and Goode (1985), still argue that the effect of earmarking described in Sælen and Kallbekken (2011) is attributable to lack of confidence in the government's management of the revenue. One of the interviewees in Kallbekken and Aasen (2010; p2187) summarises this concern in the statement: “[the revenue] Must not disappear into government coffers”.

Another possible reason that earmarking is so important is that the respondents expect to benefit personally from the green tax revenue. According to economic theory, economic agents are rational and maximise their own utility. Sælen and Kallbekken (2011) confirmed this in their study, where they found that earmarking increases acceptance because the respondents expect to obtain greater benefits when the tax income is earmarked. It is therefore of interest to see whether the effect of earmarking is lower if the tax income is earmarked for policy purposes that contribute to public benefits versus private benefits. We therefore compare using tax income to develop more environmentally friendly technology with income tax reductions. Kallbekken and Aasen (2010) found that earmarking for environmental causes is more accepted than earmarking to reduce

income tax. Several of the focus group members in their study also expressed that they preferred that there be a connection between what is taxed and how the tax income is used.

An alternative type of earmarking is to hand the tax revenues back to the citizens. Carattini et al. (2019) found that this tends to increase the acceptance for emission taxes.

### **3. Survey design and implementation**

To examine the population's preferences for the Green Tax Commission's proposals, we conducted an Internet-based survey of a representative sample of the Norwegian population in April 2017. The survey was distributed to Kantar TNS' high-quality ISO certified panel, consisting of 2696 respondents. It was completed by 1222 individuals, i.e. a 45 percent response rate, a high rate for Internet surveys. The survey was representative of the population aged 18-81 years, except that women were slightly overrepresented while young people were slightly underrepresented.

Of the many proposals from the commission, we chose two different tax proposals to investigate potential differences in preferences: the tax on red meat and the increase of toll rates around the large cities to reduce local air pollution. As a starting point, we chose a tax rate on red meat that corresponds to the general tax level for GHG emissions in Norway in 2015.<sup>3</sup> This will indirectly contribute to making the price of GHG emissions from red meat production correspond to the price of GHG emissions in other sectors. The proposal to increase toll rates around the large cities will to a larger degree make polluters pay for the actual environmental costs of local air pollution.

The survey consisted of three main parts. Initially, the respondents were asked about their attitudes towards political, climate and other environmental challenges. Some information was also given

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<sup>3</sup> The tax was based on emissions per kilo of red meat in Norwegian agricultural production, and a general GHG tax of NOK 420 per ton of CO<sub>2</sub> equivalent as proposed in the Green Tax Commission (NOU 2015:15).



about likely consequences of climate change for Norway. The second part focused on acceptance for green taxes and included some questions about car ownership and use. It also provided some information, using a combination of text, pictures and table (see the Supplementary Materials, Figure A1 for screen pictures). The last part ended with some standard demographic questions.

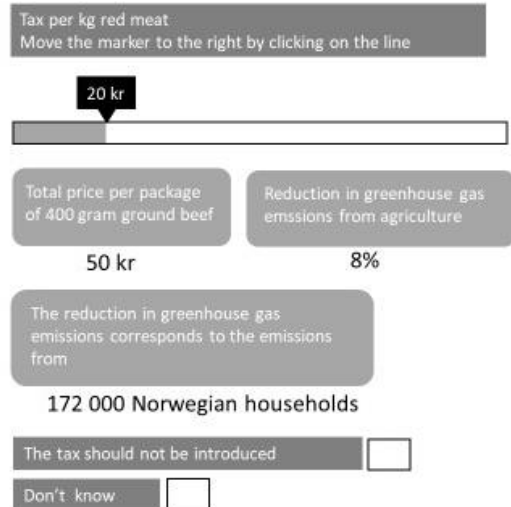
The sample in the survey was split along two dimensions. Half of the respondents answered the survey on acceptance of taxation of red meat, and the other half the survey on higher toll rates (see the Supplementary Materials, Table A1, for split sample design).

Respondents were told that they would first be questioned about their acceptance of tax without any earmarking, and then their acceptance if the tax revenue was earmarked. Since reduced income tax is often regarded as the most economically efficient, about half the respondents in each sample were informed that the tax revenue would be earmarked for income tax reduction, while the other half were told that it would be used to subsidise environmentally friendly technology. Finally, the respondents were asked what kind of earmarking they would prefer.

The red meat sample was asked to choose a maximum acceptable tax level, using a moving marker along a horizontal scale, where an increased tax level was inversely proportional to reduced emissions in the agricultural sector (see Figure 1a). Information about percentage GHG reductions from the agricultural sector, and as translated into household emissions, was shown dynamically to respondents in the survey for each tax level chosen on the scale. The tax scale went from zero to NOK 145 per kg, with the latter implying a price increase of about 40 percent.

The numbers below show how a chosen tax level affects the price of a package of 400 gram ground beef, and how this affects the emission of greenhouse gases.

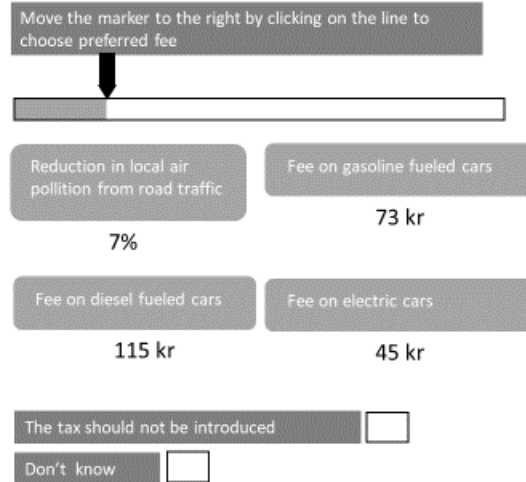
Choose your preferred tax level by clicking on the line. If you are against this tax, choose «The tax should not be introduced»



The numbers below show how an increase in the fees for Norwegian cars affect the local air pollution.

Highlight how high you think the fee should be by clicking on the line. If you are against this fee, choose «The fee should not be introduced»

Remember that the fee amount is the monthly cost if entering the city five times per week



Figures 1a and b. Questions from the survey about maximum acceptable tax/fee on a) red meat, and b) road traffic in large cities.

As depicted in Figure 1a, the respondents were shown the average price increase of a 400-gram package of ground beef. The price of ground beef in spring 2017 was estimated to be NOK 42.3 per kg, by taking the average price of ten different brands of ground meat from five different chains. On average, these brands had 203 kcal per 100 grams. According to the Green Tax Commission, cattle production is responsible for 0.02 tons of CO<sub>2</sub> equivalents per 1000 kcal. Thus, emissions per package are estimated at 0.016 ton of CO<sub>2</sub> equivalents. The price elasticity of red meat in Norway, the percentage change in red meat consumption for a one percent price increase, has been estimated to -0.68 (Rickertsen et al. 2003).

The production of red meat was thereafter related to the total GHG emissions from the agricultural sector in Norway. In 2017, the sector was responsible for 8.7 percent of Norway's GHG emissions

(SSB 2017). In 2016, more than 70 percent of GHG emissions in the sector consisted of methane and nitrous oxide emissions from ruminant digestion and manure, mainly from cattle and sheep. Gaasland and Vårdal (2012) find that ruminant production is responsible for about 80 percent of total agricultural emissions in Norway. Further, we assumed that a one percent reduction in the consumption of red meat would lead to a one percent reduction in GHG emissions related to red meat. This implies that a one percent reduction in red meat consumption leads to a 0.8 percent reduction in GHG emissions from the agricultural sector. Denoting the tax level on red meat  $A_k$ , using an average price for all types of red meat of  $p = \text{NOK } 140$  per kg, a price elasticity of  $\varepsilon_k = -0.68$ , and a share of  $C = 0.80$  of the GHG emissions from agriculture related to red meat, we get the following relationship between the tax on red meat and reductions in GHG emissions from the agricultural sector (equation 1):

$$\frac{A_k}{p} \varepsilon_k C = \text{percentage change in GHG emissions from agriculture with a tax level of } A_k (1)$$

In the survey we informed respondents how this emission reduction would compare with corresponding emissions from households. We used Statistics Norway's statistics on total GHG emissions from the household sector (SSB 2017) and divided this figure by the number of households in Norway.

The sample on higher toll rates (tax) to reduce air pollution from road traffic, were also asked to choose a maximum acceptable tax increase (Figure 1b). Road traffic in cities also contributes to other external costs, such as accidents and congestion (NOU 2015:15). The Green Tax Commission proposed that external costs related to accidents should be internalised through a traffic accident tax collected together with the liability insurance, and that congestion charges should be implemented that vary over the course of the day to internalise the external costs related to

congestion. Of these external costs, our survey focused only on the environmental costs related to air pollution from road traffic.

The respondents used a movable marker on a scale similar to that used for red meat as shown in Figure 1b. The tax was differentiated across petrol, diesel and electric cars, as these three types of cars contribute quite differently to local air pollution. By moving the marker, the respondents could see dynamically in the survey how much a certain chosen tax level, differentiated across car types, would reduce local air pollution expressed as percentages. As in the case of red meat, we used information from the Green Tax Commission to estimate this relationship. The Commission presents an estimate for the environmental costs of different car types in NOK per kilometer (NOU 2015:15).<sup>4</sup> The marginal cost of air pollution is NOK 0.28 per km ( $MC_p$ ), NOK 0.44 NOK per km ( $MC_d$ ) and NOK 0.18 NOK per km ( $MC_e$ ) for petrol, diesel and electric cars, respectively.

The Norwegian car fleet in 2015 consisted of 46.5 percent petrol cars ( $K_p$ ), 52.0 percent diesel cars ( $K_d$ ) and 1.5 percent electric cars ( $K_e$ ) (Kolshus 2015). The percentage share of environmental costs that can be attributed to car type  $i = \{p, d, e\}$  was then calculated using equation (2):

$$\frac{MC_i K_i}{MC_p K_p + MC_d K_d + MC_e K_e} \quad (2)$$

The current toll rates into the large cities of Norway vary. We took as a starting point an initial price of NOK 20. With five passes a week, this amounts to NOK 433 per month<sup>5</sup> ( $B$ ). The percentage price change, given a tax level of  $A_i$ , is then  $(\frac{A_i}{B})$  and the percentage change in the number of passes is next found by multiplying  $(\frac{A_i}{B})$  by the price elasticity of toll rates ( $\varepsilon$ ) of -0.3.

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<sup>4</sup> Other external costs of driving a car were not included in these calculations.

<sup>5</sup> 20 NOK \* 5 passes \* (52/12) weeks/month = NOK 433.33 per month

This elasticity estimation was based on Larsen and Hamre (2000), who show how much the number of passes through a toll road change with a one percent change in the toll. The elasticity of -0.3 applies in rush hours, with an initial price of between NOK 12 and NOK 55 (converted to 2016-NOK). By multiplying the change in passes for the different car types by this car's percentage contribution to local air pollution in cities, we find how much the tax reduces local air pollution (in percentage terms) for each of the car types.

If an additional environmental tax based on the environmental cost estimates presented by the Green Tax Commission is imposed, and we assume a certain mileage per month together with five passes per week,<sup>6</sup> we estimate that one would achieve an 11.4 percent reduction in local air pollution. With 52/12 weeks per month and thus 21.7 passes per month, this corresponds to an increase in the toll rates of NOK 5.6 for petrol cars, NOK 8.8 for diesel cars, and NOK 3.6 for electric cars.

The lowest permissible tax increase per month in the survey was NOK 54 per month for petrol cars (NOK 2.5 per passing), NOK 86 per month for diesel cars (NOK 4 per passing), and NOK 34 per month for electric cars (NOK 1.6 per passing). This lowest level was estimated to result in a 5.1 percent reduction in local air pollution. The highest permissible tax increase resulted in a tax increase of 266 NOK per month for petrol cars (12.3 NOK per passing), 421 NOK per month for diesel cars (19.4 NOK per passing), and 168 NOK per month for electric cars (7.8 NOK per passing). This highest level was estimated to reduce local air pollution by 25 percent.

Each indicator level on the tax scale corresponded to a certain tax level that was differentiated for the three car types. This means that a certain indicator value would correspond to a certain tax in

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<sup>6</sup> In the survey it was assumed that an average trip with a toll passing is 20 km inside the city.

NOK on diesel cars, petrol cars and electric cars. In the analysis of the results, we used the tax level on diesel cars.<sup>7</sup> The value 0 indicated that the respondent was not willing to pay any tax.

For both red meat and toll rates, the respondents had the option to “opt out” indicating that “the tax should not be introduced” or ‘don’t know’. The respondents who replied that ‘the tax should not be introduced’, were asked about their reason for this answer.

## **4. Results**

### **4.1 Preferences for environmental and climate policy**

The three most important national environmental issues for the respondents were to i) reduce waste and increase recycling; ii) prevent the release of toxic substances into nature; and iii) and provide access to local nature and recreational areas. Reduction of GHG emissions and noise and air pollution in cities were (among) the respondents’ lowest priorities (see Figure A2 in the Supplementary Materials). People were then asked to state up to two main concerns when designing climate and environmental policies (Figure 2). Somewhat surprisingly, avoiding increased economic inequality was ranked as the clearly most important concern, while economic efficiency (formulated as ‘That environmental improvement is achieved at the lowest possible cost to society’) was almost at the bottom of the list of important concerns.

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<sup>7</sup> The tax level on petrol or electric cars could equally well have been used. We chose diesel cars since they contribute mostly to local air pollution in cities.

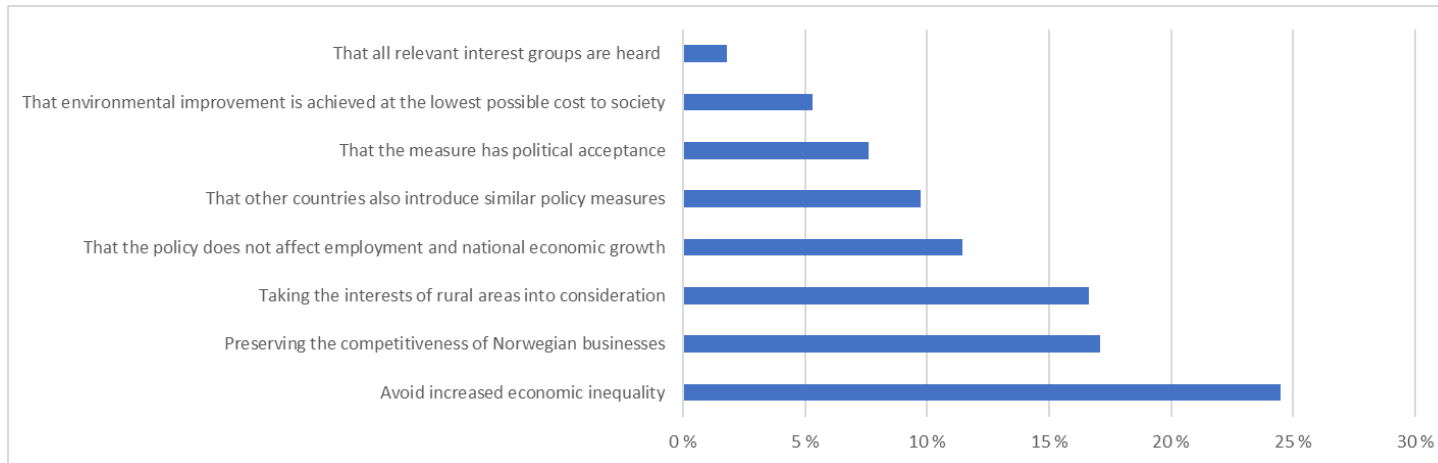


Figure 2. Responses to the question ‘Which of the following concerns should be emphasised when designing climate and environmental policies? *Choose up to two concerns*’

Moreover, only 2 percent state that they don’t believe in climate change, while 84 percent believe that climate change is induced by humans. The respondents consider the consequences of climate change to be more serious for the world than for Norway: 38 percent state that the consequences of climate change are quite or very serious for Norway, while the corresponding number for the world as a whole is 55 percent.

#### 4.2 Tax on red meat

27 percent of the respondents agreed that a tax on red meat should be implemented. The majority thought this tax should be less than NOK 25 per kg, but some replied up to NOK 50 per kg. A clear minority believed that the tax should be higher than NOK 100 per kg (see the Supplementary Materials Figure A3 for the distribution of acceptable tax). 57 percent did not agree, while 16 percent replied, ‘don’t know’. Thus, there is a clear minority in favour of such a tax. With 57 percent against the tax, the median acceptable tax level is 0 NOK. If the tax were to be implemented nevertheless, the average acceptable tax level can be computed. Those who replied, ‘don’t know’, probably have an acceptable tax level of between 0 and the average of those who agreed to the tax.

Table 1. Acceptable tax on red meat (NOK/kg). Average for the population, confidence intervals and GHG tax on red meat computed from the general GHG tax in Norway.

|  | Tax level NOK/kg<br>(95 percent confidence interval) | Respondents |
|--|--|-------------|
| Acceptable tax level on red meat<br>(‘don’t know-answers given value 0): | 9.8<br>(7.9 – 11.7)                                  | 602         |
| Acceptable tax level on red meat<br>(‘don’t know’ answers excluded):     | 11.6<br>(9.4 – 13.7)                                 | 508         |
| GHG tax on red meat computed from<br>general GHG tax in Norway           | 12   |             |

Table 1 sums up the results for the acceptable tax level for red meat. The average is NOK 9.8 per kg if ‘don’t know’ answers are given the value 0, and NOK 11.6 per kg if they are excluded from the sample so that they do not affect the average. A tax in line with the general tax level for GHG emissions in Norway (in 2015) would imply a GHG tax on red meat of NOK 12 per kg (see footnote 3). Table 1 also includes confidence intervals for the two estimates, and we notice that if the ‘don’t know’ answers are given the value 0, the acceptable tax level is significantly different from NOK 12 per kg. On the other hand, if the ‘don’t know’ answers are excluded, the acceptable tax level is *not* significantly different from the tax computed from the general GHG tax in Norway.

Most of the respondents thought that the tax revenue should be used to reduce taxes (VAT) on fruit and vegetables, or to support Norwegian agriculture. Some meant that the revenue should be

Table 2. Factors explaining willingness to accept a tax on red meat (Logit) and the size of the accepted tax (Tobit).



|  | <b>Logit<br/>'Don't know'<br/>answers<br/>excluded</b> | <b>Logit<br/>'Don't know'<br/>answers set<br/>equal to 0</b> | <b>Tobit<br/>'Don't know'<br/>answers<br/>excluded</b> | <b>Tobit<br/>'Don't know'<br/>answers set<br/>equal to 0</b> |
|--|--|--|--|--|
| <b>Variable</b>                            | <b>Coefficient<br/>(p-value)</b>                       | <b>Coefficient<br/>(p-value)</b>                             | <b>Coefficient<br/>(p-value)</b>                       | <b>Coefficient<br/>(p-value)</b>                             |
| Education                                  | 0.524**<br>(0.029)                                     | 0.529**<br>(0.025)   | 0.250**<br>(0.028)                                     | 0.233**<br>(0.028)   |
| Age  | -0.168**<br>(0.041)                                    | -0.005<br>(0.418)  | -0.007**<br>(0.040)                                    | -0.008***<br>(0.004)   |
| Personal income                            | -0.153<br>(0.563)                                      | -0.216<br>(0.362)  | -0.063<br>(0.567)                                      | -0.027<br>(0.788)  |
| Female                                     | -0.191<br>(0.470)                                      | 0.045<br>(0.839)   | -0.028<br>(0.791)                                      | -0.096<br>(0.316)  |
| Urban                                      | 0.542**<br>(0.033)                                     | 0.272<br>(0.214)   | 0.246**<br>(0.015)                                     | 0.277***<br>(0.002)  |
| Politics                                   | -0.369<br>(0.195)                                      | -0.221<br>(0.328)  | -0.135<br>(0.269)                                      | -0.117<br>(0.278)  |
| Habits (meat)                              | -0.329**<br>(0.017)                                    | -0.337***<br>(0.005)   | -0.181***<br>(0.002)                                   | -0.136***<br>(0.009)   |
| Attitudes towards<br>consumption<br>(meat) | 1.079***<br>(0.001)                                    | 1.062***<br>(0.000)  | 0.461***<br>(0.000)                                    | 0.336***<br>(0.003)  |
| Political issue<br>(climate)               | 0.857***<br>(0.004)                                    | 0.705***<br>(0.007)  | 0.368***<br>(0.003)                                    | 0.260**<br>(0.016)   |
| Environmental<br>issue (GHG<br>emissions)  | 0.410<br>(0.148)                                       | 0.249<br>(0.308)   | 0.158<br>(0.170)                                       | 0.157<br>(0.129)   |
| Climate change<br>problem                  | 0.391*<br>(0.061)                                      | 0.408**<br>(0.018)   | 0.224**<br>(0.020)                                     | 0.158*<br>(0.065)  |
| Consequences                               | 0.539***<br>(0.001)                                    | 0.508***<br>(0.000)  | 0.255***<br>(0.000)                                    | 0.230***<br>(0.000)  |
| Pseudo R <sup>2</sup>                      | 0.307  | 0.250  | 0.168  | 0.137  |
| n  | 501  | 594  |  |  |

\*\*\*, \*\* and \* indicate significant levels of 0.01, 0.05, and 0.10, respectively.

directed to environmentally friendly activities, while only 6 percent thought that income tax should be reduced. Pairwise *t*-tests of acceptable tax levels with and without earmarking showed that earmarking for reduced income tax did not increase the accepted tax level, but the accepted tax

level increased if the tax revenue was earmarked for subsidies for environmentally friendly technology.

To examine what characterises individuals who are more willing to impose a GHG tax on red meat, we estimated Logit models (Woolridge 2002) where the independent variable was equal to one for those who were positive towards the tax and otherwise zero. Since the independent variable has a corner solution at accepted tax equal to zero, we also estimated Tobit models (Woolridge 2002) to see which factors contribute to people being willing to accept a higher tax. The dependent variable was chosen to be the natural logarithm of accepted tax level. Two models were estimated for both Logit and Tobit; one where ‘don’t know’ answers were excluded and one where their value set at zero.

All models for a tax on red meat included socioeconomic variables such as age (years), Female (woman = 1, man = 0), education (higher education = 1, otherwise = 0), (natural logarithm of) individual gross annual income, and urban (if the respondent is living in Oslo, Bergen, Trondheim or Stavanger = 1, otherwise = 0). The variable ‘politics’ was equal to 1 if the respondent had voted conservative (Conservative or Progress Party) at the previous parliamentary election, and otherwise 0. We examined several specifications and chose the best model based on the values for pseudo  $R^2$ , AIC and BIC. Table 2 displays the estimated coefficients. From the Logit model we found that the following characteristics implied a significantly higher acceptance for introducing the tax (when

‘don’t know’ answers are given the value 0):

- Higher education

- Low consumption of red meat
- Negative attitude towards red meat consumption
- Climate change as a prioritised political issue
- Consider climate change as (mainly) induced by humans
- Consider climate change a serious problem
- Consider consequences of climate change serious for Norway

If ‘don’t know’ answers are excluded from the sample, lower age and urban residence also became significant in the Logit model. The results of this particular Logit model were consistent with the two Tobit models, the one with ‘don’t know’ answers excluded and the one in which ‘don’t know’ answers are set at 0 in terms of significant variables and the signs of the variables.

The results indicate that young, highly educated and urban people are most positive towards a GHG tax on red meat. Not surprisingly, this also holds for individuals stating that they eat little red meat and/or have a negative view of red meat, and individuals who are particularly concerned about the climate change problem. This provides support for valid and rational responses to the survey.

These results were robust over several model specifications (Sem 2017).<sup>8</sup> It may seem a little surprising that income does not have a significantly positive effect, as is usually found in more standard willingness to pay surveys (e.g. using the contingent valuation method, see Lindhjem et

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<sup>8</sup>For the 32 specifications that included socioeconomic variables, higher education was significant in 29 specifications, lower age in 31, and urban residence in 32, while personal income and gender were not significant in any of the specifications. Of the 16 model specifications that also included other variables, low consumption and negative attitude towards red meat were always significant. The same applies to climate change as a prioritised issue, to climate change being (mainly) driven by human activities, and to climate change as a serious problem.

al. 2013). On the other hand, the link to income is less obvious in this survey, since the respondents are not directly asked about their willingness to pay, but rather how large the tax should be. What they respond does not affect their household budget directly, but rather indirectly via their consumption of meat.

Table 3 Acceptable increase in the tax level on the use of cars in larger cities for the population on average, and estimates based on the proposal from the Green Tax Commission. The figures are NOK per month for 5 toll road passes a week.

|   | <b>Diesel cars</b> | <b>Petrol cars</b> | <b>Electric cars</b> |
|---|--------------------|--------------------|----------------------|
| Acceptable tax level<br>(‘don’t know’ answers set equal to 0, n = 619)      | 53                 | 33                 | 21                   |
| 95% confidence interval   | 45 – 62            |                    |                      |
| Acceptable tax level<br>(‘don’t know’ answers removed from sample, n = 510) | 65                 | 42                 | 27                   |
| 95% confidence interval   | 54 – 75            |                    |                      |
| Estimate based on proposal from the Green Tax Commission*                   | 191                | 121                | 76                   |

\* This estimate applies only to the costs of air pollution, not other externalities that the Commission considered.

#### **4.3 Tax on road traffic**

There was also no majority for introducing increased tax on road traffic: 59 percent answered that they were against the tax, 18 percent answered, ‘don’t know’, while 23 percent agreed that the tax

should be increased. This distribution (see Supplementary Materials figure A4) is almost identical to the responses to the tax on red meat. The median acceptable (increased) tax level equals 0 also here. If, however, the authorities choose to increase the tax, it will be useful to know what tax level the population on average is willing to accept.

The results of this part of the survey are shown in Table 3. They show, for example, that the average acceptable increase in tax on diesel cars is NOK 53 per month, which is NOK 2.5 per pass (for an assumed five weekly passes) when ‘don’t know’ responses are set equal to 0 and NOK 65 when these answers are excluded from the sample. The corresponding tax increases for petrol and electric cars, are lower. The acceptable tax increases are clearly and significantly lower than the estimates based on the Green Tax Commission’s figures, even though external costs other than air pollution (e.g. queues and accidents) are not included in those estimates. Confidence intervals are also clearly lower. There is thus a much lower level of acceptable tax (relative to the Commission’s proposed tax) for road traffic than for red meat.

Most of the respondents believed that the revenue from increased taxes should be earmarked for the transport sector, primarily public transport, but some wanted a reduced vehicle license fee or support for the development of zero emission vehicles. Some believed that the revenue should go

Table 4. Factors explaining willingness to accept tax on car use in cities (Logit) and factors that are associated with acceptance for a larger tax (Tobit).

|  | <b>Logit<br/>‘Don’t<br/>know’<br/>answers<br/>excluded</b> | <b>Logit<br/>‘Don’t<br/>know’<br/>answers set<br/>equal to 0</b> | <b>Tobit<br/>‘Don’t<br/>know’<br/>answers<br/>excluded</b> | <b>Tobit<br/>‘Don’t<br/>know’<br/>answers set<br/>equal to 0</b> |
|--|--|--|--|--|
|  | <b>Coefficient<br/>(p-value)</b>                           | <b>Coefficient<br/>(p-value)</b>                                 | <b>Coefficient<br/>(p-value)</b>                           | <b>Coefficient<br/>(p-value)</b>                                 |

|                                    |                      |                      |                      |                      |
|------------------------------------|----------------------|----------------------|----------------------|----------------------|
| Education                          | 0.597**<br>(0.039)   | 0.675***<br>(0.007)  | 0.413*<br>(0.023)    | 0.437**<br>(0.005)   |
| Age                                | -0.007<br>(0.373)    | -0.008<br>(0.293)    | -0.005<br>(0.320)    | -0.005<br>(0.282)    |
| Income                             | -0.174<br>(0.600)    | -0.134<br>(0.650)    | -0.097<br>(0.641)    | -0.075<br>(0.672)    |
| Female                             | -0.653**<br>(0.017)  | -0.768***<br>(0.002) | -0.449**<br>(0.011)  | -0.483***<br>(0.001) |
| Urban residency                    | 0.920***<br>(0.005)  | 0.811***<br>(0.005)  | 0.491***<br>(0.008)  | 0.452***<br>(0.006)  |
| Political view                     | -1.110***<br>(0.000) | -0.934***<br>(0.001) | -0.720***<br>(0.000) | -0.567***<br>(0.000) |
| Does not own a car                 | 0.646<br>(0.119)     | 0.386<br>(0.288)     | 0.337<br>(0.156)     | 0.239<br>(0.260)     |
| Owens more than one car            | 0.007<br>(0.980)     | 0.059<br>(0.836)     | -0.031<br>(0.874)    | 0.0300<br>(0.862)    |
| Owens a diesel car                 | -0.789***<br>(0.005) | -0.661**<br>(0.013)  | -0.507***<br>(0.004) | -0.391**<br>(0.012)  |
| Owens an electric car              | 0.654<br>(0.266)     | 0.660<br>(0.243)     | 0.487<br>(0.209)     | 0.441<br>(0.200)     |
| Attitude towards consumption (car) | 2.122***<br>(0.000)  | 1.976***<br>(0.000)  | 1.414***<br>(0.000)  | 1.200***<br>(0.000)  |
| Use (car)                          | -0.288**<br>(0.042)  | -0.195<br>(0.119)    | -0.182**<br>(0.041)  | -0.124<br>(0.103)    |
| Pseudo R <sup>2</sup>              | 0.273                | 0.209                | 0.129                | 0.104                |
| N                                  | 506                  | 612                  | 506                  | 612                  |

\*\*\*, \*\* and \* indicate level of significance of 0.01, 0.05, and 0.10, respectively.

to environmentally friendly activities, while only 3 percent thought that income tax should be reduced. In pairwise *t*-tests, earmarking had no significant effect on the acceptable tax levels.

We also investigated more closely what characterises people who are positive to an increase in tax levels in order to reduce air pollution in the cities. Again, we estimated two Logit models and two Tobit models. The socioeconomic variables age, female, education, income, urban residency and political views were defined and coded in the same way as for the red meat tax. In addition, we included variables for car ownership, car usage habits and attitudes towards car use. In this case, we also examined several specifications and chose the best model based on the values of pseudo- $R^2$ , AIC and BIC. Table 4 shows the estimated coefficients.

From the Logit models, we found that the following characteristics were associated with acceptance for the introduction of a tax:

- Higher education
- Male
- Urban residency
- Do not vote conservative (Conservative or Progress Party)
- Do not own a diesel car
- Negative attitude to car use
- Rarely drive a car - if 'don't know' answers are excluded from the sample.

From the Tobit models, we found that that the same characteristics as for the Logit models that were associated with acceptance of a higher tax. These results indicate that men, persons with urban residency and persons with higher education are most positive to introducing a tax to reduce local air pollution in larger towns as well as higher toll rates. It is interesting to note that men are more positive to higher taxes than women in this case. Of course, this does not mean that men are more concerned about air pollution – another possible explanation may be that women are more sceptical to reducing air pollution through increased road traffic taxes. There has been some emphasis on

the distributional effects of road traffic taxation in public debate: for example, that families with young children who must drive to childcare in the cities will be impacted. Whether or not women have thought about this to a greater extent than men is difficult to say.

It is also interesting that people living in cities are more positive to increased road traffic taxes in *cities* than other people. Although these people (and those who commute from the suburbs to the cities) will have to pay most of the increased taxes, they will also benefit most from lower air pollution. As expected, people who do not have a diesel car, drive very rarely, or are generally negative to driving, are more positively inclined to higher taxes. We also see that people who voted Conservative or Progress Party at the last election are more negative to increased taxes, which is consistent with the attitude of the latter party in particular to taxes on road traffic. These results were also robust across several model specifications (Sem 2017)<sup>9</sup>.

## 5. Discussion and conclusions

The survey results indicate that people are relatively sceptical to introducing (increased) taxes to improve the environment, whether the intended effect is better air quality in the cities or reduced GHG emissions. In both cases, more than 60 percent are against new or increased taxes, and less than 30 percent are in favour. For those in favour the tax levels people find acceptable vary widely.

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<sup>9</sup> Of the 32 specifications that included socioeconomic variables, the characteristics ‘higher education’ and ‘male’ were significant in 24 specifications and ‘lower age’ in 15. ‘Urban residency’ and not voting Conservative or Progress Party were significant in all specifications, while income and being concerned with air pollution as a political issue or environmental problem were significant in only two of the specifications. Those who do not own a diesel car are positive to the tax in all specifications. The same applies to those who have a negative attitude towards car use.



There are a variety of reasons why a majority may be negative to these taxes. One possible reason is that many are not very concerned about environmental problems. Although most respondents believed that climate change and its impact are man-made, only 38 percent thought that this was quite or very serious for Norway. And only 10 percent mentioned a reduction of GHG when they had the chance to mention up to three environmental policy considerations that were most important for Norway. Even fewer reported local air pollution.

Another reason may be that many do not see or believe in the connection between the tax and the reduction in emissions and pollution, although the relationship was explained, and an attempt was made to quantify it for the respondents.

A third reason may be that other considerations are more important. A tax on red meat can be perceived by some as an “attack” on agriculture and livelihoods in rural areas, while increased road traffic taxes can affect families with small children and others who have no acceptable alternative to using a car. Quite a few of the respondents answered that avoiding increased economic inequality and rural considerations were important when designing an environmental policy. For people who are affected personally, whether because they eat a lot of red meat or use a car in the city, self-interest may take precedence over environmental benefit.

Most of the survey respondents thought that tax revenue should be channelled back into the affected sector, in the form of lower taxes or financial support for environmentally friendly alternatives (fruit and vegetables and public transport, respectively). Very few respondents thought that the revenue should be used to reduce other distorting taxes such as income tax, as recommended by the Green Tax Commission. At the same time, earmarking had a limited effect on the level of acceptable taxes, which may indicate that this is not very important for gaining acceptance for

environmental taxes. As long as the majority of the population is sceptical to these environmental taxes, it may be difficult to achieve a political majority for them.

An important task going forward, for both the research communities and the authorities, will be to find out what is needed for the population (and the private sector) to accept the use of environmental taxes to a greater extent. Economic research has concluded that environmental taxes (or the use of cap and trade markets) are a cost-effective way to reduce pollution, and that other policy instruments are usually more expensive for society (e.g. subsidies). At the same time, it will also be important to examine the costs and benefits of other policy instruments, and not least to combine instruments to ensure real emission cuts at an acceptable cost to society.

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