

ARTICLE

Perceived economic inequality inhibits pro-environmental engagement

Rongmian Huo¹ | Shasha Yang²  | Cai Dong³ | Sijing Chen⁴ 

¹College of Humanities and Foreign Languages, China Jiliang University, Hangzhou, China

²School of Psychology and Cognitive Science, East China Normal University, Shanghai, China

³Department of Philosophy, Yonsei University, Seoul, South Korea

⁴School of Economics and Management, Zhejiang University of Science and Technology, Hangzhou, China

Correspondence

Sijing Chen, School of Economics and Management, Zhejiang University of Science and Technology, Hangzhou 310023, China.

Email: chensijing@zust.edu.cn

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Abstract

We currently inhabit an era marked by increasing economic inequality. This paper delves into the repercussions of perceived economic inequality on individual-level pro-environmental engagement and puts forth an explanatory mechanism. Across three empirical studies encompassing an archival investigation employing a nationally representative data set (Study 1), an online survey (Study 2) and an in-lab experiment (Study 3), we consistently unearth the inhibiting effect of perceived economic inequality on individuals' pro-environmental involvement, whether assessed through pro-environmental intentions or behaviours. Furthermore, our findings reveal that individuals' identification with their country elucidates these results. Specifically, perceived economic inequality diminishes individuals' national identification, encompassing their concern for the country's well-being and their sense of shared destiny with fellow citizens, thereby curbing their pro-environmental engagement. Additionally, we conduct a single-paper meta-analysis (Study 4), revealing small to moderate effect sizes for our key findings. Theoretical and practical implications stemming from these novel findings are discussed.

KEYWORDS

national identification, perceived economic inequality, pro-environmental engagement, social identity

INTRODUCTION

The United Nations (2019) highlights climate change and inequality as paramount challenges of our time, suggesting their interconnected nature. Scholarly investigations have revealed a negative correlation between economic inequality and environmental behaviour. Notably, several studies

Rongmian Huo and Shasha Yang contributed equally to this research.

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have established a significant positive relationship between carbon dioxide emissions and income inequality across diverse nations (Baek & Gweisah, 2013; Baloch et al., 2018; Jorgenson, 2015; Liu et al., 2020; Uzar & Eyuboglu, 2019). This article contributes to the existing literature in three significant ways, deepening our understanding of the link between economic inequality and environmental behaviour.

First, while prior studies have primarily focused on national-level environmental behaviour, particularly carbon emissions, the relationship between inequality and individual pro-environmental behaviour remains underexplored, despite individual pro-environmental behaviour playing a crucial role in addressing climate change (Dietz et al., 2009; Rosenthal & Ho, 2020). Second, researchers have predominantly relied on objective indicators like the Gini coefficient to assess the influence of inequality on environmental behaviours. However, Schmalor and Heine (2022) note a weak positive correlation between subjective and objective economic inequality, suggesting that perceived economic inequality may represent a distinct construct, warranting further investigation into its impact on pro-environmental behaviour. Third, building on social identity theory (Tajfel & Turner, 1979), this article proposes a novel account to explain the relationship between economic inequality and pro-environmental behaviour.

To sum up, this article proposes a novel hypothesis: Perceived economic inequality diminishes individual pro-environmental engagement by decreasing social identification. Specifically, the differentiation arising from perceived economic inequality creates social divisions based on wealth (Jetten et al., 2017), hindering individuals' ability to identify with a broader entity, such as the nation. Consequently, it impedes the pursuit of overarching goals aligned with the interests of this larger entity (Kirkland et al., 2023). This overarching hypothesis will be tested across four studies.

Economic inequality and social identification

According to social identity theory (Tajfel & Turner, 1979), individuals derive a sense of belonging and meaning by self-identifying with meaningful groups, which becomes particularly important in coping with social crises. Identification can occur at various levels, such as with a community, a nation or humanity as a whole (Rosenmann et al., 2016). Engaging in superordinate tasks, like addressing large-scale challenges such as climate change or controlling the COVID-19 pandemic, often requires individuals to identify with a broader entity (Grimalda et al., 2023). However, the dynamics of social identification can be influenced by contextual factors, including economic inequality.

According to social identity analyses of economic inequality by Jetten et al. (2017, 2021) economic inequality accentuates the role of wealth in self-categorization (Turner et al., 1987). When economic inequality is perceived, individuals tend to primarily view themselves and others in society through the lens of wealth (Jetten et al., 2017; Sánchez-Rodríguez et al., 2020). This concept finds support in the experiments conducted by Peters et al. (2022), wherein heightened levels of inequality (both objective and perceived) correlated with an increased tendency to describe their environment using terms related to wealth and demonstrated sensitivity to cues associated with others' wealth.

Furthermore, the subjective emphasis on the significance of wealth in unequal environments fosters and reinforces wealth-based social differentiation (Bjørnskov, 2008), leading individuals to perceive society as divided into two opposing groups: the poor and the rich. This differentiation impedes the development of trust and weakens in-group homogeneity, both of which are essential for forming an inclusive identity (Martínez & Del Bosque, 2013; Simon & Pettigrew, 1990). Additionally, this differentiation affects not only the relationship between these opposing groups but also extends to arbitrary third parties. For instance, Jetten et al. (2021) found that inequality influenced participants' perceptions of the relationship between the rich and the poor and negatively impacted their expectations of relationships with newcomers. This underscores Wilkinson and Pickett's (2009) argument that economic inequality poses a threat to everyone, regardless of socio-economic status. Such a threat can lead individuals to develop undifferentiated malice and a competitive mentality (Sánchez-Rodríguez et al., 2019).

Economic inequality not only exacerbates generalized competitiveness but also deepens negative perceptions of individuals outside one's immediate social circle (Moreno-Bella et al., 2023), including deteriorating views of the wealthy by the poor and vice versa. Experimental findings by Tanjitpiyanond et al. (2022) indicate that when individuals are prompted to recognize inequality in their environment, they tend to perceive members of the opposite socioeconomic group as having lower levels of morality, friendliness and warmth, regardless of their own socioeconomic status. This shift in perception extends further: Economic inequality diminishes the extent to which individuals perceive members of opposing socioeconomic groups as part of a shared humanity (Sainz et al., 2022).

Integrating these three mechanisms—perceived economic inequality emphasizing wealth as the basis for social categorization, the formation of generalized interpersonal antagonisms and the negative shift in perceptions of the opposite socioeconomic group (Jetten et al., 2017, 2021)—we posit that perceived economic inequality hinders individuals from identifying with a larger collective entity. This encompasses a sense of belonging, a shared fate and empathy and concern for individuals within that entity. Supporting this conjecture, Tanjitpiyanond et al. (2023) observed that, in the workplace, perceived increases in pay inequality were associated with reduced organizational identification and heightened perceptions of workplace conflict. This article focuses on the nation as the target of superordinate identification and investigates whether individual perceived inequality influences overall identification with the nation.

Identification and pro-environmental engagement

Pro-environmental engagement can be viewed as a cooperative behaviour (Barclay & Barker, 2020; De Nardo et al., 2017), involving the sacrifice of individual interests for collective well-being (Zelenski & Desrochers, 2021). Existing evidence suggests that social identification is effective in promoting cooperative behaviour among individuals. For instance, Smith et al.'s (2003) economic game results demonstrated that participants' identification with the collective significantly and positively influenced their cooperative behaviour. Similar findings were reported by De Cremer and Van Knippenberg (2005) and Lin et al. (2017) in organizational settings.

Researchers have proposed various mechanisms to elucidate the augmentation of self-sacrificing cooperation through social identification with a particular collective (Brewer, 2008). One well-discussed thesis posits that identification heightens the expectations of cooperative behaviour from fellow collective members (Foddy et al., 2009; Yamagishi & Kiyonari, 2000). This implies that anticipating cooperative behaviour from others diminishes concerns about potential exploitation. Furthermore, Buchan et al.'s (2011) study demonstrated that, beyond mere expectations of others' cooperation, identification with the collective still amplifies individuals' cooperative behaviour. This may be attributed to a goal transformation when an individual identifies with an entity, fostering a commitment to maximizing the collective good and motivating contributions irrespective of anticipated returns (Reese, 2016). Buchan et al.'s (2011) findings find resonance in organizational behaviour research, as evidenced by Brown et al. (2022) and Simon and Stürmer (2003), who observed that organizational identification correlates with enhanced organizational goal attainment and overall organizational performance.

Given that pro-environmental behaviour represents a distinct form of cooperative conduct benefiting the collective good, we assert a parallel effect in the environmental realm. Specifically, strong superordinate identification positively correlates with heightened pro-environmental engagement, whereas weaker superordinate identification diminishes engagement in pro-environmental involvement.

The present research

This paper presents four studies, with the initial three being empirical and the fourth constituting a single-paper meta-analysis. The primary objectives of the empirical studies are to examine

two hypotheses: (1) perceived economic inequality diminishes pro-environmental engagement and (2) identification with the nation provides an explanatory link in the aforementioned relationship. The empirical studies encompass an archival investigation based on a nationwide survey (Study 1), an online survey (Study 2) and an in-lab experiment (Study 3). To enhance the generalizability of findings, the archival study includes all selectable samples, while the latter two studies have determined appropriate sample sizes using G*Power 3.1 (Faul et al., 2007) in advance. Studies 2 and 3 have been pre-registered on OSF (https://osf.io/j6pbv/?view_only=e4dcc72f972e46a0aba605bef969d444) in adherence to recommended practices in psychological research. Study 4, as a single-paper meta-analysis, concentrates on effect sizes for key findings, offering a valuable reference for future researchers. All procedures, including measures, manipulations, and exclusions, are thoroughly reported in these studies. Raw data have been uploaded to https://osf.io/sa2fq/?view_only=e05677917b6d4f9da709e76c165b7a9f. Additionally, prior to the investigation or experiment, informed consent was obtained from all participants. Approval for this article has been granted by the ethics committee of the corresponding author's institution.

STUDY 1

Data and variables

In Study 1, we investigated the association between perceived economic inequality and pro-environmental intentions using data from the 2013 *Chinese Social Survey* (CSS 2013). Additionally, we undertook a preliminary exploration of the psychological mechanisms underlying this relationship. Robustness tests were also conducted utilizing data from the CSS 2019.¹ The CSS is a comprehensive nationwide survey initiative launched by the Institute of Sociology at the Chinese Academy of Social Sciences. CSS databases have extensive applications in scientific research and public policy formulation.

The predictor variable was perceived economic inequality, and we utilized participants' responses to question F57 as the indicator for assessing perceived economic inequality. Question F57 inquired about participants' perceptions of inequality in the distribution of wealth and income in Chinese society at the present time, with response options including '1 = Very unequal; 2 = Somewhat unequal; 3 = Rather equal; 4 = Very equal, and 8 = Difficult to determine'. We excluded 35 participants with missing values and 1036 participants who answered '8 = Difficult to determine', subsequently reverse-scoring the remaining participants. On the reverse scale, a higher number indicates higher perceived economic inequality; thus, a response of 1 implies very equal, and a response of 4 implies very unequal.

The outcome variable for Study 1 was pro-environmental intentions. We used item E85 to assess participants' pro-environmental intentions. The item inquired, 'I would be very willing to join a non-governmental environmental organization if I had the time', with response options including '1 = Exactly describes me; 2 = Somewhat describes me; 3 = Not quite describes me; 4 = Not at all describes me; 8 = Difficult to determine'. After excluding 13 participants with missing values and 806 participants who responded with '8 = Difficult to determine', we reverse-scored the remaining responses. On the reverse scale, a higher number indicates stronger pro-environmental intentions. Specifically, a response of 1 signifies that the item statement does not align with the respondent's situation at all, whereas a response of 4 implies a perfect fit.

¹The CSS 2019 data set encompasses the same predictor and outcome variables as CSS 2013. However, for the outcome variable of pro-environmental intentions, CSS 2019 solicited responses from only a subset of participants (a total of 5112 participants answered the question, including outliers). Furthermore, the measurement of the mediator variable in CSS 2019 was less comprehensive compared to CSS 2013. While CSS 2013 included five items to measure the mediator variable (as mentioned in the main text), CSS 2019 only included two of them: 'I am often proud of my country's achievements' and 'If there is a next life, I would still like to be a Chinese.' Consequently, we prioritize the analysis based on CSS 2013 as the primary results, while the results of the analysis based on CSS 2019 are presented in Section 1 of Appendix S1 as a robustness check for Study 1. It is noteworthy that the results of both analyses exhibit substantial consistency.

The mediating variable in this study was national identification (Cronbach's $\alpha = 0.73$). To assess participants' national identification, we utilized block G3, comprising five items: 'When others criticize Chinese people, I feel like criticizing myself', 'I often feel ashamed of some existing problems in my country', 'I am often proud of my country's achievements', 'If there is a next life, I would still like to be Chinese' and 'No matter what happens in China, I will stay in China even if I have the chance to leave'. Participants rated the extent to which these descriptions corresponded to their reality on a scale of 1 = Very little, 2 = Not too much, 3 = Rather, 4 = A lot and 5 = Difficult to determine. We excluded participants with missing values or those who answered '5 = Difficult to determine' for any of these five items, totalling 1522. We then calculated the means for the remaining participants on the five items, with higher means indicating greater national identification.

For control variables in Study 1, we included gender (1 = Male; 2 = Female), age, education (1 = No education at all; 9 = Graduate) and annual income (personal income in 2012). We grouped the responses for the education items as follows: '4 = High school; 5 = Technical secondary school; 6 = Vocational high school or technical school' were amalgamated into a unified score of 4. This grouping decision was made due to the common consideration that these educational levels are generally regarded as equivalent in the Chinese context. Additionally, we redefined '7 = Three-year college; 8 = University undergraduate; 9 = Postgraduate student' into scores ranging from 5 to 7. We excluded three respondents with missing values, six individuals who responded with '10 = Other' and eight participants who selected '98 = Don't know' from the analysis. We also excluded respondents with missing values in the income items (totalling 10) and those who answered '99999997 = Not applicable; 99999998 = Don't know; 99999999 = Refused to answer' (totalling 405). Additionally, due to the large absolute income values, we logarithmized the income using the $\ln(1 + \text{yearly income})$ function for more accurate representation of the relationships between variables. After these screening procedures, we obtained 7418 valid data points, with a mean age of 44.56 ± 13.57 years, and 53.19% of the participants identified as female.

Results and discussion

Descriptive statistics and correlation coefficients for the key variables are presented in Table 1. Confidence intervals for the correlation coefficients were derived through 5000 Bootstrap samples.

We initially examined the link between perceived economic inequality and pro-environmental intentions. Employing pro-environmental intentions as the outcome variable and perceived economic inequality as the predictor variable, while controlling for gender, age, education and annual income (the same below), we obtained regression results (M1) displayed in Table 2. The outcomes reveal a significant negative association between perceived economic inequality and pro-environmental intentions ($B = -0.05$, $\beta = -.05$, $SE = 0.01$, $t = -4.08$, $p < .001$, 95% CI $[-0.07, -0.02]$). Specifically, individuals perceiving societal wealth and income distribution as unequal exhibit lower intentions to engage with environmental organizations. Regression results for control variables are detailed in Table 2. To enhance robustness, we conducted two tests: first, excluding control variables ($B = -0.04$, $\beta = -.04$, $SE = 0.01$, $t = -3.12$, $p = .002$, 95% CI $[-0.06, -0.01]$), and second, including province dummy variables ($B = -0.04$, $\beta = -.04$, $SE = 0.01$, $t = -3.78$, $p < .001$, 95% CI $[-0.07, -0.02]$), with both results remaining consistent.

TABLE 1 Descriptive statistics and correlation coefficients for key variables in Study 1.

Variables	<i>M</i>	<i>SD</i>	1	2
1. PI	3.04	0.73		
2. PEI	2.77	0.75	−0.04** [−0.06, −0.01]	
3. NI	3.23	0.47	0.21*** [0.19, 0.24]	−0.04*** [−0.06, −0.01]

Note: $N = 7418$, ** $p < .01$, *** $p < .001$; numbers in square brackets stand for 95% CI of the correlation coefficient. Abbreviations: NI, national identification; PEI, perceived economic inequality; PI, pro-environmental intentions.

TABLE 2 Analysis of the primary and mediating influences of perceived economic inequality on pro-environmental intentions.

Variables	Outcome: PI		Outcome: NI		Outcome: PI	
	M1		M2		M3	
	β	95% CI	β	95% CI	β	95% CI
Predictor						
PEI	-.05***	[-0.07, -0.02]	-.03**	[-0.03, -0.005]	-.04***	[-0.06, -0.02]
Mediator						
NI					.23***	[0.32, 0.39]
Controls						
Gender	-.04***	[-0.09, -0.02]	-.03*	[-0.05, -0.003]	-.03**	[-0.08, -0.02]
Age	-.03*	[-0.003, -0.00003]	.14***	[0.004, 0.01]	-.06***	[-0.004, -0.002]
Education	.10***	[0.04, 0.07]	-.04**	[-0.02, -0.01]	.11***	[0.05, 0.07]
Income	-.01	[-0.01, 0.004]	-.01	[-0.005, 0.003]	-.01	[-0.01, 0.004]
Adj-R ²	.016		.027		.067	

Note: N = 7418, * $p < .05$, ** $p < .01$, *** $p < .001$.
Abbreviations: NI, National identification; PEI, perceived economic inequality; PI, pro-environmental intentions.

The mediating role of national identification was subsequently examined. Utilizing national identification as the outcome variable and perceived economic inequality as the predictor variable, the regression results are outlined in Table 2 (M2). Specifically, perceived economic inequality was negatively correlated with individuals' national identification ($B = -0.02$, $\beta = -.03$, $SE = 0.01$, $t = -2.60$, $p = .009$, 95% CI [-0.03, -0.005]). In obtaining M3 by introducing national identification to M1, the results indicated that the regression coefficient for perceived economic inequality remained significantly negative ($B = -0.04$, $\beta = -.04$, $SE = 0.01$, $t = -3.58$, $p < .001$, 95% CI [-0.06, -0.02]), while the regression coefficient for national identification ($B = 0.36$, $\beta = .23$, $SE = 0.02$, $t = 20.27$, $p < .001$, 95% CI [0.32, 0.39]) was significantly positive. These outcomes suggest that perceived economic inequality may be associated with lower pro-environmental intentions through its relation to reduced national identification, as illustrated in Figure 1.

We computed the indirect effect of national identification using the SPSS 25.0 macro PROCESS 4.1 (Preacher & Hayes, 2004) (Bootstrap $N = 5000$, Model = 4), as outlined in Table 3. The total effect of perceived economic inequality on pro-environmental intentions was significantly negative (Effect = -0.046, $SE = 0.01$, 95% CI [-0.07, -0.02]); the indirect effect through national identification was also significantly negative (Effect = -0.007, $SE = 0.003$, 95% CI [-0.01, -0.002]), constituting 14.62% of the total effect. Once again, these findings corroborate that perceived economic inequality is linked to lower pro-environmental intentions through its association with diminished national identification.

Finally, we conducted analyses akin to the previous ones using CSS 2019 ($N = 4292$), yielding consistent results. Specific outcomes are detailed in Section 1 of Appendix S1, along with corresponding Tables S1–S3 and Figure S1. The findings reveal (1) a significant negative association between perceived economic inequality and pro-environmental intentions ($B = -0.07$, $\beta = -.07$, $SE = 0.01$, $t = -4.59$, $p < .001$, 95% CI [-0.09, -0.04]); (2) national identification partially mediates this path (Effect = -0.015, $SE = 0.003$, 95% CI [-0.02, -0.01]), with the mediating effect accounting for 22.12% of the total effect. In essence, perceived economic inequality can decrease an individual's national identification ($B = -0.07$, $\beta = -.11$, $SE = 0.01$, $t = -7.19$, $p < .001$, 95% CI [-0.09, -0.05]) and, consequently, diminishing pro-environmental intentions ($B = 0.22$, $\beta = .14$, $SE = 0.02$, $t = 9.32$, $p < .001$, 95% CI [0.17, 0.26]). In summary, Study 1 elucidates the negative relationship between perceived economic inequality and pro-environmental intentions, along with the mediating role of national identification in this association.

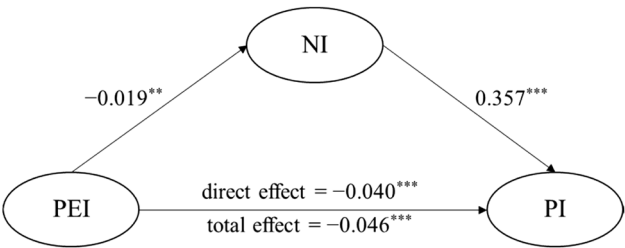


FIGURE 1 Mediation model in Study 1. $N = 7418$, *** $p < .001$, ** $p < .01$; NI, national identification; the coefficients here are nonstandard regression coefficients; PEI, perceived economic inequality; PI, pro-environmental intentions.

TABLE 3 Test of the mediating effect of national identification in Study 1.

	Effect	SE	LLCI	ULCI
Total effect	-0.046	0.01	-0.07	-0.02
Direct effect	-0.040	0.01	-0.06	-0.02
Indirect effect	-0.007	0.003	-0.01	-0.002

Note: $N = 7418$; the effect values were not standardized, allowing for a direct comparison with Figure 1.

STUDY 2

Study 2 strengthens the methodological robustness and scholarly rigour established in Study 1 through two enhancements. First, considering the limited prevalence of the outcome variable in Study 1—namely, participation as a volunteer in environmental NGOs in China, as indicated by the *Environmental Behaviours among Chinese Citizens Survey Report 2019* from the Research Team of Policy Research Center for Environment and Economy of the Ministry of Ecology and Environment of China (2019)—a potential limitation arises in generalizing the findings to other, more commonplace individual pro-environmental behaviours. To mitigate this concern, Study 2 refers to the aforementioned government report and incorporates insights from Chen et al.'s (2023) study. Consequently, Study 2 employs six pro-environmental behaviours that enjoy greater prevalence in the Chinese context as alternative outcome variables. Second, in Study 2, methodological refinement is achieved by adopting validated scales widely recognized in the existing literature for the measurement of perceived economic inequality and national identification.

Participants

The power analyses conducted using the G*Power 3.1 software indicated that a minimum of 146 participants was required for the multiple regression analysis, incorporating one predictor, one mediator and four control variables, to achieve a statistical power of 95% ($1 - \beta$) with a medium effect size of $f^2 = 0.15$ and a significance level of $\alpha = 0.05$. In our study, we distributed 320 questionnaires in China through the online platform ‘Credamo’, resulting in a total of 320 responses. After excluding 10 participants who did not fully pass the attention test [(1) Which of the following cities is the capital of China? (2) What day of the week is it today?], we obtained data from 310 participants. The mean age of the participants was 32.01 ± 9.27 , with 61.29% being female. In line with Schoemann et al.'s (2017) recommendations, we conducted a power analysis for indirect effects using the online calculator available at https://schoemanna.shinyapps.io/mc_power_med/. The results indicated that, with 310 participants recruited, Study 2 could achieve a statistical power of 91% when testing for indirect effects (using the standard deviations and correlation coefficients in Table 4).

TABLE 4 Descriptive statistics and correlation coefficients for key variables in Study 2.

Variables	<i>M</i>	<i>SD</i>	1	2
1. PB	4.01	0.59		
2. PEI	3.50	1.71	−0.40*** [−0.49, −0.31]	
3. NI	4.68	0.39	0.27*** [0.11, 0.43]	−0.27*** [−0.37, −0.16]

Note: *N* = 310, ****p* < .001; numbers in square brackets stand for 95% CI of the correlation coefficient.
Abbreviations: NI, national identification; PB, pro-environmental behaviour; PEI, perceived economic inequality.

Variables

In Study 2, the predictor variable remained perceived economic inequality, exhibiting a high internal consistency with Cronbach's α of 0.94. We selected four items from the study conducted by Schmalor and Heine (2022) to measure inequality, including statements such as ‘Almost all the money that is earned goes to only a few people’, ‘Besides those at the very top, no one else has much money at all’, ‘Real opportunities to succeed in life are only available to the wealthy’ and ‘Only those at the top own any wealth at all’. Respondents rated these items on a 7-point scale, where 1 = Strongly disagree and 7 = Strongly agree. The measurement of participants' perceived economic inequality utilized the mean scores derived from these four items, with higher mean scores indicating elevated levels of perceived economic inequality.

The outcome variable was pro-environmental behaviour (Cronbach's α = 0.75). Following Chen et al.'s (2023) research and the *Environmental Behaviours among Chinese Citizens Survey Report 2019*, we selected six items to assess participants' pro-environmental behaviour. These included ‘waste sorting’, ‘reuse of plastic bags’, ‘bringing own utensils when ordering takeout’, ‘bringing own shopping bags when shopping’, ‘educating family and friends about environmental protection’ and ‘recycling cans, bottles or paper’. Respondents rated these items on a 5-point scale, ranging from 1 = Never to 5 = Always. The average score across the six items was used to indicate the frequency of participants' pro-environmental behaviours, with higher mean scores reflecting a greater frequency of engagement in pro-environmental actions in their daily lives.

In Study 2, a validated scale, developed by McFarland et al. (2012), was employed to measure participants' national identification. This scale evaluates an individual's identification with a group at three levels: community, nation or humanity as a whole. In this study, we specifically focused on the middle level, that is, the nation, as the target of participants' identification. This decision is informed by the recognition that, while mitigating climate change requires international collaboration, attaining unified global action is currently formidable, as exemplified by the recent impasse at COP28 regarding the agreement on fossil fuel phase-out. Therefore, based on considerations of realistic feasibility, we opted for the nation as the focal point of individual identification. In accordance with the investigation conducted by Gulevich and Osin (2023), we opted for nine items derived from the scale developed by McFarland et al. (2012) to gauge national identification (Cronbach's α = 0.87). Examples of these items include: ‘How close do you feel to Chinese? 1 = Not at all close; 5 = Very close’ and ‘How often do you use the word ‘we’ to refer to Chinese? 1 = Almost never; 5 = Very often’. All items were rated on a 5-point scale, and further details on the remaining items and scoring can be found in Section 2 of Appendix S1. The mean scores on these nine items were used to represent participants' national identification, with higher mean scores indicating a stronger national identification.

The control variables for Study 2 encompassed gender (1 = Male; 2 = Female), age, education (1 = Junior high school and below; 6 = Doctoral degree) and annual income (1 = ¥50,000 and below; 7 = more than ¥500,000).²

²Given the rapid economic growth in China over the past two decades, as evidenced by data from the National Bureau of Statistics of China showing that the per capita disposable income in 2023 is 2.37 times higher than in 2012, the categorization of income in Study 2 differs from that used in the CSS 2013 to more accurately reflect this current economic reality.

Results and discussion

A common method bias test was initially conducted. Employing Harman's one-way method, an exploratory factor analysis of the scales used in Study 2 revealed a total of four factors with eigenvalues exceeding 1. The variance explained by the first factor was 30.70%, which fell below the critical criterion of 40%. Consequently, it can be reasonably assumed that there is no significant common method bias issue. Descriptive statistics and correlation coefficients for pro-environmental behaviour, perceived economic inequality and national identification are presented in Table 4. The confidence intervals of the correlation coefficients were obtained by conducting 5000 iterations of bootstrap sampling.

In the initial analysis, we examined the relationship between perceived economic inequality and pro-environmental behaviour. Using pro-environmental behaviour as the outcome variable and perceived economic inequality as the predictor variable, while controlling for gender, age, education and annual income (the same below), we derived the regression results (M1) presented in Table 5. We found a significant negative association between perceived economic inequality and pro-environmental behaviour ($B = -0.11$, $\beta = -.32$, $SE = 0.02$, $t = -6.13$, $p < .001$, 95% CI $[-0.15, -0.07]$). This suggests that the negative relationship between perceived economic inequality and pro-environmental intentions observed in Study 1 also applies to pro-environmental behaviour.

Subsequently, we examined the mediating role of national identification. Initially, national identification was regressed as the outcome variable with perceived economic inequality as the predictor variable, yielding M2. Following this, the mediating variable of national identification was added to M1, resulting in M3. Specifically, perceived economic inequality was associated with a reduction in national identification ($B = -0.06$, $\beta = -.26$, $SE = 0.01$, $t = -4.54$, $p < .001$, 95% CI $[-0.09, -0.03]$). Weaker national identification, in turn, corresponded to less pro-environmental behaviour ($B = 0.24$, $\beta = .16$, $SE = 0.08$, $t = 3.10$, $p = .002$, 95% CI $[0.09, 0.39]$), consistent with the Study 1 findings.

Total, direct and indirect effects in the model were calculated using PROCESS 4.1 (Preacher & Hayes, 2004) in SPSS 25.0, performing 5000 iterations of bootstrap sampling (Model = 4). Specifically, the total effect (Effect = -0.110 , $SE = 0.02$, 95% CI $[-0.15, -0.07]$) and direct effect of perceived economic inequality on pro-environmental behaviour (Effect = -0.096 , $SE = 0.02$, 95% CI $[-0.13, -0.06]$) were both significantly negative. Moreover, the indirect effect through national identification was also significantly negative (Effect = -0.014 , $SE = 0.01$, 95% CI $[-0.03, -0.0002]$), accounting for 13.00% of

TABLE 5 Analysis of the primary and mediating influences of perceived economic inequality on pro-environmental behaviour.

Variables	Outcome: PB		Outcome: NI		Outcome: PB	
	M1		M2		M3	
	β	95% CI	β	95% CI	β	95% CI
Predictor						
PEI	-.32***	[-0.15, -0.07]	-.26***	[-0.09, -0.03]	-.28***	[-0.13, -0.06]
Mediator						
NI					.16**	[0.09, 0.39]
Controls						
Gender	-.10*	[-0.24, -0.01]	-.11*	[-0.18, -0.002]	-.09	[-0.22, 0.01]
Age	.26***	[0.01, 0.02]	-.01	[-0.01, 0.005]	.26***	[0.01, 0.02]
Education	.10	[-0.005, 0.18]	-.01	[-0.07, 0.06]	.10	[-0.002, 0.18]
Income	.06	[-0.02, 0.09]	.05	[-0.02, 0.06]	.05	[-0.03, 0.08]
Adj-R ²	.252		.075		.272	

Note: N = 310, *** $p < .001$, ** $p < .01$, * $p < .05$.
Abbreviations: NI, national identification; PB, pro-environmental behaviour; PEI, perceived economic inequality.

the total effect. This aligns roughly with the indirect effect calculated in Study 1 (14.62% and 22.12% in the two surveys, respectively). Finally, we repeated the analysis with the control variables excluded, yielding findings consistent with the main results, as detailed in Section 3 of Appendix S1.

Finally, we conducted an exploratory analysis to gain more nuanced insights into whether the negative relationship between perceived economic inequality and pro-environmental behaviour persists across different levels of socioeconomic status, as measured by education and income. The results indicated that (1) the interaction between education and perceived economic inequality was significantly positive ($B = 0.06$, $\beta = .72$, $SE = 0.03$, $t = 2.23$, $p = .026$, 95% CI [0.01, 0.11]); however, (2) the interaction between income and perceived economic inequality, although positive, was not statistically significant ($B = 0.01$, $\beta = .11$, $SE = 0.02$, $t = 0.73$, $p = .466$, 95% CI [-0.02, 0.04]). These findings suggest that the negative relationship between perceived economic inequality and pro-environmental behaviour is more pronounced among individuals with lower levels of education, while this association weakens as education levels rise. However, it is important to acknowledge that different categorizations were employed for the income measures in Studies 1 and 2. Consequently, the robustness of the findings in Study 2 regarding income as a moderating variable requires further validation through additional research.

In summary, despite employing a more rigorous methodology to assess the outcome and mediating variables in Study 2, we consistently observed results closely mirroring those of Study 1. Specifically, a significant negative correlation exists between perceived economic inequality and individuals' pro-environmental behaviour, primarily driven by a reduction in individuals' identification with the country. Thus, both hypotheses 1 and 2 have been validated. Nevertheless, a limitation persists in the findings of Study 2—we are still unable to establish the causal relationship between perceived economic inequality and pro-environmental engagement, a gap we aim to address in Study 3.

STUDY 3

The primary objective of Study 3 was to utilize the Bimboola paradigm (Jetten et al., 2015; Sánchez-Rodríguez et al., 2019), widely employed in existing literature, to furnish experimental evidence supporting Studies 1 and 2.

Participants

The analyses employed in Study 3 included independent samples t -test and multiple regression. The determination of the sample size was based on the requirements of the independent samples t -test, which has a relatively high sample size requirement. Power analyses conducted using G*Power 3.1 software indicated that, with a medium effect size of $d = 0.50$ and a significance level of $\alpha = 0.05$, the independent samples t -test necessitated a minimum of 210 participants to achieve a statistical power of 95%. We successfully recruited a total of 260 college students. Following the exclusion of 6 participants who did not fully pass the attention check [(1) Which of the following cities is the capital of China? (2) What day of the week is today?], we obtained a final data set of 254 valid samples. The average age of the participants was 21.76 ± 1.56 years old, and 65.35% were female.

Design and variables

In Study 3, we employed a one-factor, two-level between-participants design, randomly assigning participants to either a high or low inequality group. The mediator variable for Study 3 was national identification (Cronbach's $\alpha = 0.90$), using the same question items as in Study 2. Following the Bimboola paradigm established in existing literature (Jetten et al., 2015; Sánchez-Rodríguez et al., 2019), participants in Study 3 were asked to express their identification with the virtual country of Bimboola. There were two dependent

variables in Study 3. The first was pro-environmental intentions (Cronbach's $\alpha = 0.76$), assessing the extent to which participants were willing to adopt the same six pro-environmental behaviours in their daily lives as in Study 2. Responses ranged from 1 to 5, where 1 indicated 'Not at all' and 5 indicated 'Very much'. Higher mean scores suggested stronger pro-environmental intentions. Additionally, participants were asked about their willingness to donate to environmental programmes initiated by the Bimbooleen government, with donation amounts ranging from 0 Bimbooleen yuan³ to 100 Bimbooleen yuan.

Procedure

Participants were randomly assigned to either a high inequality group or a low inequality group. At the outset of the experiment, participants were instructed to envision residing in a fictional country named Bimboola. Individuals in the high economic inequality group were informed that the wealthiest segment of the population earned a monthly income of up to 198,500 Bimbooleen yuan, while the low-income group had an average monthly income of only 1500 Bimbooleen yuan. Conversely, participants in the low economic inequality group were informed that the richest group earned 150,000 Bimbooleen yuan, while the low-income group could earn up to 50,000 Bimbooleen yuan. In both scenarios, participants were told that they belonged to the middle-income group and were asked to articulate, in three to five sentences, their perspectives on Bimboola's societal conditions, their experience living in the country and their sentiments about their residence. Additionally, participants were tasked with assessing the level of economic inequality in Bimboola, using a scale where 1 indicated complete inequality and 5 signified total equality. It is important to note that, to maintain consistency with Studies 1 and 2, we reverse-scored this variable in subsequent analyses, with higher numbers after reverse scoring indicating increased levels of inequality. Following the manipulation, we assessed participants' identification with Bimboola using the identical scale employed in Study 2, with the only modification being the substitution of 'China' or 'Chinese' with 'Bimboola' or 'Bimbooleen', respectively. Subsequently, participants were informed that Bimboola was grappling with severe environmental challenges and were queried about the extent to which they were willing to adopt pro-environmental behaviours in their daily lives and the amount they would be willing to contribute to government-sponsored environmental initiatives (refer to Section 4 of Appendix S1 for detailed information on the experimental manipulation and measurement questions for the dependent variable).

Results and discussion

A manipulation validity test for perceived economic inequality was initially conducted, revealing that participants in the high economic inequality group ($n = 128$, $M = 4.43$, $SD = 0.61$) exhibited significantly higher levels of perceived economic inequality than those in the low economic inequality group ($n = 126$, $M = 2.21$, $SD = 0.60$) ($t(251.99) = 29.33$, $SE = 0.08$, $p < .001$, $d = 3.68$, 95% CI [2.07, 2.37]). Subsequently, the two groups of participants were examined for differences in national identification, pro-environmental intentions and donation. Results demonstrated that increased economic inequality did reduce participants' national identification with Bimboola ($M_{\text{high}} = 3.05$, $SD_{\text{high}} = 0.69$, $M_{\text{low}} = 4.01$, $SD_{\text{low}} = 0.43$; $t(214.25) = -13.27$, $SE = 0.07$, $p < .001$, $d = -1.66$, 95% CI [-1.10, -0.81]), willingness to engage in pro-environmental behaviours in daily life ($M_{\text{high}} = 4.03$, $SD_{\text{high}} = 0.70$, $M_{\text{low}} = 4.37$, $SD_{\text{low}} = 0.43$; $t(211.30) = -4.69$, $SE = 0.07$, $p < .001$, $d = -0.59$, 95% CI [-0.49, -0.20]), and the amount of money contributed to government environmental programs ($M_{\text{high}} = 30.78$, $SD_{\text{high}} = 21.25$, $M_{\text{low}} = 52.22$, $SD_{\text{low}} = 24.56$; $t(252) = -7.44$, $SE = 2.88$, $p < .001$, $d = -0.93$, 95% CI [-27.11, -15.77]). Figure 2 visualizes the aforementioned differences.

³The yuan is the primary unit of Chinese currency, and presently, 1 yuan is approximately equivalent to 0.14 US dollars.

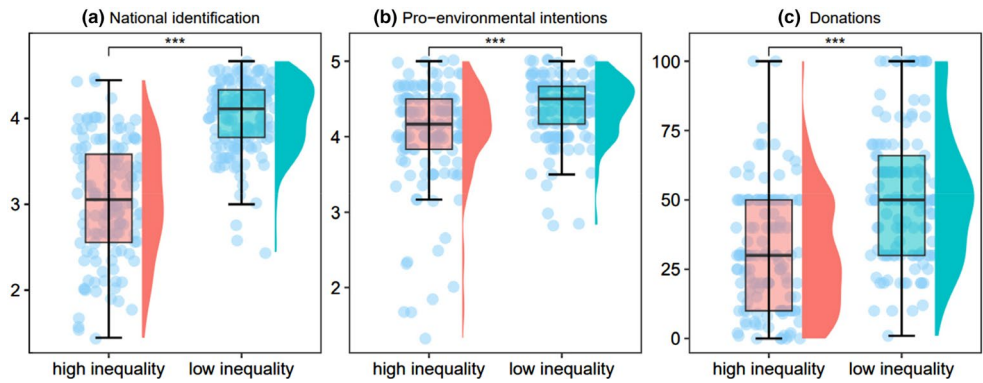


FIGURE 2 Differences in national identification, pro-environmental intentions and donations between the high and low inequality groups. *** $p < .001$. The box plot is described as follows: The horizontal line within the box represents the median, while the lower and upper edges of the box indicate the first quartile (Q1) and the third quartile (Q3), respectively, encompassing 50% of the data. The length of the box (Q3 – Q1) represents the interquartile range (IQR). Lines outside the box denote the upper limit (Q3 + 1.5IQR) and the lower limit (Q1 – 1.5IQR), with points beyond these limits considered outliers.

TABLE 6 Test of the mediating effect of national identification in Study 3.

Predictors	Outcomes	Total effect	Direct effect	Indirect effect
MEI	Intentions	–0.34 [–0.48, –0.19]	0.12 [–0.05, 0.28]	–0.45 [–0.62, –0.30]
	Donations	–21.43 [–27.08, –15.78]	–5.72 [–12.43, 0.99]	–15.72 [–20.35, –11.40]
PEI	Intentions	–0.12 [–0.18, –0.07]	0.06 [–0.01, 0.12]	–0.18 [–0.24, –0.12]
	Donations	–8.51 [–10.75, –6.27]	–2.56 [–5.16, 0.04]	–5.95 [–7.67, –4.38]

Note: $N = 254$; numbers in square brackets indicate 95% CI.
Abbreviations: MEI, manipulated economic inequality; PEI, perceive economic inequality.

To comprehensively investigate the mediating effects of national identification, we conducted four mediation tests using manipulated economic inequality (coded as 0 for low economic inequality and 1 for high economic inequality) and perceived economic inequality (rated from 1 to 5, with higher values indicating greater inequality) as predictor variables. Pro-environmental intentions and amount of donation were treated as outcome variables, with gender and age included as control variables. The analyses were conducted using PROCESS 4.1 (Preacher & Hayes, 2004), and Table 6 presents the total, direct and indirect effects in each model.

In summary, our findings indicate the following: (1) the total effect of manipulated/perceived economic inequality on pro-environmental intentions was significantly negative, with a non-significant direct effect, and a significantly negative indirect effect mediated by national identification; (2) similarly, the total effect of manipulated/perceived economic inequality on donations was significantly negative, with a non-significant direct effect, and a significantly negative indirect effect mediated by national identification. The aforementioned outcomes imply that, despite employing distinct dependent variables such as pro-environmental intentions measured by the scale and donations, our findings consistently converge, underscoring the robustness of our results.

These results align broadly with Studies 1 and 2, albeit with a notable difference: The direct effects were significant and substantial in Studies 1 and 2, but not in Study 3. We speculate that this discrepancy may stem from the fact that Studies 1 and 2 were conducted in real-world settings, allowing for the inclusion of numerous potential mediating variables in the ‘economic inequality → pro-environmental engagement’ pathway. In contrast, Study 3 employed a scenario-based approach, limiting the information

provided to participants about a virtual country and consequently constraining the impact on their behavioural intentions and actions within that context.

STUDY 4

The principal revelation of this study underscores that perceived economic inequality hampers individuals' pro-environmental engagement. To quantify the average magnitude of this inhibitory effect, a single-paper meta-analysis was conducted in Study 4 (McShane & Böckenholt, 2017). The analytical focus encompassed five specific effect sizes: (1) standardized regression coefficients denoting perceived economic inequality's impact on pro-environmental intentions, extracted from the 2013 CSS data set in Study 1; (2) standardized regression coefficients representing perceived economic inequality's influence on pro-environmental intentions sourced from the 2019 CSS data set (refer to Section 1 of Appendix S1); (3) standardized regression coefficients illustrating the relationship between perceived economic inequality and pro-environmental behaviours as identified in Study 2; (4) standardized regression coefficients gauging the effect of measured (vs. manipulated) perceived economic inequality on pro-environmental intentions as observed in Study 3; and (5) standardized regression coefficients examining the impact of measured (vs. manipulated) perceived economic inequality on donation amounts in Study 3. Employing R 4.3.1 for single-paper meta-analysis revealed a combined standardized regression coefficient of perceived economic inequality on pro-environmental engagement ($\beta = -.22$, 95% CI $[-0.36, -0.07]$, $z = -2.93$, $p = .003$). Converting this standardized regression coefficient (β) to an r -value using the formula provided by Peterson and Brown (2005) ($r = \beta + 0.05\lambda$, where $\lambda = 0$ if β is negative, and $\lambda = 1$ otherwise) resulted in an effect size (r) of -0.22 . This effect size falls between small and medium effect sizes (small: $r = 0.10$; medium: $r = 0.30$; large: $r = 0.50$) as defined by Cohen (1988).

The findings from a comprehensive meta-analysis of 322 studies conducted by Richard et al. (2003) involving a substantial sample size ($N > 8,000,000$) revealed that the average effect sizes in social psychological studies were relatively modest ($r = 0.21$). Importantly, the effect sizes observed in the key findings of this paper align generally with the observations made by Richard et al. (2003).

GENERAL DISCUSSION

The association between economic inequality and environmental concerns has roots in the last century, notably spearheaded by Boyce (1994), who pioneered the integration of inequality into discussions of environmental degradation. Boyce (1994) argued that greater inequality in wealth correlates with poorer environmental quality. Subsequent studies by Baek and Gweisah (2013), Baloch et al. (2018), Jorgenson (2015) and Uzar and Eyuboglu (2019) consistently found a negative correlation between national-level carbon emissions and economic inequality within countries. Unlike these existing studies that primarily focus on macro-level carbon emissions, the first novelty of this article is that inequality can similarly inhibit pro-environmental engagement at the individual level. Therefore, it is reasonable to infer that reducing perceived inequality can promote individual pro-environmental behaviour. This is significant, as emphasized by Dietz et al. (2009) and Rosenthal and Ho (2020), who highlight the crucial role of individual pro-environmental behaviours as levers for mitigating environmental problems.

The second contribution of this article lies in the incorporation of perceived inequality into the realm of pro-environmental research. Despite the weak correlation between objective and perceived economic inequality (Schmalor & Heine, 2022), emerging evidence suggests that perceived economic inequality can be as influential as its objective counterpart (Chen & Yang, 2024; Jachimowicz et al., 2023). Moreover, there is a growing body of research indicating that perceived economic inequality often yields more robust predictions than objective measures of inequality at the aggregate level, in forecasting both individual and societal outcomes (Gimpelson & Treisman, 2018; Hauser & Norton, 2017). The findings

of this study indeed underscore the significance of perceived economic inequality at the individual level in predicting pro-environmental engagement. This bears theoretical and practical implications. Theoretically, while objective inequality pertains to macro-level aggregates, subjective inequality operates at the individual level, enabling the assessment of correlations between inequality and various psychological constructs. From a practical standpoint, effecting change in objective inequality is often a protracted process. Therefore, by investigating subjective inequality and its associated psychological variables, this study offers valuable insights for devising targeted psychological interventions.

The third contribution of this paper is to propose national identification as a potential factor explaining the negative association between perceived economic inequality and pro-environmental engagement. Specifically, the perception of economic inequality within a country impedes individuals from identifying with that nation, which, in turn, is associated with diminished efforts to enhance its well-being and the welfare of its citizens, including pro-environmental behaviours aimed at addressing environmental challenges.

The application of the social identity approach to environmental action is an emerging area (Barth et al., 2021). Fritsche et al. (2018) have proposed a comprehensive model known as the Social Identity Model of Pro-Environmental Action (SIMPEA) to explicate the influence of social identity on pro-environmental engagement. It is crucial to acknowledge that identification can manifest at various levels, ranging from smaller groups (e.g. environmental organizations or local communities) to larger categories (e.g. a country or a conglomerate of countries like the European Union), or even encompassing all of humanity (Rosenmann et al., 2016). Current research primarily concentrates on two levels of identification: affiliation with environmental organizations or collectives and identification with humanity as a whole. Regarding the former, some studies indicate that individuals who identify more with environmental groups exhibit greater willingness to pay a premium for environmentally friendly products, stronger commitment to collective action, more positive attitudes towards eco-branding, and increased participation in activities related to environmental protection (Bartels & Hoogendam, 2011; Bliuc et al., 2007; Fielding et al., 2008). As for the latter, Reysen and Katzarska-Miller (2013) found that identification with humanity as a whole positively predicts a spectrum of pro-social values, including concerns for environmental sustainability. Direct support for this comes from a systematic review by Pong and Tam (2023), demonstrating the consistent positive association between global identity and pro-environmental behaviour or concerns across various studies.

In contrast, research on the relationship between national identification and pro-environmental behaviour remains relatively scarce. We posit that a significant reason for this scarcity lies in the dual nature of national identification, encompassing both negative and positive orientations. On the one hand, given the association between national identification and nationalism, some authors propose that national identification may prompt individuals to downplay their country's environmental issues. This denial mechanism is theorized to diminish the perceived threat to one's country and foster a sense of superiority over other nations. Consequently, this denial is presumed to reduce individuals' engagement in pro-environmental activities (Bonaiuto et al., 1996). However, it is essential to note that national identification can also manifest positive aspects, including concern for the country's problems, fellow citizens and a shared destiny with other members of the nation. Scholars have delineated these two facets of national identification as nationalistic identification and patriotic identification, respectively (Aydin et al., 2022). As our findings reveal, the expression of national identification in the form of patriotic identification positively relates to pro-environmental engagement. Our results align with Aydin et al.'s (2022) findings, which assert that, in both a Turkish sample and a cross-cultural sample spanning over 70 countries, the constructive form of national identification was positively linked to pro-environmental beliefs and behaviours.

The aforementioned findings have both theoretical and practical implications. Theoretically, they suggest that constructive national identification can potentially foster individuals' pro-environmental engagement, akin to identification with environmental organizations and humanity as a whole. Given the relative scarcity of research in this domain, our findings present a novel avenue for future scholarly

exploration. Practically, this paper proposes that reinforcing constructive national identification may serve as a viable strategy to enhance national efforts in combating environmental degradation. However, it is crucial to acknowledge that this study did not experimentally manipulate national identification, thus precluding the provision of causal evidence for the relationship between national identification and pro-environmental engagement. Additionally, the possibility that other variables influence this relationship cannot be dismissed. Therefore, policy formulation based on the findings of this paper should proceed with caution and warrant further investigation.

In concluding this paper, we would like to address its limitations and suggest potential avenues for future research. A concept particularly pertinent to this paper is system justification belief, which refers to individuals' tendency to rationalize the social, political and economic arrangements to which they belong (Jost & van der Toorn, 2012). A heightened level of system justification belief renders inequality more psychologically tolerable for individuals, consequently leading to reduced negative affect (Goudarzi et al., 2020). Therefore, a possible corollary is that when individuals possess higher system justification belief, inequality may exert a diminished negative impact on their national identification and corresponding pro-environmental behaviour. Given that existing research has identified significant cross-cultural and situational variations in system justification belief (Trump, 2020; Vargas-Salfate et al., 2018), it remains to be tested whether the conclusions drawn in this paper are applicable in societies and cultures that differ from China.

Second, despite employing diverse measures for pro-environmental intentions and behaviours, this paper relies on self-reported data, lacking an objective measure. While studies indicate a substantial correlation between self-reported and objective measures of pro-environmental behaviour (Kormos & Gifford, 2014), instances of intentional or unintentional overestimation due to social desirability may introduce bias. Therefore, future research could benefit from incorporating objective measures to validate and strengthen the reliability of the paper's findings.

Third, the measurement-of-mediation design utilized in this study raises concerns regarding causality. Although Study 3 experimentally manipulated perceived economic inequality to establish its causal effect on pro-environmental engagement, the causal relationship between national identification and pro-environmental engagement remains ambiguous due to the lack of experimental manipulation of national identification. Consequently, multiple pathways and mediators could potentially account for our findings. Future researchers might address this limitation by developing and employing methods such as an experimental-causal-chain design, thereby providing a more rigorous test of the conclusions drawn in the present research.

AUTHOR CONTRIBUTIONS

Rongmian Huo: Conceptualization; funding acquisition; project administration; resources; writing – original draft. **Shasha Yang:** Data curation; formal analysis; investigation; visualization; methodology; writing – original draft. **Cai Dong:** Investigation; writing – original draft. **Sijing Chen:** Conceptualization; data curation; formal analysis; project administration; supervision; resources; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

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 STATEMENT

Raw data have been uploaded to OSF (Open Science Framework): https://osf.io/sa2fq/?view_only=e05677917b6d4f9da709c76c165b7a9f.

ETHICS STATEMENT

All participants provided informed consent, and the study design was approved by an ethics review board.

ORCID

Shasha Yang  <https://orcid.org/0000-0002-3114-5232>

Sijing Chen  <https://orcid.org/0000-0003-3908-9666>

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