The Moral Cost of Carbon: A Research Program

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The Moral Cost of Carbon (MCC) is a revealed preference measure that tells us how much people are willing to sacrifice to address the carbon externality. We define the concept as an internal moral tax people implicitly apply to their consumption decisions. It differs from other measures based on citizens' willingness to mitigate greenhouse gases, such as the willingness to pay to offset carbon emissions or contribute to funding a long-term emission reduction program. The MCC is the amount people are willing to forgo to avoid emitting carbon emissions in their daily consumption decisions.

In this research program, we ask two questions. First, should the MCC inform the design of climate policies and cost-benefit analysis? We argue that yes. When carbon markets are incomplete, i.e., in the absence of a global price on carbon, how much people are willing to internalize the carbon externality informs about the extent society can rely on collective action to address the climate problem. The MCC complements the SCC and has a role to play in cost-benefit analysis. Given it measures how much a particular population is willing to sacrifice to avoid the carbon externality, it can, thus, serve as a benchmark for the cost of local climate policy this population should and could support. Moreover, the level of the MCC could also interact

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with carbon policies, notably carbon pricing schemes as we found in our work. The degree to which people are morally motivated, thus, depends on the climate policies in place, which, in turn, impacts their design and how to target them.

The second question this research program focused on is whether the MCC can be measured in an externality valid way for a representative population? In our ongoing research, we have made notable progress on this front. Below, we explain how the MCC differs from other approaches to measure individuals' willingness to mitigate carbon emissions. We then provide details on our proposed approach to estimate the MCC in a given population, present results from our ongoing research, and discuss how the MCC can be used to inform policy.

1 Related Literature

There is a long-standing debate on the role of morality in markets (e.g., Dewatripont and Tirole, 2024), and especially of moral suasion as an economic instrument (Romans, 1966). In times of crisis, governments often rely on moral appeals to induce change in behaviors (e.g., Reiss and White, 2008). Empirical evidence from laboratory settings and field experiments suggests that in comparison to economic incentives, such interventions could induce relatively small and non-persistent behavior changes (e.g., Ito et al., 2018). The effectiveness of moral suasion, however, appears to be highly context-specific and to vary along different margins of a decision-making task.[1]

Our goal is related but clearly distinct from the above literature. We do not demonstrate how moral appeals could be effective in addressing the climate change issue. Our aim is to assess if (some) individuals internalize the carbon externality without explicit appeals to do so and to derive a precise metric to measure the degree to which individuals are self-motivated. The MCC

[1]For instance, Bursztyn et al. (2019) find that moral suasion has a larger impact than economic incentives on credit card debt repayment in the Indonesian context. Torgler (2004) finds that moral suasion does not impact the extensive margin of tax compliance, but does impact the variable tax amount being paid.

is a behavioral parameter that could emerge from past moral appeals by governments or citizen groups, a decision-maker's own actions, social norms, and other factors that shape moral behaviors.

2 How to Measure the MCC

Our elicitation procedure is distinct from the prior literature looking at willingness to pay for carbon mitigation. The MCC is a behavioral parameter, which is distinct from willingness-to-pay for carbon offsets (e.g., Rodemeier, 2022; Imai et al., 2022), for permits from regulated carbon markets (e.g., Diederich and Goeschl, 2014), or for net zero policies (e.g., Ashenfarb and Kotchen, 2024). Unlike these previous studies, there is no delegation in the effort to reduce carbon emissions in our estimation of the MCC. We are looking at how much individuals are willing to sacrifice when they internalize carbon externality. This is a key distinction from the previous literature and our contribution to the debate on the role of individual preferences in using the social cost of carbon.

A key challenge in measuring the MCC is that biased beliefs and idiosyncratic preferences could confound its elicitation. For instance, upon observing an individual consuming a vegetarian meal, we cannot readily distinguish preferences for vegetarian food, beliefs about the carbon footprint of food, and the level of moral motivation to reduce one's carbon footprint. Our strategy to identify the distribution of the MCC is to use information treatments that only target the belief about the size of the carbon externality, and not the other components of the choice environment, and provide within-subject variation in beliefs. Our general approach requires observing two choices by the same individual and an information shock between those choices.

In our research program, we are implementing this general approach in a series of field experiments where we offer lotteries for holiday packages. As part of these lotteries, we design a procedure to elicit the compensation amount for low-carbon versus high-carbon packages. In a baseline scenario, where we do not provide an information signal about the difference in carbon

footprints, we elicit the compensation amount that subsidizes the price of the low-carbon package. We then provide information about the carbon externality, and do a second elicitation for each individual and find the compensation amount such that they are willing to change their initial choice. This procedure allows us to estimate an individual-specific MCC across a wide range of scenarios and domains. We are currently investigating the MCC in the context of holiday, transportation, food, and lodging choices.

3 Some Estimates of the MCC

In this ongoing research program, we are measuring the MCC across different contexts and populations. Here, we report results from our first study.

In 2022, we conducted an artefactual field experiment with an online panel participants recruited from the Grenoble Metropolitain region. For this study, participants were contacted via email to participate in an online study. Our goal was to offer them a special prize as a reward for being dedicated panel members. As a token of appreciation for their participation in the panel, we wanted to offer a holiday package via a lottery.

The holiday package we offered consisted of a two-day retreat in Chamonix, a world-famous mountain village in the French Alps. The package consisted of two-night accommodation, transport by car from Grenoble to Chamonix (about 2.5 to 3 hours travel time),[2] a dinner, and a brunch. For the high-carbon package, the accommodation was in a traditional detached mountain house (mazot), the transport was via a combustion engine car, and the meals were meat-based. For the low-carbon package, the accommodation was in a mountain apartment within a multi-apartment building, the transport was via an electric car, and meals were vegetarian. We also offered some cash for each option, which they could spend at their own discretion. Our elicitation procedure consists of varying this cash amount using a multiple-price-list choice procedure. That

[2]To avoid selection based on whether or not a participant could drive by car to Chamonix, we offered to drive the winning participant, which we did ourselves at the time to deliver the package.

is, in a choice scenario, participants were presented with two options and had to choose their preferred option. Following this choice, they were given a list of binary choices with increasing cash amounts for their non-preferred option. For each option, participants had to select their preferred option. The cash amount where participants switched corresponds to the compensation amount such that they are indifferent between the two options. The lottery was incentive-compatible. The implementation of our procedure to estimate the MCC was successful and robust to the features of the experiment. Our final estimating sample contains 580 participants.

Three important results emerge. First, we find that 62.9% of all participants (in the main sample with $N = 580$) did were carbon-inattentive in the baseline choice. That is, they did not consider the carbon footprint as an important attribute in their choice.

Second, the MCC is zero for a large share of individuals, but vary between the carbon-inattentives and carbon-attentives. Figure 1 presents the distribution of the MCC for all treated, and the distributions for the carbon-inattentives and carbon-attentives. For carbon-inattentives, individuals who do not think about the carbon externality, also do not care about it. In comparison, only 15% of the carbon-attentives have an MCC of zero. Overall, more than 50% of our sample has an MCC of exactly zero. This is an important takeaway. A high share of individuals who are not morally motivated to address the carbon externality, combined with a high share of carbon inattentives, could mean that collective voluntary action would not be sufficient to address the carbon externality. Figure 1 also shows that for individuals who put a moral value on the externality, this value is very large. Conditional on not being zero, the average MCC is 1047 euros/ton of CO_2 (Panel A, Table 1). This high value is driven by individuals with a very large MCC; note however that the median MCC for individuals with a positive MCC is also economically significant: 539 euros/ton of CO_2. In Panel B and C of Table 1, we report statistics for the distribution of MCC for carbon-inattentive and carbon-attentive individuals, respectively. Conditional on not being zero, the mean and median MCC for carbon-attentive individuals is much larger than for carbon-innattentives. This confirms the patterns shown in Figure 1—participants

who thought about the carbon externality also tend to value it more than participants who did not think about it.

In our study, we also tested the effects of motivation crowding on the MCC. We investigated how having to pay a carbon fee could change the level of moral motivation. We denote the MCC with a carbon fee by $\mu_i(\tau)$ and without by $\mu_i(0)$. In Figure 2, we report three distributions of $\mu_i(\tau) - \mu_i(0)$. Panel a) shows the distribution for all treated participants. For 35% of the sample, the external incentive did not impact the MCC. Complete crowding-out is observed for about 20% of our sample, and partial crowding-out corresponds to about 10% of our sample. Another 18% of our sample responded to the fee in a way that we label as backfire motivation crowding-out, a reduction in the moral cost which is larger than the amount of the fee. Finally, 17% of our sample increased their moral cost in response to the fee, thus exhibiting crowding-in behavior. This distribution, however, conceals important differences between individuals who had a positive MCC prior to the introduction of the fee (i.e., $\mu_i(0) > 0$) and others who had an MCC of zero ($\mu_i(0) = 0$). Panel a) of Figure 2 shows the distribution of $\mu_i(\tau) - \mu_i(0)$ for morally motivated individuals ($\mu_i(0) > 0$). Among those, motivation crowding-out is much less prevalent. In fact, most of the crowding-out comes from individuals with $\mu_i(0) = 0$ (Panel b). We interpret this behavioral response as evidence of moral licensing (Jacobsen et al., 2012; Blanken et al., 2015). Once we account for the effect of the fee on the WTA, these individuals ask for a smaller compensation for the carbon-intensive option. The introduction of the fee on the high-carbon package thus effectively makes this option morally more appealing for some individuals. This stark dichotomy between the two types of individuals also informs the debate about the role of Kantians versus Consequentialists in the design of policy instruments. In our setting, the share of individuals that are morally motivated, absent extrinsic incentives, also tend to have a stable MCC with respect to extrinsic incentives. On the other hand, the share of individuals who are not morally motivated to address the carbon externality responds more to the extrinsic incentive.

4 Implications for Policy Design

How should policy analysts use the MCC? In this research program, we propose a few options. First and foremost, we believe that, like the SCC, the MCC is highly context-specific, and should then be used with this caveat in mind. Estimating the MCC to inform global climate policies might simply not be possible. However, we believe that for the design of local policies, the MCC can be easily estimated and is an appropriate measure of a local population's degree of internalization of the carbon externality. Take, for instance, the case of a city that aims to design a tourist tax to achieve its net zero objective. What should be the level of this tax given the level of moral motivation of its typical tourist population? Alternatively, consider an organization, a university for instance, that aims to reduce its carbon footprint. What measures and how stringent should such measures be if we were to account for the distribution of the MCC of its employees.

In our research program, we investigate how we should modify the classic Pigouvian instruments accounting for the MCC and especially its heterogeneity. Whereas policymakers could be tempted to adjust Pigouvian instruments to account for morally motivated consumers, the vast degree of heterogeneity poses challenges to the design of second-best instruments. Firms, on the other hand, could exploit this heterogeneity to offer goods and services targeted to morally-motivated consumers. We illustrate these ideas in the context of designing Pigouvian instruments for luxury goods and services in the tourism industry. But these results have broader implications.

Finally, note that MCC has a direct link with the nascent literature that proposes to use Marginal Value of Public Fund (MVPF) to evaluate public policies, including climate policies (Finkelstein and Hendren, 2020; Hahn et al., 2024). As defined by (Hahn et al., 2024), the MVPF is society's willingness to pay (WTP) for a given climate policy over its fiscal cost. In defining the WTP, we thus need determine how society should value one ton of carbon. Using the MCC for such calculations could better reflect the trade-offs a given population is willing to do to reduce its carbon emissions.

References

Ashenfarb, Matthew, and Matthew Kotchen. 2024. Stated preference estimates of the average social cost of carbon. Technical report, National Bureau of Economic Research.

Blanken, Irene, Niels Van De Ven, and Marcel Zeelenberg. 2015. A meta-analytic review of moral licensing. *Personality and Social Psychology Bulletin* 41 (4): 540–558.

Bursztyn, Leonardo, Stefano Fiorin, Daniel Gottlieb, and Martin Kanz. 2019. Moral incentives in credit card debt repayment: Evidence from a field experiment. *Journal of Political Economy* 127 (4): 1641–1683.

Dewatripont, Mathias, and Jean Tirole. 2024. The morality of markets. *Journal of Political Economy* 132 (8).

Diederich, Johannes, and Timo Goeschl. 2014. Willingness to pay for voluntary climate action and its determinants: Field-experimental evidence. *Environmental and Resource Economics* 57: 405–429.

Finkelstein, Amy, and Nathaniel Hendren. 2020. Welfare analysis meets causal inference. *Journal of Economic Perspectives* 34 (4): 146–167.

Hahn, Robert W, Nathaniel Hendren, Robert D Metcalfe, and Ben Sprung-Keyser. 2024. A welfare analysis of policies impacting climate change. Technical report, National Bureau of Economic Research.

Imai, Taisuke, Davide D Pace, Peter Schwardmann, and Joël J van der Weele. 2022. Correcting consumer misperceptions about co_2 emissions .

Ito, Koichiro, Takanori Ida, and Makoto Tanaka. 2018. Moral suasion and economic incentives:

Field experimental evidence from energy demand. *American Economic Journal: Economic Policy* 10 (1): 240–267.

Jacobsen, Grant D, Matthew J Kotchen, and Michael P Vandenbergh. 2012. The behavioral response to voluntary provision of an environmental public good: Evidence from residential electricity demand. *European Economic Review* 56 (5): 946–960.

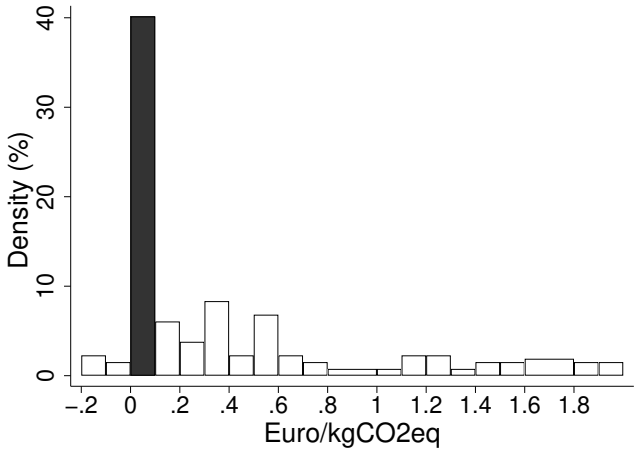
Reiss, Peter C, and Matthew W White. 2008. What changes energy consumption? prices and public pressures. *The RAND Journal of Economics* 39 (3): 636–663.

Rodemeier, Matthias. 2022. Willingness to pay for carbon mitigation: Field evidence from the market for carbon offsets. *Available at SSRN 4315854* .

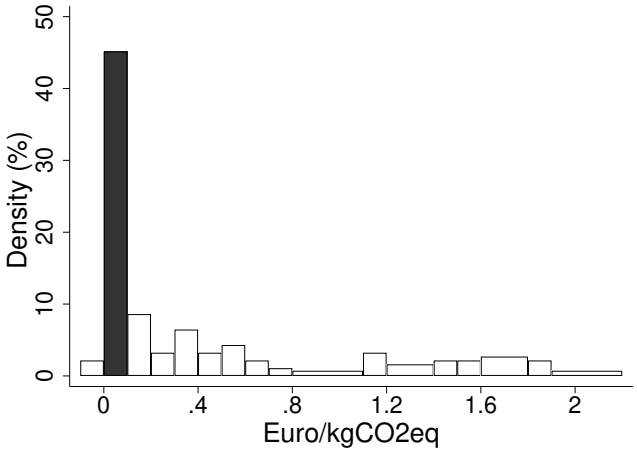
Romans, J Thomas. 1966. Moral suasion as an instrument of economic policy. *The American Economic Review* 56 (5): 1220–1226.

Torgler, Benno. 2004. Moral suasion: An alternative tax policy strategy? evidence from a controlled field experiment in switzerland. *Economics of governance* 5 (3): 235–253.

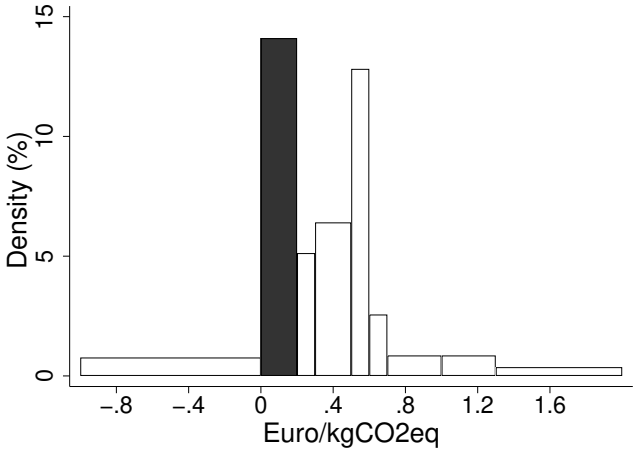
5 Figures and Tables



(a) All Treated



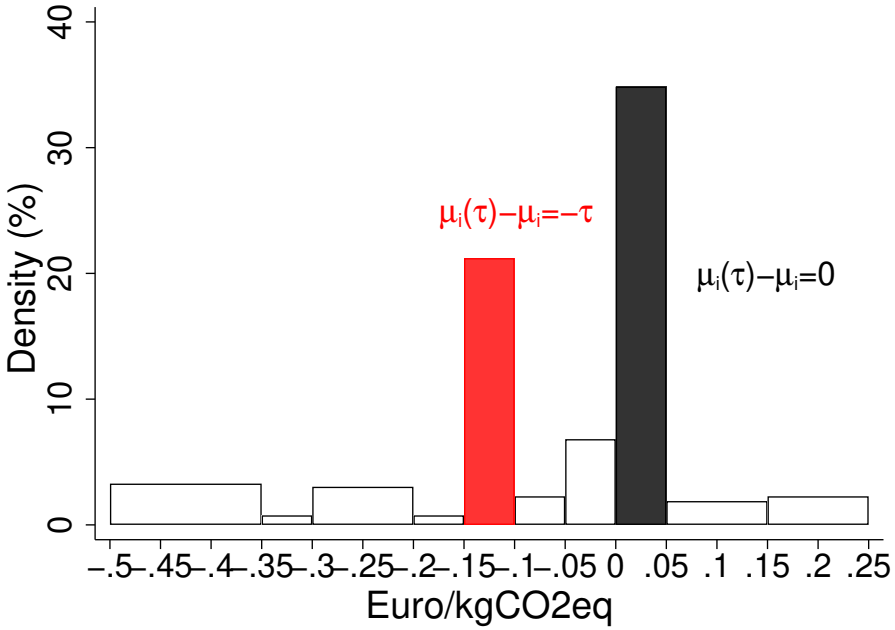
(b) Carbon-Inattentives



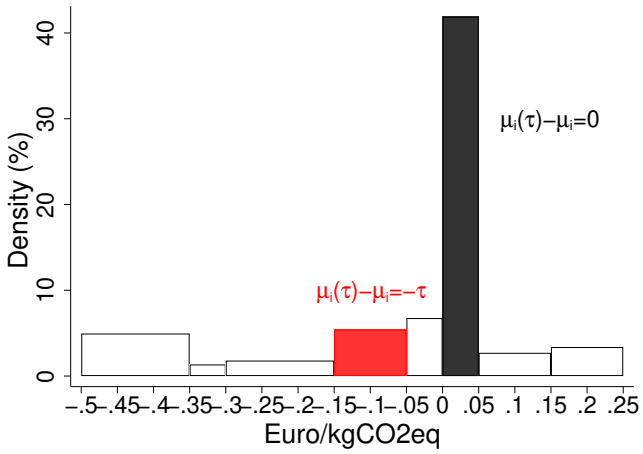
(c) Carbon-Attentives

For all distributions, we restrict the sample to participants for which the treatment led to correct beliefs (i.e., $\mathcal{B}_i(\Delta e) = \Delta e = +/- 10\text{kgCO2eq}$)

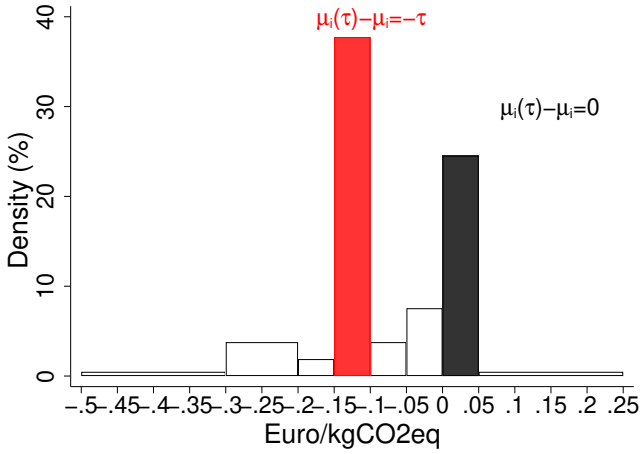
Figure 1: MCC Distributions



(a) All Treated



(b) Participants with $\mu_i(0) > 0$



(c) Participants with $\mu_i(0) = 0$

Distribution of $\mu_i(\tau) - \mu_i$. At zero (in black), we have $\mu_i(\tau) = \mu_i$. The red bar denotes the distribution where the carbon fee induces a complete crowding out of the moral cost, i.e., $\mu_i(\tau) - \mu_i = -\tau$.

Figure 2: Heterogeneity: Distribution of Motivation Crowding-Out

Table 1: MCC Estimates

	MCC Last Switch	MCC Follow-up WTA	MCC First Switch
Panel A: All Participants			
$E[MCC]$	603.1	792.3	547.1
$med(MCC)$	214.3	142.9	142.9
Nb Obs	125	223	124
$E[MCC \mid > 0]$	1047.1	1523.2	969.1
$med(MCC \mid > 0)$	539.3	1079.2	539.3
Nb Obs	72	116	70
Panel B: Carbon-Inattentives			
$E[MCC]$	445.7	635.6	419.6
$med(MCC)$	142.9	35.2	140.8
Nb Obs	91	158	91
$E[MCC \mid > 0]$	827.7	1271.2	795.6
$med(MCC \mid > 0)$	571.4	1087.0	539.3
Nb Obs	49	79	48
Panel C: Carbon-Attentives			
$E[MCC]$	1024.6	1173.2	898.5
$med(MCC)$	320.5	307.7	333.3
Nb Obs	34	65	33
$E[MCC \mid > 0]$	1514.6	2061.1	1347.8
$med(MCC \mid > 0)$	500.0	1000.0	562.5
Nb Obs	23	37	22

Notes: Each column relies on a different approach to extract the WTA from the MPL procedure, which is then used to compute the MCC. In the first column, we consider only switchers, i.e., participants who switched between options within a MPL elicitation. In the case of multiple switching, we use the last switch to infer the pivotal choice. In the second column, we also include non-switchers and use their stated WTA, which was asked in a follow-up but non-incentivized question. In the third column, we only include switchers, as in the first column, but use the first switch, in case of multiple switches, to determine the pivotal choice. In each panel, we report the mean and median of the MCC, and the conditional mean and median for participants with a positive MCC.