Sustainable lifestyle choices in food and their rebound effects

Mont, Oksana; Lehner, Matthias; Richter, Jessika Luth; Plepys, Andrius

2023

Document Version:
Publisher's PDF, also known as Version of record

Sustainable lifestyle choices in food and their rebound effects

Oksana Mont, Matthias Lehner, Jessika Luth Richter, and Andrius Plepys
All at the International Institute for Industrial Environmental Economics at Lund University, Lund, Sweden
oksana.mont@iiiee.lu.se

SCP23 - Joint ERSCP, SCORAI and WUR Conference on Transforming Consumption-Production Systems Toward Just and Sustainable Futures
Wageningen, The Netherlands | Jul 05, 2023 - Jul 08, 2023

To be cited as:
Mont, O., Lehner, M., Richter, J. L., and A. Plepys (2023) Sustainable lifestyle choices in food and their rebound effects. SCP23 - Joint ERSCP, SCORAI and WUR Conference on Transforming Consumption-Production Systems Toward Just and Sustainable Futures, Wageningen, The Netherlands | Jul 05, 2023 - Jul 08, 2023

Abstract

The urgency of addressing the sustainability crisis requires a comprehensive approach encompassing both technological advancements and changes in human behavior. Food represents a crucial domain where everyday choices closely intertwine with environmental and social impacts. This study investigates the interplay between sustainable food strategies and rebound effects, which refer to the reduced effectiveness of measures due to economic and psychological responses following efficiency improvements. Drawing from the "EU 1.5-degree Lifestyles" project, we identified nine impactful strategies through a literature review and expert interviews. These strategies include minimising food waste, consuming tap water instead of bottled alternatives, reducing animal-based products, adopting vegan and vegetarian diets, and choosing organic, seasonal vegetables and fruits and food sharing. The findings from this study are valuable for policymakers seeking to develop effective and sustainable food policies while mitigating rebound effects. By understanding the rebound mechanisms associated with individual food strategies, policymakers can enhance the overall effectiveness of their measures and address the sustainability crisis more systematically.

Keywords

Sustainable food strategies, rebound effects, re-spending, time rebounds, systematic literature review

1 Introduction

Both technological solutions and behavioural changes have been identified as important strategies for reducing the sustainability crisis we face (IPCC, 2022). One of the areas in which environmental and social impacts are closely linked to choices in everyday life is food. The environmental impacts of food production and consumption lead to some of the highest consumption-based GHG emissions, resource use (Ivanova et al., 2020), and energy consumption (Owen et al., 2017). At the same time, the food domain has one of the highest potentials for reducing impacts and resource use by consumer intervention (Wynes & Nicholas, 2017). Emerging studies identify strategies for households to substantially reduce their environmental and social impacts. Our research within the "EU 1.5-degree Lifestyles"[1] project developed a list of eight impactful strategies based on the extensive literature review and interviews with experts.[2] These strategies include: avoiding food waste at home, drinking tap water in place of bottled water and manufactured drinks, reducing animal-based products, switching to a vegan and a vegetarian diet, eating only organic, and only seasonal vegetables and fruit. These options have different reductions of tCO2eq/cap. A systematic literature review of 53 studies from different countries demonstrated that a vegan diet is associated with a mean reduction of 0.9 tCO2eq/cap, while a vegetarian diet – with 0.5 tCO2eq/cap reduction (Ivanova et al., 2020).

At the same time, evidence emerges that projections associated with potential improvements almost always come short due to the so-called rebound effects. The rebound effect is a widely used umbrella term for various economic and psychological responses to improved efficiency and sufficiency in different domains of production and consumption that lead to reduced effectiveness of measures and offsetting some of the potential savings. Most studies so far have been on the rebound effects of energy efficiency measures (Owen et al., 2017). In our research, we seek to explore extant knowledge about the mechanisms for rebound effects in the food domain and their scale.

We are conducting a systematic literature review of rebound effects associated with food-related lifestyle options. We use the SCOPUS database to make targeted searches in titles, abstracts and keywords, and we code the final samples of articles in Nvivo. We hypothesise that the aforementioned sustainable lifestyle strategies for households might have different mechanisms for rebound effects. Thus, we aim to test this hypothesis by mapping and categorising rebound mechanisms associated with individual food strategies and comparing them.

The results will be of value for policymakers who develop sustainable food policy measures and seek to mitigate associated rebound effects to improve policy effectiveness.

2 Rebound effects of sustainable lifestyle choices in food

2.1 Avoid food waste at home

Reducing food waste has the largest potential to reduce GHG emissions compared to other options, such as buying a fuel-efficient car. However, this is also a measure with the highest rebound effect, 77%, according to Chitnis et al. (2014) and 57%, according to Hagedorn and Wilts (2019). In a study by Lekve Bjelle et al. (2018), eliminating food waste leads to between 68% and 100% of rebound effects. Avoidance or prevention of food waste in households saves money. It thus can lead to an economic rebound effect when these savings are spent on food products and services or other consumption categories (Binswanger, 2001). If savings from avoidance of food waste go into energy-intensive categories, such as air travel and heating of space, the environmental benefits of avoiding food waste can be completely negated (Martinez-Sanchez et al., 2016).

---

[1] https://onepointfivelifestyles.eu/

[2] For the methodology used for collecting data and developing 50 sustainable lifestyle options see https://onepointfivelifestyles.eu/news/how-can-we-move-towards-15deg-living

It is usually hard to estimate what people re-spend their savings on. In WRAP (2014), an observation was made that when reducing food waste, people tend to spend 50% of their savings on up-trade of foods, i.e., purchasing food of higher quality and cost, such as buying local food, better quality meat or switching to higher-cost food categories. A study by Salemdeeb et al. (2017) used this observation in developing their scenarios. Their overall results show rebound effects from avoiding food waste to be in the range of 23%-59%, where the latter comes from re-spending on GHG-intensive categories, such as fuel and flying. The 23% rebound effects are associated with re-spending on education, communication and real estate services.

Studies suggest, therefore, that reducing food waste through food prevention, such as better planning of food shopping and meals, avoiding cooking too much food and reusing leftovers, should also be accompanied by using the generated savings on low-impact consumption categories (Martinez-Sanchez et al., 2016). Such low-impact categories are "health, education and culture", as suggested by Albizzati et al. (2022), who advocate policy support for consumption categories that are not only low or negligible in terms of their environmental impacts, but also have positive social impacts.

2.2 Reduce animal-based products in my diet

Many studies evaluate the environmental impacts of different 'green diets' types where a certain meat reduction is modelled. For example, a study by Tukker et al. (2011) modelled three scenarios, where two had lower meat consumption. The study demonstrated that even such a modest change as substituting red meat by 40% with chicken, seafood and cereals could lead to an 8% reduction in impacts associated with food consumption. The same result is arrived at even if the direct rebounds - income effects – are taken into calculation.

2.3 Switch to a vegan diet

A vegan diet is usually defined as a diet without meat, fish, eggs and dairy products. A study by Andersson & Nässén (2023) shows that a vegan diet leads to lower CO2eq/cap/yr from food compared to a typical diet, as could be expected, but that it also has a positive spill-over effect on other consumption domains, thereby reducing impacts elsewhere. This is explained by vegans' strong pro-environmental values that prevent them from re-spending in categories with high environmental impacts.

2.4 Switch to a vegetarian diet

A vegetarian diet is usually defined as a diet without meat and fish. Overall, a few studies investigate the rebound effects of a vegetarian diet (Grabs, 2015). A study with a hypothetical scenario of a reduction of meat consumption at home (50%) and in restaurants (50%) by Europeans arrived at a 25% rebound effect (Wood et al., 2018). These rebound effects were caused by the increased demand for non-meat products and increased consumption of other products triggered by savings from the no-meat diet. A study of vegetarianism by Grabs (2015) shows significant rebound effects: 76-130% - for energy use and 25-88% - for GHG emissions. Higher-income groups show lower rebound effects – 76% for energy and 25% for GHG emissions, and lower-income groups have higher rebound effects: 130% and 88%, respectively, because they tend to spend savings on more environmentally intensive goods. An interview study by Dreijerink et al. (2021) explored awareness about the moral licensing effects of Dutch consumers who already follow a vegetarian diet and those who are not. For vegetarians, following this diet became habitual, so little effort was required from them. Still, for some of them, efforts were required concerning the social context, e.g., ensuring that there were vegetarian options when they were eating out. But the highest effort was for those who were not vegetarian. Switching to a vegetarian diet would require abandoning eating meat and fish, the taste and texture of which they liked. Also, learning new recipes and finding new products and substitutes was mentioned as additional effort. Most of the interviewees disagreed with the suggestion that they would follow moral licensing after they had become vegetarian. However, 5 out of 26 interviewed consumers offered examples of moral licensing behaviour, ranging from eating meat after several days of following a vegetarian diet (direct rebound) to having fewer hesitations when considering buying a less fuel-efficient car (indirect rebound).

2.5 Eat only organic vegetables and fruit

Our search strings yielded just one article that specifically mentioned an organic-based diet and estimated the associated rebound effects. According to Lekve Bjelle et al. (2018), eating an organic green diet leads to between -47% and -68% rebound effects. The minus sign indicates a negative rebound effect – an increase in the cost of implementing the action. When other measures are added, such as local products and composting, the negative rebound effects increase to -91%-134%, again due to the high costs of implementing both of these actions.

Organic food is often mentioned as an example of a re-spending category of goods that helps avoid rebound effects due to higher prices of organic products (Hertwich, 2005). So, when efficiency measures lead to cost savings, the savings should be spent on higher-quality goods with lower sustainability impacts. Studies show that pro-environmental norms and values are essential in making these decisions (Andersson & Nässén, 2023). This supports an earlier study where the assumption was that 'green' consumers would re-spend on organic products (Carlsson-Kanyama et al., 2005).

2.6 Eat only seasonal vegetables and fruit

Our searches did not find sources that would explicitly calculate the rebound effects of eating seasonal vegetables and fruit. This might be due to the difficulty of defining what seasonal means in terms of seasonal local or seasonal global foods. The difference between these two categories of seasonal food has implications for the environmental impact and associated rebound effects (Schanes et al., 2016). Seasonal global products might not necessarily have larger environmental impacts; it depends on the production methods both in agriculture and food processing (Brooks et al., 2011).

2.7 Locally produced food

Our search did not find any studies where the rebound effects of locally produced food were calculated or estimated. A general comment is that rebound effects will be linked to the prices of locally produced food. In some countries, they will be lower than imported goods, in other countries, such as Sweden, they will be typically higher than imported food products. Overall, locally produced food cannot be equated with sustainable food as it might not be the best option from a food security or environmental point of view (Stein & Santini, 2022).

2.8 Drink tap water in place of bottled water or manufactured drinks

No specific studies investigating the rebound effects of switching from drinking tap water instead of bottled water or manufactured drinks have been identified, probably due to low spending on these items in the household budget.

2.9 Food sharing (a new category)

A study of a peer-to-peer platform that collects and redistributes food showed 83% of the environmental rebound effect due to households re-spending money saved on sharing on other products and services (Meshulam et al., 2022).

3 Summary of rebound effects and mitigating measures

The following conclusions can be made regarding rebound effects associated with food-related behavioural choices. First, the definition of a ‘sustainable diet’ differs significantly among the studies. Researchers use different types of boundaries with different parameters that are considered or calculated. This makes a direct comparison of the studies’ results difficult.

The main types of rebounds discussed in studies are *re-spending and time rebounds*. Actions with negative rebound effects result from a cost increase in implementing the action. Therefore, an often-met recommendation for reducing rebound effects associated with food consumption is that dietary changes must be accompanied by increased spending on substitute food products.

One general conclusion is that changes in diet have a relatively little net impact on energy use and GHG emissions and large rebound effects. For example, in a study by Druckman (2011), reducing food waste had a 59% rebound effect, while setting the thermostat to a 1°C less had only a 7% rebound effect. Their relatively low energy intensity explains the little net impact on the energy use in the lifecycle of food products compared to other consumption domains such as mobility and housing (Grabs, 2015). Thus, one explanation of high rebound effects is that food options' relatively low energy and GHG emissions are often replaced with high energy intensity activities such as driving or flying (Buhl et al., 2017).

Studies that analysed shifts in diet according to the recommended dietary intake (RDI) also show more than 100% rebound effects for energy consumption and 45-50% for GHG emissions (Lenzen & Dey, 2002), while a study of a shift to a less meat and dairy products diet by Alfredsson (2004) showed a 140% rebound effect.

There are also considerable differences between low and high-income groups, with high-income groups showing lower rebound effects. For example, a study by Lenzen and Dey (2002) demonstrated that the highest income quintile had 112% rebound effects when shifting to a diet according to RDI, while the lowest income quintile had a 123% rebound effect from the switch. Some studies, therefore, suggest that policies should be directed at the lower income groups to help prevent rebound effects (Grabs, 2015).

Regarding policies, studies show that in food, so far, primarily soft policy measures have been applied, such as eco-labels, information campaigns and various information platforms and forums for disseminating and providing trustworthy information. However, studies recommend stronger policies such as eliminating subsidies on GHG-intensive types of food and subsidies to ecological and organic food (Schanes et al., 2016).

4 Acknowledgements

This paper is produced as part of the EU project "Policies and Tools for Mainstreaming 1.5° Lifestyles", which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003880.

5 References

Albizzati, P. F., Rocchi, P., Cai, M., Tonini, D., & Astrup, T. F. (2022). Rebound effects of food waste prevention: Environmental impacts. *Waste Management*, *153*, 138–146. https://doi.org/10.1016/j.wasman.2022.08.020

Alfredsson, E. C. (2004). '"Green"' consumption—No solution for climate change. *Energy*, *29*(4), 513–524.

Andersson, D., & Nässén, J. (2023). Measuring the direct and indirect effects of low-carbon lifestyles using financial transactions. *Journal of Cleaner Production*, *386*, 135739. https://doi.org/10.1016/j.jclepro.2022.135739

Binswanger, M. (2001). Technological progress and sustainable development: What about the rebound effect? *Ecological Economics*, *36*(1), 119–132.

Britton, E., Brigdon, A., Parry, A., & LeRoux, S. (2014). Econometric modelling and household food waste. *Banbury: WRAP*.

Brooks, M., Foster, C., Holmes, M., & Wiltshire, J. (2011). Does consuming seasonal foods benefit the environment? Insights from recent research. *Nutrition Bulletin*, *36*(4), 449–453. https://doi.org/10.1111/j.1467-3010.2011.01932.x

Buhl, J., Geibler, J. von, Echternacht, L., & Linder, M. (2017). Rebound effects in Living Labs: Opportunities for monitoring and mitigating re-spending and time use effects in user integrated innovation design. *Journal of Cleaner Production*, *151*, 592–602. https://doi.org/10.1016/j.jclepro.2017.03.001

Carlsson-Kanyama, A., Engström, R., & Kok, R. (2005). Indirect and direct energy requirements of city households in Sweden: Options for reduction, lessons from modeling. *Journal of Industrial Ecology*, *9*(1–2), 221–235.

Chitnis, M., Sorrell, S., Druckman, A., Firth, S. K., & Jackson, T. (2014). Who rebounds most? Estimating direct and indirect rebound effects for different UK socioeconomic groups. *Ecological Economics*, *106*, 12–32. https://doi.org/10.1016/j.ecolecon.2014.07.003

Dreijerink, L., Handgraaf, M., & Antonides, G. (2021). Rationalizing Inconsistent Consumer Behavior. Understanding Pathways That Lead to Negative Spillover of Pro-environmental Behaviors in Daily Life. *Frontiers in Psychology*, *12*. https://www.frontiersin.org/articles/10.3389/fpsyg.2021.583596

Druckman, A., Chitnis, M., Sorrell, S., & Jackson, T. (2011). Missing carbon reductions? Exploring rebound and backfire effects in UK households. *Energy Policy*, *39*(6), 3572–3581. https://doi.org/10.1016/j.enpol.2011.03.058

Font Vivanco, D., Freire-González, J., Galvin, R., Santarius, T., Walnum, H. J., Makov, T., & Sala, S. (2022). Rebound effect and sustainability science: A review. *Journal of Industrial Ecology*, *26*(4), 1543–1563. https://doi.org/10.1111/jiec.13295

Grabs, J. (2015). The rebound effects of switching to vegetarianism. A microeconomic analysis of Swedish consumption behavior. *Ecological Economics*, *116*, 270–279. https://doi.org/10.1016/j.ecolecon.2015.04.030

Hagedorn, W., & Wilts, H. (2019). Who should waste less? Food waste prevention and rebound effects in the context of the *Sustainable Development Goals*. *GAIA - Ecological Perspectives for Science and Society*, *28*(2), 119–125. https://doi.org/10.14512/gaia.28.2.10

Hertwich, E. G. (2005). Consumption and the Rebound Effect: An Industrial Ecology Perspective. *Journal of Industrial Ecology*, *9*(1–2), 85–98. https://doi.org/10.1162/1088198054084635

IPCC. (2022). *Climate Change 2022. Mitigation of Climate Change* (p. 2913). IPCC.

Ivanova, D., Barrett, J., Wiedenhofer, D., Macura, B., Callaghan, M., & Creutzig, F. (2020). Quantifying the potential for climate change mitigation of consumption options. *Environmental Research Letters*, *15*(9), 093001. https://doi.org/10.1088/1748-9326/ab8589

Lekve Bjelle, E., Steen-Olsen, K., & Wood, R. (2018). Climate change mitigation potential of Norwegian households and the rebound effect. *Journal of Cleaner Production*, *172*, 208–217. Scopus. https://doi.org/10.1016/j.jclepro.2017.10.089

Lenzen, M., & Dey, C. J. (2002). Economic, energy and greenhouse emissions impacts of some consumer choice, technology and government outlay options. *Energy Economics*, *24*(4), 377–403. https://doi.org/10.1016/S0140-9883(02)00007-5

Martinez-Sanchez, V., Tonini, D., Møller, F., & Astrup, T. F. (2016). Life-Cycle Costing of Food Waste Management in Denmark: Importance of Indirect Effects. *Environmental Science & Technology*, *50*(8), 4513–4523. https://doi.org/10.1021/acs.est.5b03536

Meshulam, T., Font-Vivanco, D., Blass, V., & Makov, T. (2022). Sharing economy rebound: The case of peer-to-peer sharing of food waste. *Journal of Industrial Ecology*. Scopus. https://doi.org/10.1111/jiec.13319

Owen, A., Brockway, P., Brand-Correa, L., Bunse, L., Sakai, M., & Barrett, J. (2017). Energy consumption-based accounts: A comparison of results using different energy extension vectors. *Applied Energy*, *190*, 464–473.

Salemdeeb, R., Font Vivanco, D., Al-Tabbaa, A., & zu Ermgassen, E. K. H. J. (2017). A holistic approach to the environmental evaluation of food waste prevention. *Waste Management*, *59*, 442–450. https://doi.org/10.1016/j.wasman.2016.09.042

Schanes, K., Giljum, S., & Hertwich, E. (2016). Low carbon lifestyles: A framework to structure consumption strategies and options to reduce carbon footprints. *Journal of Cleaner Production*, *139*, 1033–1043. https://doi.org/10.1016/j.jclepro.2016.08.154

Stein, A. J., & Santini, F. (2022). The sustainability of "local" food: A review for policy-makers. *Review of Agricultural, Food and Environmental Studies*, *103*(1), 77–89. https://doi.org/10.1007/s41130-021-00148-w

Tukker, A., Goldbohm, R. A., de Koning, A., Verheijden, M., Kleijn, R., Wolf, O., Pérez-Domínguez, I., & Rueda-Cantuche, J. M. (2011). Environmental impacts of changes to healthier diets in Europe. *Ecological Economics*, *70*(10), 1776–1788. https://doi.org/10.1016/j.ecolecon.2011.05.001

Wood, R., Moran, D., Stadler, K., Ivanova, D., Steen-Olsen, K., Tisserant, A., & Hertwich, E. G. (2018). Prioritizing Consumption-Based Carbon Policy Based on the Evaluation of Mitigation Potential Using Input-Output Methods. *Journal of Industrial Ecology*, *22*(3), 540–552. https://doi.org/10.1111/jiec.12702

Wynes, S., & Nicholas, K. A. (2017). The climate mitigation gap: Education and government recommendations miss the most effective individual actions. *Environmental Research Letters*, *12*(7), 074024. https://doi.org/10.1088/1748-9326/aa7541