

THE IMPACT OF A BONUS-MALUS TAX IN ONLINE GROCERY SHOP

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THE IMPACT OF A BONUS-MALUS TAX IN ONLINE GROCERY SHOP**Summary**

Bonus-malus taxation scheme has been used as an economic instrument to decrease CO₂ emissions caused by different sectors. Across two experiments, we tested the effects of a bonus-malus taxation scheme on the carbon footprint of grocery baskets. More specifically, we disentangled bonus-malus price effect from its psychological effect. To do that, we isolated the effects of price adjustment, tax salience (i.e., provision of tax signposts), and justification messages. In a second experiment, we also investigated the effectiveness of traffic lights carbon labels. While bonus-malus had no impact on basket emissions, traffic light labels significantly reduced carbon footprint. These findings offer valuable insights for policy makers targeting food-related emissions.

Keywords: bonus-malus; carbon footprint labels; tax salience; groceries; norms

L'IMPACT D'UNE TAXE BONUS-MALUS DANS UNE ÉPICERIE EN LIGNE

Résumé :

Le dispositif fiscal de bonus-malus a été utilisé comme instrument économique pour réduire les émissions de CO₂ générées par différents secteurs. Dans le cadre de deux expériences, nous avons testé les effets d'un système de bonus-malus sur l'empreinte carbone des paniers d'achat alimentaires. Plus précisément, nous avons distingué l'effet prix du bonus-malus de son effet psychologique. Pour ce faire, nous avons isolé les effets de l'ajustement des prix, de la saillance de la taxe (c'est-à-dire l'affichage de panneaux indiquant la taxe) et des messages de justification. Dans une deuxième expérience, nous avons également examiné l'efficacité des étiquettes carbone de type « feux tricolores ». Alors que le bonus-malus n'a eu aucun impact sur les émissions des paniers, les étiquettes tricolores ont significativement réduit l'empreinte carbone. Ces résultats apportent des enseignements précieux pour les décideurs publics visant à réduire les émissions liées à l'alimentation.

Mots-clés : bonus-malus; étiquettes carbone; saillance fiscale; consommation alimentaire; normes

Global warming driven by carbon emissions continues to affect our planet, as rising global surface temperatures significantly influence sea levels, ice volume, and ocean temperatures (Intergovernmental Panel on Climate Change, 2023). Food sector is one of the greatest contributors to the greenhouse gas emissions, responsible for around 26% of the total global emissions (Poore & Nemecek, 2018).

Different taxation systems have been introduced to reduce carbon emissions. A green fiscal measure, bonus-malus scheme is one of the tools that may be effective to promote sustainable behaviour. In their experiment, Hilton et al. (2014) demonstrated that bonus-malus promoted sustainable travel choices by both its price effect and psychological impact. Similarly, by running a framed field experiment, Panzone et al. (2021) found that bonus-malus scheme can promote sustainable food choices by reducing absolute carbon content of participants' shopping baskets in an experimental online grocery shop.

In 2007, France implemented this environmental taxation policy, bonus-malus system, designed to promote the adoption of lower CO₂-emitting vehicles within the national fleet (Pourquier & Vicard, 2016). Under this scheme, the *bonus écologique* provides financial incentives to consumers purchasing vehicles with low emissions (CEDEF, 2021), while the *malus écologique* imposes penalties on those opting for cars with higher CO₂ emissions (ADEME, 2020).

In order to explore the effect of this scheme on consumer demand, d'Haultfoeuille, Givord, & Boutin (2014) carried out a study. Their findings revealed that the scheme affected consumer behavior in ways that deviated from predictions based on econometric models. Additionally, they argued that broader macroeconomic conditions were unlikely to account for this discrepancy, suggesting that non-monetary factors associated with the scheme may have played a role in shaping consumer choices.

Given the significant contribution of the food sector to carbon emissions, applying a bonus-malus taxation scheme could be a promising strategy to promote lower-emission consumption. However, research exploring the use of such schemes in the context of sustainable grocery choices remains scarce. Crucially, understanding the non-monetary effects of bonus-malus systems is essential for their effective implementation. As highlighted d'Haultfoeuille, Givord, & Boutin (2014), price effect may not be adequate to explain the effect of green fiscal measures on behavior. Moreover, non-monetary interventions—such as carbon footprint labeling or the use of injunctive norms—may also play a key role in encouraging more sustainable consumer decisions and reducing CO₂ emissions. Throughout two laboratory experiment studies, our aim was to test not only the price effect of bonus-malus in the sustainable online grocery consumption context but also its psychological effect. Moreover, we also tested the main effect of traffic lights carbon labels (TL) on the second experiment allowing us also to detect whether bonus-malus and TL interacts.

To address our research questions, we developed an incentive-compatible experimental online grocery store, which we named *Greenshop*. This platform is a modified version of the virtual shop used in the study by Kanay et al. (2021). It featured a variety of grocery items organized across different virtual six shelves (fruits and vegetables, meat and fish, dairy and eggs, prepared food, sweet goods, and savoury goods). Participants were given €25 to spend in the shop and were required to use at least €20 before they could exit.

Experiment 1

This experiment aimed to assess the impact of a bonus-malus scheme on sustainable grocery choices, specifically focusing on the carbon footprint of consumers' shopping baskets. We first examined the influence of price effect. Beyond this, we explored the psychological dimensions of the scheme by evaluating the effects of tax salience—introduced via tax signposts—and the presence of an injunctive normative message explaining the rationale

behind the bonus-malus. We also tested whether the normative message alone could lead to lower-carbon basket selections.

We tested our hypotheses on the experimental online grocery-shopping platform we constructed. On this platform participants could buy their products with the budget we attributed. In the end of the experiment, they had 1/5 chance to gain the products they have chosen.

Method

Participants

One hundred and ninety-six participants were initially recruited in Toulouse School of Economics from its subject pool. Participants were aged between 17 and 37 ($M = 20.58$, $SD = 3.01$) with an average of 1.97 ($SD = 1.58$) years of higher education (post-baccalauréat).

Experimental Conditions

In the conditions where we modified prices with bonus and malus, half of the products in the Greenshop was subsidized (i.e., provision of a bonus) and the other half was taxed (i.e., provision of a malus) according to their carbon footprint relative to that of *median* product. We have used two different bonus-malus amounts, 5% and 15%. In the condition where we justified the application of the bonus-malus scheme, we presented an injunctive normative message on the landing page of the grocery shop. In the condition where we wanted to test tax salience, together with the bonus-malus justification message, we have presented the amount of bonus and malus attributed to products. In the condition where we only wanted to test the impact of injunctive norm, we presented an injunctive normative message about the danger of carbon emissions on the landing page of the grocery shop. Overall, we had eight experimental conditions.

1. No norm baseline condition: Baseline prices were used.
2. No norm medium bonus-malus without display condition: Prices were adjusted with a bonus-malus scheme at a medium rate. The malus and bonus rate implemented to initial price of each product was 5.5%. Participants were not informed about the implementation of the bonus-malus and the bonus or malus amount attributed to each product was not displayed.
3. No norm large bonus-malus without display condition: Prices were modified with a large bonus-malus scheme at a rate of 15%. Participants were not informed about the bonus-malus implementation and the bonus or malus amount attributed to each product was not displayed.
4. Norm baseline condition: Baseline prices were used and participants were provided with an injunctive normative message about the danger of CO₂ generated from grocery shopping.
5. Norm medium bonus-malus without display condition: Prices were modified with a medium bonus-malus. An injunctive normative message justifying the implementation of the bonus-malus because of the danger of CO₂ generated from grocery shopping was presented on the landing page, but the bonus or malus amount attributed to each product was not displayed.
6. Norm medium bonus-malus display condition: Prices were modified with a medium bonus-malus whose implementation was justified by the injunctive normative message (i.e., same message as in the norm medium bonus-malus without display condition was used). The bonus or malus amount attributed to each product was displayed.
7. Norm large bonus-malus without display condition: Prices were modified with a large bonus-malus. The implementation of the bonus-malus was justified by the injunctive normative message (i.e., same message as in the norm medium

bonus-malus without display condition was used), but the bonus or malus amount attributed to each product was not displayed.

8. Norm large bonus-malus display condition: Prices were modified with a large bonus-malus whose implementation was justified by the injunctive normative message (i.e., same message as in the norm medium bonus-malus without display condition was used). The bonus or malus amount attributed to each product was displayed.

Results

In order to operationalize the sustainable behaviour, we took into account the kilograms of carbon footprint per kg of basket, which was the dependent variable. The independent variable was the bonus-malus scheme.

To detect whether our experimental manipulation had a main effect on the carbon content of shopping baskets, we conducted a one-way ANOVA of which the results showed a non-significant effect ($F(7, 185) = 0.39, p = .91, \eta_p^2 = .02$). Therefore, we could not detect an impact of price, tax salience, tax justification and injunctive norm on the carbon content of shopping baskets.

Discussion of Experiment 1

We found that bonus-malus taxation scheme altered carbon content of shopping basket neither through its price effect nor its psychological impact. Several factors may explain why our initial experiment did not produce a significant effect on the carbon footprint of shopping baskets. These include a small sample size, potentially confusing or inconsistent communication of the bonus-malus scheme, unclear display of bonus/malus amounts, and a lack of participant understanding regarding how the scheme influenced final prices. Additionally, the normative message about greenhouse gas emissions may have been difficult to comprehend. To address these limitations, we conducted a second experiment with improved framing of the bonus-malus and a larger sample, as indicated by a power analysis.

Experiment 2

This study aimed to assess the effect of a bonus-malus scheme on sustainable grocery choices, measured by the carbon content of shopping baskets. We examined both the price effect and the psychological impact of tax salience and a justificatory message. Additionally, we investigated the influence of TL, known for promoting sustainable choices (e.g., Muller, Lacroix, & Ruffieux, 2019), and explored their interaction with the bonus-malus scheme.

In this experiment, we have changed the way we calculated tax (i.e., malus) amount to better reflect the CO₂ content of products. We have chosen two tax amounts, 80€ per ton of CO₂ (i.e., medium rate) and 250€ per ton of CO₂ (i.e., high rate). Products having high carbon footprint received a malus according to their absolute carbon footprint. Bonus amount was calculated in a way to have a budget neutral scheme. Prices of the products having medium carbon content were not changed. Concerning the tax justification message, we used a more comprehensible message and explained how bonus-malus scheme worked in the shop in a simpler way. To operationalize tax salience, we used tax signposts. In other words, in the conditions where we wanted to test the impact of tax salience, we presented the amount of tax (i.e., malus) and bonus attributed to products.

Method

Participants

Six hundred and fifteen participants were recruited in University Toulouse-Jean Jaurès. Participants were aged between 17 and 45 ($M = 20.91, SD = 3.35$) with an average of 1.67 ($SD = 1.34$) years of higher education (post-baccalauréat).

Experimental Conditions

The design of the experiment was a 5 x 2 factorial design crossing bonus-malus and TL variables. Bonus-malus variable had 5 levels (i.e., first level where we used baseline prices; second level where we modified prices with the medium rate; third level where we modified prices with the medium rate and presented the tax justification message and tax signposts; fourth level where we modified prices with high amount; fifth level where we modified prices with high amount and presented the tax justification message and tax signposts). TL variable had two levels; we either showed a label for each product according to their carbon footprint (red vs. amber vs. green) or not.

Results

The dependent variable was carbon footprint per kg of shopping basket (in kg). A two-way ANOVA was conducted to determine the effect of bonus-malus and TL on the carbon content of shopping baskets as well as their interaction. Results showed that TL had a significant main effect on carbon content of shopping baskets ($F(1, 593) = 14.07, p < .001, \eta_p^2 = .02$). By contrast, bonus-malus did not have any effect on carbon content ($F(4, 593) = 0.19, p = .94, \eta_p^2 = 0$). Therefore, our hypotheses concerning price effect of a bonus-malus on sustainable consumption and psychological impact of bonus-malus on sustainable consumption were not supported. Finally, the interaction between TL and bonus-malus was not significant ($F(4, 593) = 1.72, p = .14, \eta_p^2 = .01$).

Discussion of Experiment 2

This experiment showed that bonus-malus scheme had an influence consumer behavior neither through its price effect nor its psychological impact despite using two different bonus-malus scheme amounts. As predicted, and in line with the literature, color coded carbon labels reduced carbon content of shopping baskets.

Discussion and Conclusion

The unexpected outcomes of the *bonus-malus* scheme in our experiments may stem from several factors. One possibility is motivational crowding-out, where external incentives like taxes reduce individuals' intrinsic motivation to act sustainably (Frey & Oberholzer-Gee, 1997). Low tax acceptability may also play a role; prior research suggests that transparency about how tax revenues are used (e.g., for environmental goals) and careful framing (e.g., using terms like "climate contribution" instead of "carbon tax") can improve public support (see Baranzini & Carattini, 2017). Presenting the bonus-malus as revenue-neutral and aimed at promoting sustainability may similarly enhance acceptability.

Although the experiments were conducted in similar online shops, differences in budget use may explain the discrepancies between our results and those of Panzone et al. (2021). In their study, participants could spend as little as £7 and keep the rest of the £25 budget, encouraging lower spending and potentially lower carbon baskets. In contrast, our participants had to spend nearly the entire budget (€20 of €25), reducing the likelihood of lower carbon footprints through limited spending. Additionally, while Panzone et al. measured total CO₂ emissions, we used CO₂ per kilogram of the basket to better reflect sustainability. For instance, a basket filled with low-CO₂ products like potatoes could weigh more than one with high-CO₂ items like chicken, allowing for more meals and longer-lasting, more sustainable consumption.

We demonstrated that TL could reduce carbon footprint of participants' shopping baskets, a result that is in line with the findings in the literature (e.g., Muller, Lacroix, & Ruffieux, 2019; Thøgersen & Nielsen, 2016; Vanclay et al., 2011). Our study adds evidence to the effectiveness of such colour-coded labels. Moreover, as non-coercive measures, TL labels may be easier to implement, and public support for carbon labeling—confirmed by a Carbon Trust (2020) survey across several countries including France—further supports their policy potential.

Our studies have limitations, including potential demand effects due to visible labels and a non-representative sample drawn from university settings. The controlled environment and limited product range may not reflect real-world shopping. Future research should test bonus-malus and labeling strategies in everyday settings, use more diverse samples, and explore ways to improve scheme acceptability.

To conclude, over two experiments, we found that bonus-malus had an impact on sustainable grocery consumption neither through a price effect nor a psychological effect. Finally, we demonstrated that TL were effective in reducing basket carbon footprint. The findings from our studies can inform policy strategies aimed at reducing CO₂ emissions from food consumption.

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