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Factual information on the environmental impacts of consumption abroad increases citizens' problem awareness, but not support for mitigating such impacts☆

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ABSTRACT

Vastly increased international trade over the past few decades has resulted in an ever larger geographical spread in the environmental impacts of local consumption. Particularly in the case of high-income countries, a large share of their total environmental footprint of local consumption now materializes in places far beyond the respective national border. On the presumption that democratic policy-makers should, and often do, act in line with prevailing public opinion we examine whether currently weak policies addressing consumption-based environmental impacts abroad may reflect a gap in knowledge among citizens, and how closing this gap would affect policy preferences concerning the greening of international supply chains. We do so based on an experiment, embedded in a large representative survey (N = 8'000) in Switzerland, a high-income country with a very large extraterritorial environmental footprint. The main finding is that there is a major gap in knowledge among the mass public in this area, and that this gap can be closed. However, closing the information gap does not lead to a significant change in policy preferences in favor of reducing the global environmental footprint of local consumption. This points to major policy challenges in trying to mitigate problems of environmental impact shifting in the global economy.

1. Introduction

Transnational business activity has grown tremendously over the past few decades and has contributed to economic growth and increasing aggregate welfare in many parts of the world (Ben-David and Loewy, 1998; Dollar and Kraay, 2004; Sala-i-Martin, 2006; Caliendo and Parro, 2015). While this activity, and international trade in goods in particular, tends to increase both the efficiency of production and the portfolio of goods and services available to consumers globally, it has also been associated with major environmental (Copeland and Taylor, 2003; Spilker et al., 2017) and social challenges (Ruggie, 2013). Child labor, exploitation of workers, deforestation, water and air pollution, and greenhouse gas emissions are among the most prominent challenges in this regard. Moreover, since pollution- and labor-intensive production have, in tendency, moved from higher- to lower-income countries, negative environmental and social impacts of expanded global production networks have accumulated primarily in poorer countries (see Aklin, 2016; Christensen, 2019; Jorgenson and Burns, 2007; Kolcava et al., 2019; Özler and Obach, 2009; Peters et al., 2011).

Current macro-level research on environmental footprints in fact indicates that today's rich countries have achieved higher levels of environmental quality within their national boundaries at least in part by geographically dissociating consumption from production and importing a large share of polluting goods from abroad (Jorgenson and Rice, 2005; Lutter et al., 2016; Peters et al., 2011; Weinzettel et al., 2013). We refer to this phenomenon as international environmental impact shifting.

Governments, international organizations, and civil society actors

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are paying increasing attention to this issue (Krukowska, 2021; Liobikienė and Dagiliutė, 2016). But policy action, which would be required to stop and reverse international environmental impact shifting, remains rather weak (Wiedmann et al., 2020). The most prominent form of such action are environmental clauses in preferential trade agreements (PTAs). Recent research shows that such clauses may have indeed a, albeit rather modest, mitigating effect on international environmental impact shifting (Martínez-Zarzoso and Oueslati, 2018; Zhou et al., 2017; Brandi et al., 2020). Moreover, several European countries and the European Union as such have recently initiated regulatory efforts aimed at achieving greater sustainability in global supply chains (European Commission, 2021; Rühl, 2020; Schilling-Vacaflor, 2021). To what extent and effect these efforts will be implemented remains to be seen.

On the presumption that public opinion is a key driver of public policy choices (Burstein, 2003), one reason for (still) rather weak policy action in this area to date is, presumably, low levels of public awareness and policy support for at least acceptance of stronger mitigation action. While macro-level research has recently contributed a wealth of new insights on how environmental impacts are – *de facto* – (re-)allocated between countries in the aggregate, there is virtually no research to date on what citizens and consumers know about this issue, and how they form their opinions and policy preferences in this area. Moreover, several European countries and the European Union as such have recently initiated regulatory efforts aimed at achieving greater sustainability in global supply chains. To what extent and effect these efforts will be implemented remains to be seen.

In this article, we thus focus on three goals: (1) we inquire the extent to which citizens and consumers are aware of where the environmental footprint of their consumption materializes, i.e., we quantify descriptively the extent of a gap in knowledge in this domain; (2) whether and how citizens would update their issue knowledge (awareness) and problem perception in response to new factual information; and (3) what the impacts of an information provision on citizens' policy preferences concerning sustainability regulation of global supply chains might be, i.e., whether information on the extent and severity of international environmental impact shifting affects the willingness for green regulatory policy. For this purpose, we conducted a survey experiment in an affluent country, Switzerland. Using a multi-year panel study, we assessed knowledge levels in a first survey wave, and treated respondents with information on global environmental impacts of Swiss consumption in a second survey wave. We find that respondents hold large-scale misperceptions; that providing information on environmental impacts of local consumption increases citizens' issue knowledge and issue concern substantially; but does only in part lead to a change in preferences for policy action. To the best of our knowledge, the present study is the first of its kind.

In the following section, we outline a set of theoretical arguments and their expected empirical implications. This is followed by a presentation of the study design, the empirical findings, and a section in which we discuss these findings, their policy implications, and pathways for future research.

2. Theoretical arguments and expected empirical implications

According to the Environmental Kuznets Curve (EKC) model (see for an overview Spilker et al., 2017), high levels of economic welfare are associated with stronger postmaterial values, including environmental concern, which in turn results in increased mass public demand for environmental protection (Ekins, 1997; Harbaugh et al., 2002; Rothman, 1998; Stern, 2004). Such public demand is a key driver of environmental quality and helps to explain why democracies, at some point of relatively high income, could be improving their environmental performance despite additional increases in economic output (Dinda, 2004; Atwi Saab et al., 2018).

Recent research focusing on total global environmental impacts of local consumption argues, however, that empirical evidence for this argument does not uphold when switching from a territorial to a consumption-based impact perspective – over the past few decades, the extraterritorial environmental impact of consumption has in fact increased rather than decreased for many high-income democracies, even while their domestic environmental impact has decreased at the same time (Peters et al., 2011; Knight and Schor, 2014).

Knowledge of this challenge appears to be rising in academia and policy-making (Wiedmann et al., 2020; O'Neill et al., 2018). Green economy and sustainable consumption advocates in many high-income countries are thus shifting their focus towards global environmental impacts of national economic activity (Palacková, 2019). However, ambitious and thus costly policy action to mitigate international environmental impact shifting and achieve globally sustainable levels of local consumption eventually requires that consumers and citizens care equally about environmental impacts of their consumption both at home and abroad (Barnett et al., 2010).

Knowing is commonly regarded as a prerequisite for caring about a societal problem and supporting solutions to it (Krosnick et al., 2006). In other words, knowing how consumption impacts the environment not only locally, but also abroad, is a necessary (but probably not a sufficient) condition for supporting costly policy interventions aimed at "cleaning up" global supply chains. The information deficit model thus provides a useful starting point for our research for two reasons (Bulkeley, 2000).

First, to our knowledge there is no literature that assesses information effects with regards to domestic vs. foreign environmental impacts of local consumption. Other than in related areas such as climate policy (e.g. Ding et al., 2011) we do not know how much consumers and citizens actually know about the issue of global impacts of consumption, how a (potential) information gap could be closed, and what implications this could have for policy preferences in this area (Chiambaretto et al., 2021).

Second, and more importantly, knowledge actually most likely is a relevant bottleneck in Switzerland, on which we focus empirically (thus far, similar data on other countries is lacking). A nationally representative survey of the population indicates that, in 2018, only 38% of Swiss residents perceived environmental impacts of Swiss consumption to accrue primarily abroad. 17% replied that they accrue primarily domestically, and 45% that they accrue abroad and domestically in equal proportion (Fig. 1).[1] In reality, more than 70% of the global environmental impact of Swiss consumption materializes abroad (Frischknecht et al., 2018). Hence, severe misperceptions prevail in the Swiss population. Such misperceptions could have major consequences for public support for global supply chain policies. For instance, if citizens, who are also consumers, underestimate their global environmental footprint while noticing local environmental improvements, they might be inclined to be satisfied with current levels of environmental policies, and not extend environmental concern beyond the national setting or for global supply chains.

In this article, we first examine whether such a gap in factual knowledge with respect to global environmental impacts of local consumption can be closed when citizens are exposed to credible information. While we expect this to be the case on average, whether and to what extent citizens actually take up factual information is by no means guaranteed. Reasons that could prevent knowledge-updating could be inattention (Alvarez et al., 2019, complexity in processing information (Viswanath and Finnegan Jr, 1996), or biases therein (Benegal and Scruggs, 2018). It is worth noting that the first hypothesis is related to the concept of survey-experimental manipulation checks (Mutz and Kim, 2020; Mutz and Pemantle, 2015), whereby we assess whether, in a

[1] These figures are from a pre-treatment wave of the Swiss Environmental Panel survey whose data we use for the empirical analysis in this article (Rudolph et al., 2021).

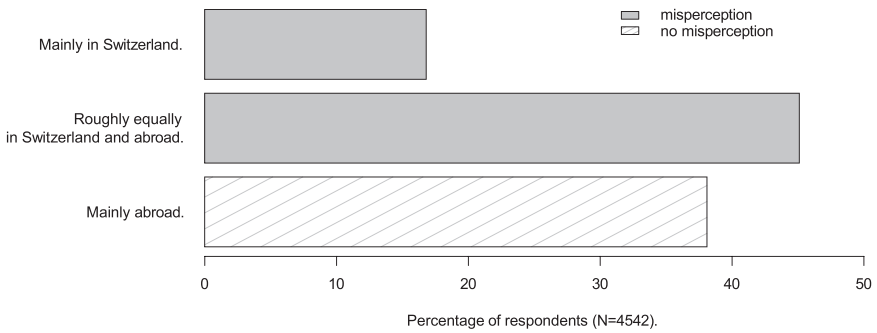


Fig. 1. Answers to survey question on where the largest share of environmental impacts of Swiss consumption accrues, data from first wave of Swiss Environmental Panel (Rudolph et al., 2021).

first step of a causal chain, the theoretical construct "knowledge" is indeed manipulated by the treatment. As the above-mentioned factors might induce heterogeneity in information uptake, we also address the question of heterogeneity in subgroups of prior knowledge, education, and partisanship (discussed at the end of this section). As a first step in our argument, Hypothesis 1 thus focuses on the extent of information-based updating of knowledge levels.

Hypothesis 1. Exposure to information on global environmental impacts of local consumption substantively increases individuals' knowledge on this subject.

However, becoming aware of global environmental impacts of local consumption does not necessarily imply that individuals will develop concern and update policy preferences on this issue, once they have received more information on it. First, they may refuse to develop an opinion on this subject. Second, economic models of citizens' demand for environmental quality would let us expect that concern for these extraterritorial impacts might not develop, as citizen are not affected personally – following "the motto 'out of sight, out of mind' … [that if] voters or decision makers do not themselves suffer from the consequences of pollution, they will not demand or order pollution reductions, unless they have other motives for doing so" (Vogel, 1999, 182). It is hence an open question whether ethical responsibility, or similar reasons, lead to such concern, and whether individuals actually perceive foreign environmental and social impacts as something negative. Prior research indicates that in an affluent society such as Switzerland, we might assume that high levels of post-material values have developed that also lead to information translating into concern (Inglehart, 1995). This has been shown for our country case, and extraterritorial environmental (and social) impacts of production (Rudolph et al., 2022). We hence assume that citizens, on average, follow some norms of responsibility for action, and therefore expect that individuals who receive information that Switzerland offloads a large share of its total environmental footprint of consumption abroad are on average more likely to also develop an opinion about this issue and perceive these environmental impacts abroad as problematic.

Hypothesis 2. Exposure to information on global environmental impacts of local consumption induces individuals to perceive these global environmental impacts as problematic.

Even if individuals update their knowledge on global environmental impacts and perceive them as problematic, it remains open whether they will endorse potential solutions to the problem. We expect, however, that reducing the information deficit will in general induce citizens to be more supportive of policies that address the issue (H3).

It is worth noting that comparable research on information effects in environmental policy-making, which focuses mostly on climate change (Walsh and Tsurusaki, 2014; Malka et al., 2009), arrives at inconclusive findings on this matter. Some of this research suggests that closing information gaps has some (modest) positive effects on support for more ambitious climate policy (Diamond et al., 2020). Other studies argue that providing more information does not necessarily result in the mass public lining up its policy preferences with prevailing scientific opinion (Norgaard, 2006; Suldovsky, 2017).

Looking at the drivers of these different results, Shi et al. (2016) find that the effect depends on the type of knowledge: "Higher levels of knowledge about the causes of climate change were related to a heightened concern. However, higher levels of knowledge about the physical characteristics of climate change had either a negative or no significant effect on concern." (Shi et al., 2016, 759). The information provided in our experiment falls into the former category, leading us to expect potentially positive effects on concern.

Hypothesis 3. Exposure to information on global environmental impacts of local consumption induces more support for mitigation policies.

Finally, we propose that information deficits and the implications of reducing them, are likely to differ by characteristics of individuals. We develop particular arguments in this regard, based on theoretical arguments about A) which citizens are likely to exhibit particular gaps in issue knowledge (Viswanath and Finnegan Jr, 1996), and B) partisan information gaps (Benegal and Scruggs, 2018). We propose that take-up and use of information likely differs across these subgroups. Thus far, we know little about this question empirically, however, though understanding whether and how particular subgroups update information will help to develop expectations on how information provision could affect policy coalitions supporting mitigation of environmental impact shifting.

First, from the perspective of the knowledge gap hypothesis (Viswanath and Finnegan Jr, 1996), we expect citizens with higher education and higher income levels to know more about the issue (Hwang and Jeong, 2009).[2] Even though misperceptions are still widespread in these subgroups as well, we expect high-education and high-income subgroups to experience less informational value from new information (provided through our treatment) on global environmental footprints of local consumption. In addition, as stipulated by the knowledge gap hypothesis, education moderates the ability to take up and process new information, leading to higher educated individuals acquiring new information better (Lind and Boomgaarden, 2019). However, with increasing income,[3] policies on mitigating environmental impact shifting become more costly in absolute terms, which may result in individuals with a higher income being more informed about the issue but

[2] This becomes apparent in our pre-treatment data: 50% of respondents with a high education level correctly perceive footprints to primarily accrue abroad compared to only 31% of respondents with a low education level. With respect to income, 43% of respondents with an income in the highest income quartile perceive environmental impacts to primarily accrue abroad compared to 34% of respondents with a an income in the lowest quartile (Rudolph et al., 2021).

[3] Income is positively linked to a higher environmental footprint (Kennedy et al., 2014).

less concerned and less willing to support costly policies (Norgaard, 2006; Kennedy et al., 2015).

Second, in accordance with the partisan information gap argument, we expect that citizens process information differently, depending on their prior attitudes and partisan views (Benegal and Scruggs, 2018). It is worth noting that correct perceptions (in terms of where environmental footprints accrue) are more likely for individuals who align with a leftist political ideology, even though misperceptions are widespread in these subgroups as well.[4] Consequently, we expect that additional information has a smaller effect on knowledge and preferences of citizens with a leftist ideology. On the other hand, considering potential processes of motivated reasoning (Bartels, 2002; Lewandowsky et al., 2013; Kahneman and Tversky, 1996), individuals may selectively process and/or discount new information depending on whether it conforms with or contradicts prior worldviews or beliefs. Here, we expect that individuals who align with a rightist ideology perceive global environmental impacts as less problematic (Veenstra et al., 2016) and change opinions less when exposed to new information on this subject.

In addition to effects of political ideology (but also income and education) on motivated reasoning, we argue in line with Nyhan and Reifler (2010) that misperceptions moderate the uptake of knowledge and the level of concern independent of political ideology, income, and education. When individuals are introduced to new information that contradicts their prior knowledge, we expect them to be less likely to increase their stated issue knowledge or to decrease their stated issue knowledge (indicating a *"backfire effect"*).

3. Study design

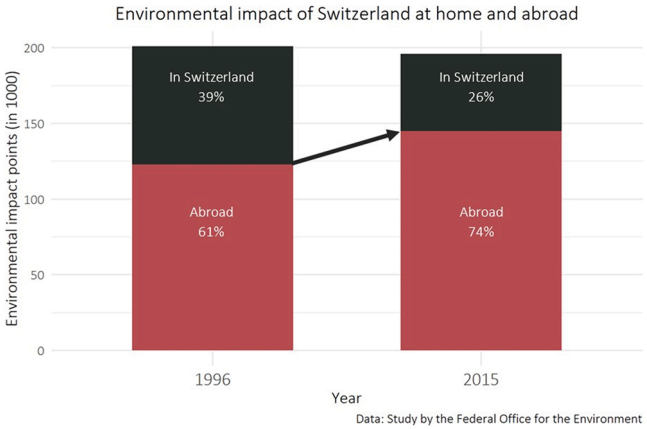
We empirically assess the above arguments with data from the Swiss Environmental Panel (SEP) (Quoß et al., 2021). Switzerland is an interesting country case for our purposes. It is among the most affluent countries in the world, a mature democracy, and more than 70% of its total environmental footprint of consumption materializes abroad. Data from multi-national surveys shows that general levels of environmental concern in Switzerland are similar to those in other high-income countries, suggesting that findings for other countries might turn out to be rather similar (Franzen and Vogl, 2013).

The data used for this article is from a wave of the SEP that was fielded between November 2019 and April 2020 (80% of fieldwork was completed by December 13). The stratified random sample is representative of the Swiss resident population 18 years and older. Sampling is based on information provided by the Swiss Federal Statistical Office. 8280 participants took part online and an additional 2780 in paper and pencil form in this wave, but the experiment analysed in this study was implemented only in the online version.

3.1. Vignette experiment

To assess the effects of providing information on global environmental effects of local consumption, we randomly exposed survey participants to information (or no information, in the control group) on this matter. The control group received one sentence of brief introduction to the set of subsequent questions: *All goods that we use or consume in Switzerland ("Swiss consumption") cause an environmental impact during manufacture, transport, sale and use.* The treatment group received the following information consisting of both text and a figure that illustrated the information provided in the text:.

> *All goods that we use or consume in Switzerland ("Swiss consumption") cause an environmental impact during manufacture, transport, sale and use. These goods are produced both in Switzerland and abroad. Therefore, part of the environmental impact occurs in Switzerland and part abroad. A study by the federal government shows:*
>
> a) The overall global environmental impact of Swiss consumption has remained almost the same for more than 20 years.
>
> b) The proportion of environmental pollution occurring within Switzerland has fallen sharply.
>
> c) The proportion of environmental pollution occurring abroad has risen sharply. Nearly 75% of Switzerland's environmental pollution occurs in other countries, as more and more of the goods we use or consume are produced abroad.
>
> There is also another important point: The total, i.e. global, environmental impact of Swiss consumption is much greater per capita than in most other countries in the world. If every person in the world had the same impact on the environment as every person living in Switzerland, we would need around three planets. You can see this information again in the following graph:



It is important to note that these pieces of information are based on real-world data from Frischknecht et al. (2018). The last sentence of the treatment referring to the need for three planets if every person in the world had the same environmental footprint as people in Switzerland was taken from the wording of a national policy proposal (green economy initiative), which was voted on in 2016 (rejected with 63–37%).

After this, respondents both in the treatment and control group were asked to what extent they agree or disagree with a set of eight statements (presented in randomized order). For this we used a Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The scale also included a "don't know"-option. With the "don't know" responses, we are able to analyze the degree of uncertainty. The eight statements on issue knowledge, issue concern, and policy preferences are listed in Table 1. The first item measures respondents' knowledge of the global environmental impact of Swiss consumption. With respect to issue concern, three items measure respondents' evaluation of the situation, how they

[4] 52% of respondents identifying themselves as politically left correctly perceive environmental impacts to primarily accrue abroad [12% domestically, 36% at home and abroad].

Table 1
Survey Items on Issue Knowledge, Issue Concern, and Policy Preferences.

Category	Item
Issue Knowledge	• *Most of the environmental pollution caused by the use and consumption of goods in Switzerland occurs abroad.*
Issue Concern	• *The environmental impact caused by Switzerland abroad is far too high.*
	• *What other countries do with their environment and what the state of the environment is there is none of our business.*
	• *When other countries export goods to Switzerland, they benefit economically. Therefore, they also have to accept environmental damage in the production of these goods.*
Policy Preferences	• *We need to provide much more support than in the past to poorer countries to better protect their environment.*
	• *Voluntary measures taken by Swiss importers to control their international supply chains are sufficient to ensure that imported goods are produced abroad in an environmentally friendly manner. There is no need for new government regulations.*
	• *If a Swiss company produces goods abroad, its activities there should be subject to the same strict environmental regulations as in Switzerland.*
	• *Switzerland should only allow products from abroad to enter Switzerland if they are manufactured under strict environmental regulations, even if these products then become more expensive.*

assess it and whether they are concerned. The remaining four items capture respondents' preferences for policies and other actions. Included are a wide set of policies that could potentially mitigate environmental impact shifting, such as import restrictions of pollution-intensive goods (Sakai and Barrett, 2016) or voluntary business initiatives (Kolcava and Bernauer, 2021; Kolcava et al., 2021). To check if our items capture different dimensions, we conducted a principal component analysis (PCA) in Appendix Section A.4.

3.2. Items on subgroup characteristics

In addition to our main survey items, we gathered information on a number of subgroup characteristics, such as formal education, income, political ideology, and misperceptions. We capture respondents' education level with three categories ("low" corresponds to compulsory school or lower, "middle" ranges from apprenticeship to higher technical/vocational training, and "high" ranges from higher technical training to university). Income is measured in five income-categories ("low", "lower-middle", "middle", "upper-middle", "high") on the basis of income quantiles. Concerning political ideology, we employed an 11-point scale from left to right ("left" as a category for values 1–4, "center" for values ranging from 5 to 7, and right for values 8–11).

To assess the role of misperceptions on the treatment effect, we made use of items that were included in a previous wave of this panel survey. In a pre-treatment wave we asked respondents about their knowledge about the environmental footprint of Swiss consumption. Respondents were asked if the environmental footprint of Swiss consumption accrues mostly abroad, at home, or at an equal share at home and abroad. Since most of the environmental impact of Swiss consumption accrues abroad, we categorize the perception that the Swiss footprint accrues mostly at home or to equal shares at home and abroad as misperceptions. We link the data of the pre-treatment survey and the survey with the treatment through personal identifiers. Capturing misperceptions in a pre-survey wave ensures that respondents are not directly primed on the matter before entering the treatment/control conditions.

The survey also included items on general environmental attitudes (Diekmann and Preisendörfer, 2003), and various other items we use for the analysis (for the full survey item wordings, see subsection A.2 in the appendix). As we implemented the survey project in Qualtrics, we also gathered data on the time respondents spent on each survey page. We analyze the data by employing bivariate and multivariate linear regressions.

3.3. Statistical methods

To allow for robust statistical identification of causal relationships between the provision of information, issue knowledge, issue concern, and policy preferences, we rely on an experimental approach (Mutz, 2011). Because we ensured that the control group and treatment group exhibit, as expected, balance on potential socio-demographic and political confounding variables (see Appendix Table A.2), and hence are confident that randomization worked well, we can conduct difference-in-means tests (corresponding to a bivariate linear regression) to estimate the causal effect of information provision (Angrist and Pischke, 2009). For this we assume that we can interpret the 5-point Likert scale as a metric concept. Where we use binary dependent variables, this implies linear probability models, which eases interpretation and is justified given the distribution of our dependent variables (Gomila, 2021). We follow up with logit models (see Appendix Table A.5) to assess the robustness of our findings (Best and Wolf, 2015). To check the robustness of our effects we used the Benjamini-Hochberg procedure (Benjamini and Hochberg, 1995) to calculate adjusted p-values. Where we assess subgroup effects, we define subgroups via binary or three-categorical indicator variables, and estimate models that regress the dependent variable on treatment provision, subgroup indicator(s) and their interaction. For the subgroup analysis, we rely on our exceptionally large sample size (n of around 8000) for adequate statistical power.[5]

4. Results

First, we present our findings for the general effects of the information treatment. Subsequently, we focus on the interaction between the information treatment and individuals' characteristics.

4.1. Providing information on global environmental impacts

In Fig. 2 we present our findings on the effect of the information treatment on agreement/disagreement with the statements regarding issue knowledge, issue concern, and policy preferences. We observe that exposure to our information treatment on environmental impacts (first panel of Fig. 2) leads to a substantial increase in respondents' agreement with the statement "environmental impacts accrue abroad", which we interpret as improved knowledge about global environmental impacts of local consumption for our treatment group. This finding supports our first hypothesis (H1).

Regarding the effect of the information treatment on individuals' evaluation of global environmental impacts (row 2–4 in Fig. 2), we observe that support substantially increases for the statement that global environmental impacts of local consumption are too high. Compared to the control group, the treatment group on average expresses a 0.57 point stronger agreement with the statement. We find no significant differences for the perception that the environmental impact abroad is none of the respondent country's business (with agreement levels already being extremely low) or beneficial to other countries. The strong shift in general problem perception ("impacts too high") supports our expectation that additional information on global environmental impacts of local consumption would increase individuals' perception that environmental impacts pose a problem (H2). At the same time, while respondents may be concerned about the environmental impact of

[5] See discussion in https://statmodeling.stat.columbia.edu/2018/03/15/need-16-times-sample-size-estimate-interaction-estimate-main-effect/.

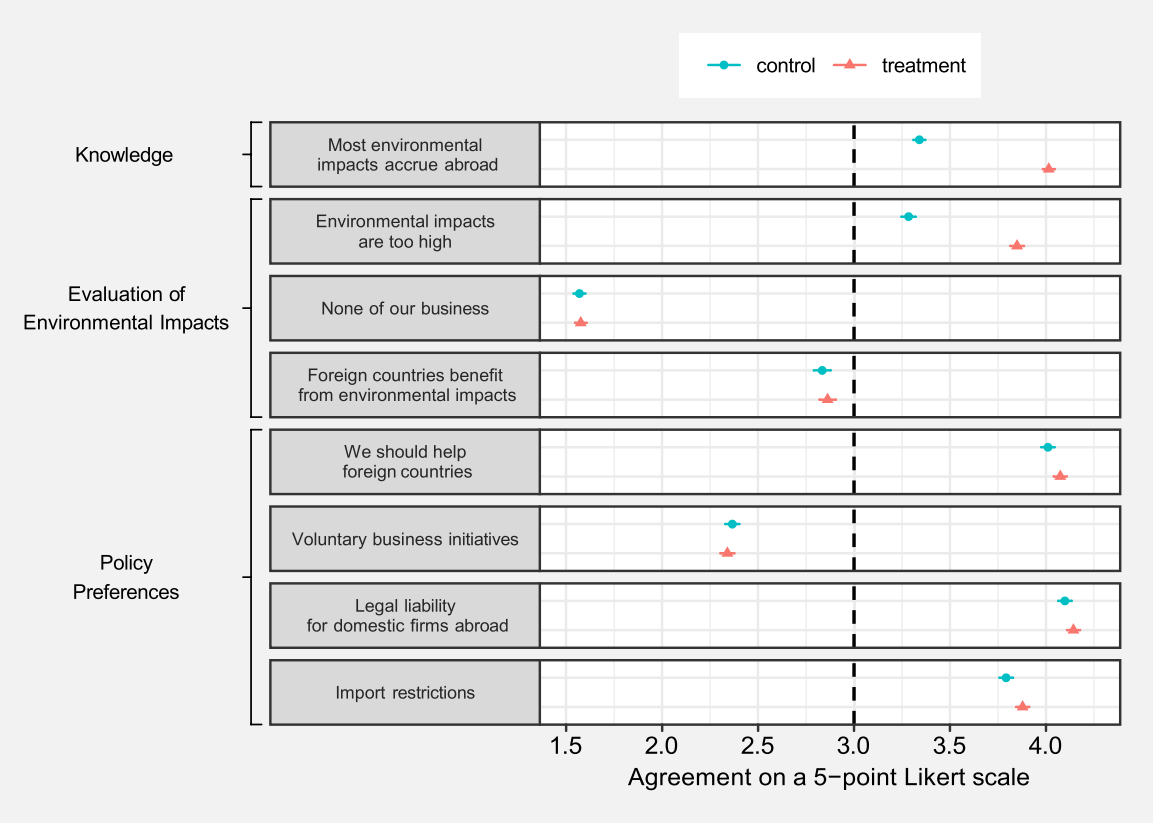


Fig. 2. Summary of all Treatment Effects. Lines depict 95%-Confidence Intervals. Calculated estimates and p-values are presented in Appendix Table A.3.

consumption abroad, their assessments of whether other countries benefit from environmental impact shifting (expressing favor) and/or whether this falls under the responsibility of Switzerland (expressing neglect) seems to be independent from respondents' information level.

The results presented in the bottom panel of Fig. 2, indicate how exposure to new information affects policy preferences with regard to the global environmental impacts of local consumption (presented in four items). Treated individuals are significantly more likely to support additional help for countries that take on the environmental burden of Swiss consumption, and they are significantly more likely to support import restrictions. Support for strict environmental regulation of domestic firms abroad increases, but only statistically significant at the 10% level. We find no statistically significant change in support for voluntary business initiatives. Substantively, treatment effects are much smaller compared to how additional information affects knowledge and evaluation of global environmental impacts. We thus find only mixed support for H3. Differences seem to exist with regard to the specific purpose of the mitigation policy but the overall effects are less pronounced compared to those on issue knowledge and issue concern, which is in line with findings of previous studies about policy preferences' resistance to change (Rode et al., 2021). Furthermore, the treatment effect does not seem to depend on the costliness of the mitigation policy in question.[6]

After looking at the effect of the treatment on each dependent variable independently, Appendix Section A.3 presents these results in the combined form of a mediation analysis. We find that the overall (substantively small) positive effect of the treatment on policy preferences runs mainly via the indirect path of increasing issue knowledge and concern. Thus, our findings indicate that motivated reasoning might impede the increase in issue knowledge, issue concern, and eventually policy support.

In addition, we examined how providing information on environmental impacts of consumption affects respondents' confidence regarding their issue knowledge, and the extent to which they have formed attitudes regarding the concern and policy preference items. For this, we examined the percentage of "don't know" answers (displayed in Appendix Figure A.3). For the knowledge item, we interpret a decrease in the share of "don't know" answers as an indirect manipulation check showing whether respondents have understood the treatment. For the other items on the other hand, choosing "don't know" can rather be interpreted as being uncertain (in part due to lacking knowledge) and thus showing no formed attitude (Alvarez and Franklin, 1994).

We observe rather high levels of uncertainty about where environmental impacts accrue. In the group that did not receive information on environmental impacts, over 14% of respondents answered that they do not know whether environmental impacts linked to Swiss consumption largely accrue at home or abroad. In the treatment group, this share is more than four percentage points lower, showing a large increase in issue knowledge due to the information treatment. With respect to issue concern, for two out of three items, we see a decrease in uncertainty. This is (with a decrease of about 7% points) particularly pronounced for the assessment of whether environmental impacts abroad are "too high". For the items indicating policy preferences, we see increases in uncertainty for three out of four items (albeit substantially small and significant only for import restrictions). Respondents who received the information treatment expressed higher levels of uncertainty about whether restrictions on imports should be imposed.

We interpret these findings on uncertainty such that receiving additional information decreases uncertainty about the issue and its

[6] Individuals who receive the treatment do not perceive less costly mitigation policies (support for producing countries) as more attractive while perceiving more costly policies (import restrictions that would increase retail prices) as less attractive.

evaluation, but marginally increases uncertainty over how to deal with "outsourcing" of environmental impacts (e.g. by helping foreign countries and by implementing import restrictions).

4.2. Individual-level attributes

We now move to the question of whether individual-level attributes (education, income, political ideology, prior misperceptions concerning the distribution of environmental footprints) moderate information-acquisition treatment effects and affect issue knowledge, issue concern, and policy preferences.

4.2.1. Education

Factors such as education, income, and political ideology are likely to affect the uptake of additional information and the evaluation of global environmental impacts in general. We expect higher education to correlate with more knowledge and more concern about environmental impacts. Fig. 3 presents corresponding interaction effects of education with treatment exposure on issue knowledge and issue concern. As expected, higher education correlates with more issue knowledge and higher issue concern to begin with.

Concerning the moderation of information treatment effects, with low (compared to average) education, we find no significant differences for issue knowledge and issue concern – it is worth noting, however, that the issue knowledge item is affected in the expected direction and to a relatively large extent at about 0.2 scale points. For high (compared to average) education, we find significant increases in issue knowledge and significant decreases (but only at the 10% level) for "foreign countries benefit". With respect to policy preferences, Appendix Table A.6 shows that high (compared to average) education significantly increases (but only at the 10% level) support for import restrictions and decreases support for voluntary business initiatives. Appendix Table A.10, which depicts all individual-level attributes in a multivariate regression for the treatment group, also indicates that individuals with lower levels of education favor voluntary business initiatives to mitigate environmental impacts abroad. However, it should be noted that the effect of education almost disappears when controls for misperceptions are added (Appendix Table A.11). Taken together, what we observe with respect to education does not support our expectations on a knowledge gap closure, especially for individuals with lower levels of education. Education does not seem to be an important moderator of additional information on issue knowledge and issue concern. Only respondents with already high levels of education update their issue knowledge (but not issue concern) when approached with new information.

4.2.2. Income

Next, we investigate moderation by income. As indicated in Fig. 4, higher income correlates with more issue knowledge and more concern about global environmental impacts. At the same time, higher income is not associated with more support for policies that mitigate environmental impact shifting (Appendix Table A.10, (5)-(8)). This indicates that even though higher income individuals are more concerned about the environmental impact of domestic consumption abroad, this concern does not translate into support for policies to mitigate these environmental impacts. One possible explanation could be the costs of mitigation policies, as various studies show that more affluent individuals hold greener preferences (on average), but are responsible for a larger environmental footprint (both domestically and abroad), whose reduction thus results in progressive opportunity costs (Chancel and Piketty, 2015; Sager, 2019; Koslowski et al., 2020; Bruderer Enzler and Diekmann, 2015).

Concerning the moderation of treatment effects, respondents with higher income are more likely to update knowledge with respect to impacts of local consumption. In regard to issue concern, higher income respondents do not indicate stronger agreement to "impacts are too high", but rather indicate stronger agreement that "other countries benefit" (although insignificant, $p = 0.16$). Concerning policy preferences, Appendix Table A.6 shows that income only moderates treatment effects for support for voluntary business initiatives (significant only at the 10% level). In sum, these findings show that the treatment effect of additional information on global environmental impacts is moderated by income with respect to issue knowledge but not with respect to issue concern. This lack of correspondence between issue knowledge and issue concern seems to affect lower levels of support for policies to mitigate international environmental impact shifting.

4.2.3. Political ideology

Next, we assess moderation by political ideology (Fig. 5). To begin with, as expected, we note that the more on the political left a respondent is, the more this respondent indicates issue knowledge and issue concern (with political ideology turning out to be an even more important predictor than income (Appendix Table A.10)). However, informing respondents has slightly different effects on the political left and right. Compared to respondents with a centrist ideology, left-leaning respondents are more prone to update their knowledge on environmental impacts of local consumption when receiving additional information. With respect to issue concern, political ideology does not moderate the treatment effect if respondents perceive the environmental impact as too high. However, when treated, right-leaning respondents

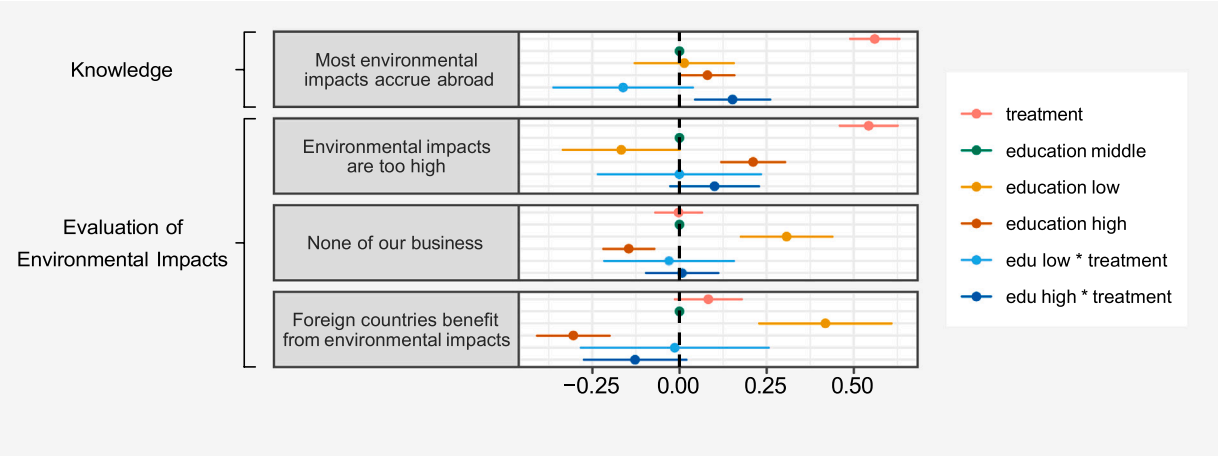


Fig. 3. Education and treatment effects. Reference category for education is average level of education. Education is measured with three categories ("low" corresponds to compulsory school or lower, "middle" ranges from apprenticeship to higher technical/vocational training, and "high" ranges from higher technical training to university). Estimates and p-values are presented in Appendix Table A.6.

are even more likely to think that the environmental impact abroad is none of their country's business. With respect to policy preferences, Appendix Table A.8 shows that political ideology does not moderate treatment effects. Taken together, we observe that political ideology moderates issue knowledge merely for left-leaning individuals, but not issue concern. For right-leaning individuals the treatment only increases their notion that environmental impacts in other countries are none of their business. The overall null effects for right-leaning individuals on issue knowledge and concern could be the result of two effects that cancel each other out: on the one hand, they know less to begin with and have more to learn from the information treatment (knowledge gap hypothesis), on the other hand, they might be less willing to process and discount this information (motivated reasoning hypothesis).

4.2.4. *Misperception*

To further explore the empirical relevance of arguments on motivated reasoning, we now turn to pre-existing knowledge of individuals about environmental impacts of domestic consumption. To assess the effect of pre-existing knowledge, we use data from a previous wave of the Swiss Environmental Panel where we asked respondents about where global environmental impacts of Swiss consumption tend to accrue (see Fig. 1). Respondents who answered that most of the environmental impact accrues in Switzerland or who answered that half accrues abroad and half accrues in Switzerland can be considered to hold misperceptions about the global environmental impact of Swiss consumption.

In Fig. 6, we show the effects of the information treatment moderated by respondents' prior misperceptions about the Swiss environmental footprint (with the reference category being respondents without prior misperception). As expected, a larger prior misperception correlates with both lower issue knowledge and also lower issue concern. Respondents who hold misperceptions are much more likely to state that foreign countries benefit from international environmental impact shifting (thereby viewing the accumulation of environmental impacts as a proxy for economic development).

Concerning the moderation of treatment effects, we observe no effect of misperception on the uptake of information. However, misperception appears to moderate treatment effects with respect to respondents agreement to "impacts are too high" in the opposite of the expected direction, indicating that respondents with strong misperceptions do not update their issue knowledge but increase their issue concern. Medium level misperceptions also decrease the notion that "foreign countries benefit". With respect to policy preferences, misperceptions do not moderate the effect of information except for support if other countries

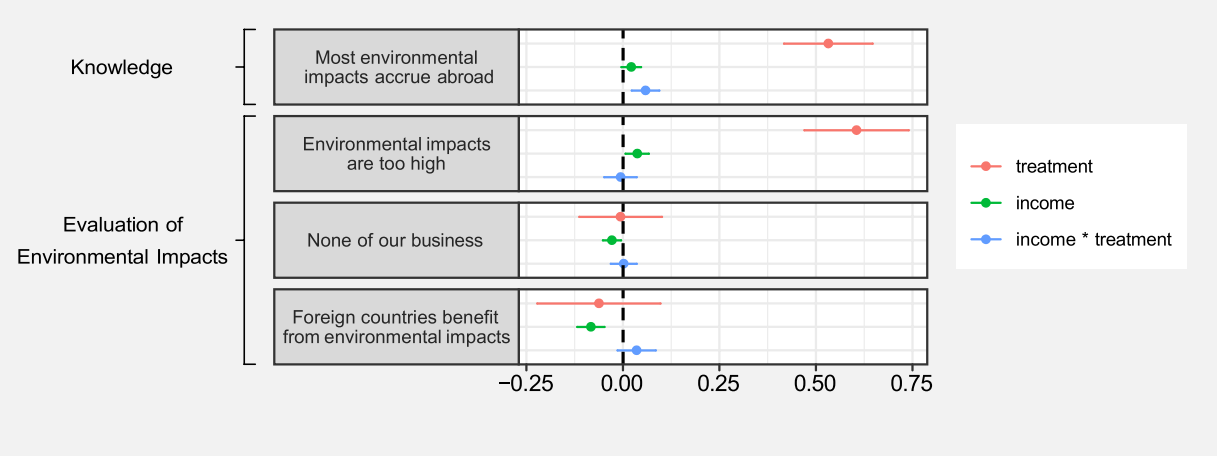


Fig. 4. Income and treatment effects. Income is measured in five income-categories ("low", "lower-middle", "middle", "upper-middle", "high") on the basis of income quantiles. Estimates and p-values are presented in Appendix Table A.7.

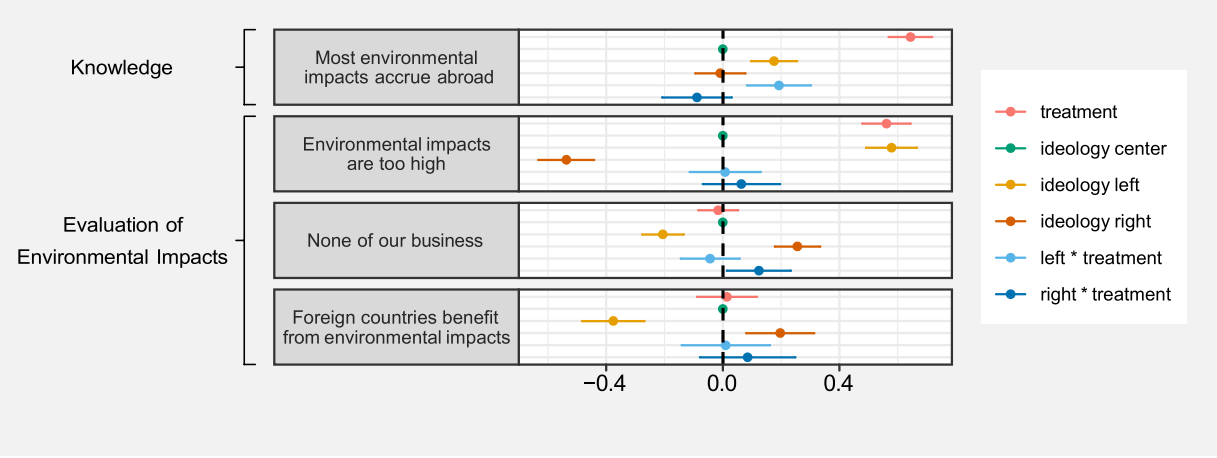


Fig. 5. Political ideology and treatment effects. Reference category is ideology center. Political ideology is measured on a 11-point scale from left to right ("left" as a category for values 1–4, "center" for values ranging 5–7, and right for values 8–11).Estimates and p-values are presented in Appendix Table A.8.

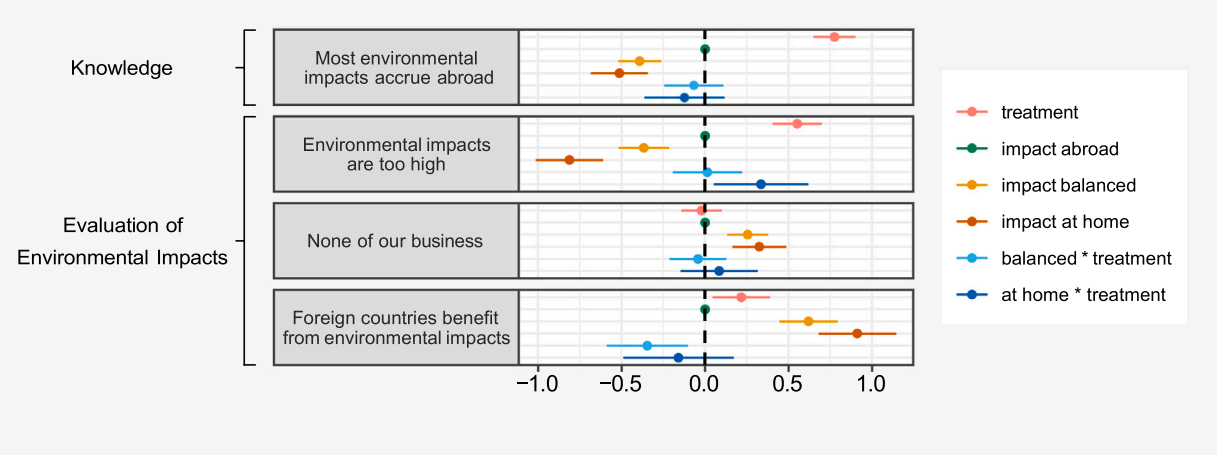


Fig. 6. Effect of misperception. Reference category is no misperception ("impact abroad"). Estimates and p-values are presented in Appendix Table A.9.

should receive help to deal with environmental issues (Appendix Table A.9). Those who hold the misperception that the environmental impact of Swiss consumption is balanced (compared to no misperception) are less supportive of help for foreign countries when receiving information (significant decrease but only at the 10% level, see Appendix Table A.9). If weak misperceptions are a proxy for the respondents ambivalence, our findings seem to contradict insights by Steenbergen and Lavine (2018) on the positive effect of ambivalence on the correction of prior biases.

One could argue that misperceptions might be a consequence of low levels of environmental concern, which influences both issue knowledge and issue concern. However, as shown in Appendix Table A.11 in the appendix, when controls for environmental concern and political ideology are added, the effect of misperception still remains significant. This suggests that the effect of misperception is not simply a function of low levels of environmental concern or a rightist political ideology. For robustness, we also check if treatment effects are influenced by trust in science. Malka et al. (2009) find for the US context that party affiliation and the level of trust in science of survey respondents matters – increased knowledge is associated with increased concern about climate change only for those respondents who either trust the information provided by scientists or who identify as Democrats or Independents. For the Swiss context, we do not expect a comparable level of political polarisation, but the effect of trust in science could still be relevant (Huber et al., 2021, but see Diamond et al., 2020). As shown in Appendix Table A.12, trust in science does not moderate the treatment effects.[7]

5. Conclusion

Our research and its results speak to a growing literature on the trade-environment nexus, and how to make global supply chains more sustainable. The shifting of environmental impacts of consumption from higher-income to lower-income countries (Kolcava et al., 2019), above all via international supply chains, creates major challenges in trying to arrive at a mutually beneficial process of economic globalization for the Global North and South (Boyce, 2004) and for successfully tackling climate change (O'Brien and Leichenko, 2000). International institutions have been calling on multinational corporations of the Global North and their governments to make their global supply chains more sustainable (United Nations, 2011; OECD, 2018). But only recently, and accompanied by highly politicized debates, this is beginning to reflect in actual government policies.[8] Public pressure is one crucial component in trying to better understand where this materializes – for our setting, Switzerland, Rudolph et al. (2022, 2) e.g. argue that "public pressure induced political elites, against their prior policy positions, to support [legislation on sustainable supply chains] that is now being implemented and goes beyond policy in several other high-income democracies." Consequently, in this article we explored the influence of one potentially important precondition for such public pressure, factual knowledge of the issue (Krosnick et al., 2006; Bulkeley, 2000).

Particularly, we studied how factual information on international environmental impact shifting could affect citizens' issue knowledge, issue concern, and policy preferences with respect to global environmental impacts of domestic consumption, and policies for mitigating such impacts.

We arrive at three main findings: First, our research reveals a considerable gap in knowledge in this domain, similar to related areas, most prominently climate change (e.g. Walsh and Tsurusaki, 2014; Malka et al., 2009). Consequently, increasing knowledge on how consumption impacts the environment not only domestically, but also abroad, could contribute to enhancing public policy support for more ambitious measures in this domain.

Second, our research indicates that exposure to more information on this issue substantively increases issue knowledge and issue concern, in line with findings in related research on how specific types of information can shape public perceptions of environmental issues (Shi et al., 2016).

Third, regarding preferences on policies to mitigate these impacts, we find that exposure to additional information leads to small increases in support for helping other countries reduce local environmental impacts from producing goods for Switzerland, and support for import restrictions on environmentally harmful products. Mediation analysis shows that this effect is mainly due to an increase in issue knowledge and issue concern, as expected in our theoretical argument. Yet, support for voluntary business initiatives and stricter environmental regulation in this domain does not change when individuals are exposed to information on the environmental impacts of Swiss consumption abroad.

[7] We also looked at trust in the government, parliament, environmental organizations, and media (not shown in this analysis) of which none moderated treatment effects.

[8] See e.g. discussions in the European Union and its member states on supply chain governance, e.g. the French *Loi de vigilance*, the German *Lieferkettengesetz*, or, in our country context, legislative action around the "Responsible Business" initiative. For an overview, see https://www.nortonrosefulbright.com/en/knowledge/publications/0ed8097a/around-the-globe-business-human-rights-update.

Because our survey experimental treatment effectively and substantively increased respondents' average knowledge and concern levels, akin to a successful manipulation check, we can be confident that these substantively small changes are not the consequence of an ineffective treatment (Mutz and Pemantle, 2015; Mutz and Kim, 2020). Rather, policy preferences on extraterritorial environmental footprints are unlikely to change as a result of additional provision of factual issue knowledge. This finding is in contrast to some studies on related issue areas; e.g., knowledge on the causes of climate change is strongly related to pro-climate attitudes (Tobler et al., 2012). We find no effects of such strong magnitude. However, our results tie in with recent research showing that trade skepticism is causally related to general environmental concern (Nguyen et al., 2021; Rudolph et al., 2020).

Fourth, we do not find that the provision of factual information is particularly effective in increasing issue knowledge among subgroups of less concerned individuals – commonly, citizens on the political right. Other studies have indicated that closing the gap in issue knowledge might be possible through more media exposure (Yang and Ho, 2017). However, individuals who previously held misperceptions of environmental impact shifting update their knowledge as strongly as individuals without misperceptions, and increase their concern about impacts over-proportionally.

The main policy-implications of our findings are twofold. On the one hand, more science-based information on country-external environmental impacts of domestic consumption can be effective in terms of raising mass public awareness and concern about this issue, similar to what has been shown by research in the climate domain (Shi et al., 2016; Lyytimäki et al., 2013; Wibeck, 2014). Yet, in order to effectively increase knowledge and concern also among parts of society that normally pay less attention to environmental issues, provision of factual information seems insufficient. This applies even in an empirical setting (Switzerland) where groups with lower levels of environmental concern have comparatively high levels of education or income (due to rather low levels of societal inequality (Chancel et al., 2021)).

On the other hand, more knowledge does only appear to marginally increase public support for policy interventions that could mitigate environmental impacts in our setting, in contrast to strong associations observed in related domains (Tobler et al., 2012). Hence, while we observe issue knowledge to increase, information does not substantively affect citizen preferences along a broad menu of options discussed in current political practice in the field of global supply chains governance – trade policy (e.g. Brandi et al., 2020), voluntary corporate action (Kolcava et al., 2021, government regulation of supply chains (Rudolph et al., 2022), or green foreign aid (Roberts et al., 2009). It is even worrying that factual information increases existing gaps in knowledge and concern among the left and right of the political spectrum, negatively affecting the potential for political coalitions. This points to the importance of fundamental worldviews and values that individuals hold in shaping policy support (Bechtel et al., 2019), and indicates that increasing knowledge is no panacea for increasing policy support.

Future research could investigate whether information provision that at the same time communicates societal or international norms could be more effective (see Fesenfeld et al., 2022; Rudolph et al., 2022). Another fruitful pathway for future research might be the cross-examination of our empirical findings in other country contexts, for which our study could serve as a useful template. Our empirical focus on Switzerland comes with a specific societal and institutional setting in which our findings must be interpreted. As shown in detail by Rudolph et al. (2020, Appendix A.4), economic openness is vital to the Swiss economy, which also exhibits a very high, and increasing, environmental footprint abroad. And while the country in principle follows a consociational approach in policy-making, both trade and environmental policy are politically contested. At the same time, pro-environmental attitudes, knowledge on trade, and attitudes towards trade policy are comparable to other high-income countries.

It would be particularly interesting to assess whether information provision works differently in settings characterized by different types of polarization (on the issue or societal level). Recent research indicates that science communication can increase issue polarization (Hart and Nisbet, 2012) due to motivated reasoning. While this is studied mostly for highly politicized political issues (Su, 2022), our research ties in with results of Stanley et al. (2020), suggesting that this can occur also for political topics of lower salience (Stanley et al., 2020). At the same time, such polarization is observed particularly in contexts with a polarized party system, where elite cues become important and information accuracy is contested (Bayes and Druckman, 2021), and/or where information is related to perceptions of identity (Kahan, 2012). This is likely not to be the case in our setting. Though, in our case, factual information increased knowledge polarization among the political left and right, it is important to note that both political camps aligned their perception with reality on average.

CRediT authorship contribution statement

David Presberger: Conceptualization, Methodology, Software, Validation, Formal analysis, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration. **Franziska Quoß**: Conceptualization, Software, Formal analysis, Investigation, Resources, Data Curation, Writing - Review & Editing, Visualization, Supervision. **Lukas Rudolph**: Conceptualization, Investigation, Writing - Review & Editing, Supervision. **Thomas Bernauer**: Conceptualization, Investigation, Writing - Review & Editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2023.04.019.

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