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A systematic review and meta-analysis of the relationship between economic inequality and prosocial behaviour

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How does economic inequality relate to prosocial behaviour? Existing theories and empirical studies from multiple disciplines have produced mixed results. Here we conduct a systematic review and meta-analysis to systematically synthesize empirical studies. Results from 192 effect sizes and over 2.5 million observations in 100 studies show that the relationship varies from being negative to positive depending upon the study (95% prediction interval −0.450 to 0.343). However, on average, there is a small, negative relationship between economic inequality and prosocial behaviour ($r = -0.064$, $P = 0.004$, 95% confidence interval −0.106 to −0.021). There is generally no evidence that results depend upon characteristics of the studies, participants, the way prosocial behaviour and inequality were assessed, and the publication discipline. Given the prevalence of economic inequality and the importance of prosocial behaviour, this systematic review and meta-analysis provides a timely study on the relationship between economic inequality and prosocial behaviour.

How is economic inequality related to prosocial behaviour? Prosocial behaviour involves actions that benefit others[1], such as donating, volunteering and cooperating with and helping others. Economic inequality involves disparities in the distribution of economic resources (for example, income and wealth) within a population. Across several disciplines, some theorists predict that higher economic inequality is associated with less prosocial behaviour, while others predict that it is associated with more prosocial behaviour. In this Article, we systematically gather empirical research on this question and use meta-analysis to examine the average relationship between economic inequality and prosocial behaviour, and some potential moderators. We next review empirical evidence on different potential relationships between economic inequality and prosocial behaviour, potential theoretical explanations for them, reasons a systematic review and meta-analysis is needed, and a brief description of the current study.

The empirical evidence on the relationship between economic inequality and prosocial behaviour is inconsistent. With respect to charitable giving, most previous studies find a negative relationship with economic inequality[2–6]. Most empirical research on other forms of prosocial behaviour, such as volunteering and informal help (for example, dropping off food and helping someone move), also finds a negative correlation with economic inequality[7–16]. Yet other studies find that charitable giving increases when the level of economic inequality increases[17–20] or find a null relationship[21–24]. With respect to volunteering and informal help, some studies similarly find a positive association with economic inequality[25–29], while other studies find no relationship[30–34]. We next review key theories on why such potential relationships between economic inequality and prosocial behaviour may exist.

First, although this systematic review and meta-analysis cannot test potential mechanisms directly, we build on and extend a recent review that identified several reasons for a potential negative relationship between economic inequality and prosocial behaviour[35] (Fig. 1). Note that these reasons are not fully distinct, and may work together to produce lower prosocial behaviour.

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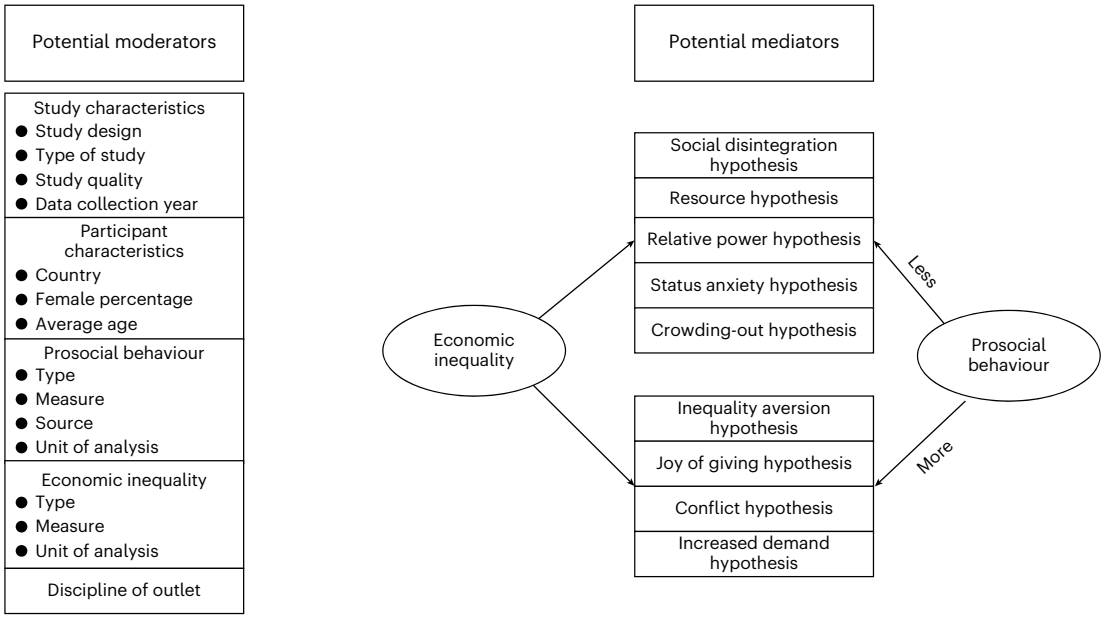

Fig. 1 | Potential moderators and mediators of the relationship between inequality and prosocial behaviour.

Social disintegration hypothesis is the most frequently used explanation for why inequality may predict lower prosocial behaviour[35]. The idea is that resource differences lead to status differences between people, which increases distance and reduces cohesion across groups, ultimately leading to reduced interpersonal trust (that is, individuals' confidence that others are good)[2,36]. Indeed, as inequality has increased over time, living in similar-income neighbourhoods (income segregation) has also increased, and trust has declined[37]. Research finds that high economic inequality is associated with less social trust[38,39], and that less social trust is associated with less prosocial behaviour[40,41]. When they are examined together, economic inequality is negatively associated with social trust, which in turn contributes to lower levels of prosocial behaviour[3].

The resource hypothesis posits that those with more resources (for example, time, money and education) have more to give, while those with fewer resources have less to give[35]. However, this probably depends on the distribution of resources. Highly unequal populations have many people with fewer resources, and a few people with more resources. The potential increased giving of the few rich people may not be able to offset the reduced giving of the larger group of poorer people, which would result in a net decrease in prosocial behaviour[35,42]. In addition, more equal societies, which distribute a variety of resources and services more evenly, provide broader access and opportunities across many social groups to foster different kinds of civic engagement[42]. This should thus help to stimulate such behaviour overall, and thus, this also supports the rationale for decreased prosocial behaviour in more unequal societies. Yet, the resource hypothesis could also predict a null relationship between inequality and prosocial behaviour. This would occur if the increased giving from the fewer rich people offset the reduced giving from the resource-scarce masses, which would result in no change in prosocial behaviour.

The relative power hypothesis is another common explanation for why inequality may predict lower prosocial behaviour[35], including political and civic engagement[43–45]. It suggests that unequal resource distributions create parallel unequal power distributions. Unlike the resource hypothesis, the relative power hypothesis posits that both those with higher power and those with lower power will be less likely to give, but for different reasons. High economic inequality concentrates more economic resources and power to influence political and civic affairs among a small group of elites. Thus, the larger group of disadvantaged individuals may feel powerless and have less motivation to contribute to society, while the smaller elite group may feel that they are more entitled and deserving of additional resources[46,47]. Downward social comparison may make the rich compare themselves more favourably relative to the general population. This wide gap perceived between themselves and the poor may increase their entitlement, and ultimately reduce prosocial behaviour[47,48].

Status anxiety hypothesis suggests that inequality can also increase status anxiety, or worries about one's social position declining or being judged unworthy[49,50]. Such concerns could make people feel more aware of competition[49], more focused on maintaining their own status and, thus, less likely to share their resources with others (R. Willer, M. Feinberg, F. J. Flynn and B. Simpson, unpublished manuscript).

Crowding-out hypothesis suggests that economic inequality may negatively relate to prosocial behaviour because of increased government spending. According to the Meltzer–Richard Model, higher economic inequality is associated with a higher desire for government redistribution, which is in turn associated with more actual government spending[51–53]. Given that government redistribution, particularly government social spending, plays an important role in diminishing economic inequality, it may crowd out prosocial behaviour, particularly charitable giving[54,55].

Yet, there are also some potential reasons to predict a positive relationship between economic inequality and prosocial behaviour (Fig. 1). Inequality aversion hypothesis is the most common explanation[35]. Inequality increases the presence and potential salience of needs in society, since it concentrates income and wealth in a privileged few at the expense of the broader masses. Awareness of need is a key mechanism that drives charitable giving[56]. Indeed, research finds that people are so uncomfortable with unequal outcomes that they at times willingly reduce their own personal allocations in order to increase equal outcomes[57]. Thus, it is possible that inequality aversion could promote prosocial behaviour in order to address increasing social needs.

Increased joy of giving hypothesis suggests that economic inequality may increase the utility (pleasure) of prosocial behaviour[58]. Economists posit that people pursue utility maximization[59–61]. Economic inequality may enhance the utility of prosocial behaviour because,

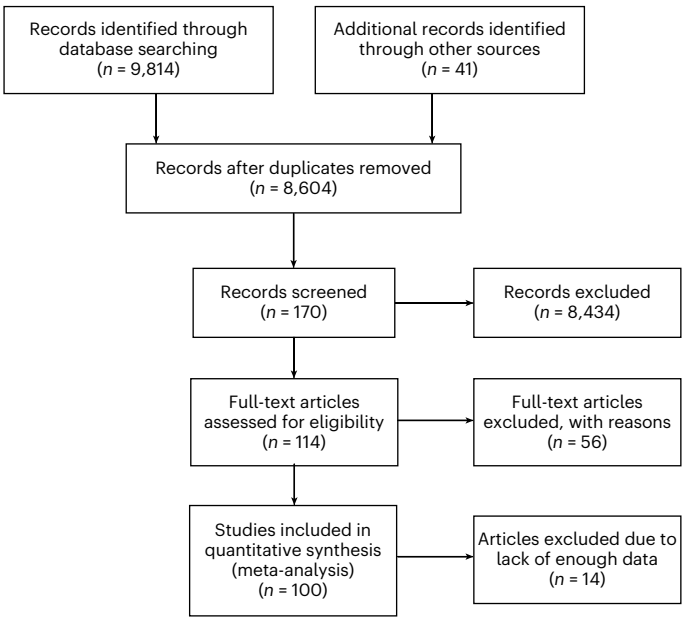

Fig. 2 | PRISMA flow diagram.

when there are more people in need, prosocial behaviour may have a higher social value[25].

Another explanation for potentially increased prosocial behaviour is that higher inequality creates conflicts between different economic groups that result in mobilization among less privileged groups in response to this injustice[35]. This mobilization could involve the creation or support of non-profit organizations, in an attempt to promote fairer resource distributions.

Increased demand hypothesis (for example, Weisbrod's government failure theory)[62] suggests that governments can only satisfy the demands of the median populations, so unmet demands must resort to other channels such as the non-profit sector[63]. Economic inequality may increase the demand for non-profit organizations, which in turn support prosocial behaviours such as charitable giving and volunteering.

These mixed empirical results and theoretical perspectives pose a great challenge to knowledge accumulation and advancement on this topic. The current study uses systematic review and meta-analysis to attempt to reconcile these differing findings. Meta-analysis is 'a quantitative method of synthesizing empirical research results in the form of effect sizes'[64] (p. 7). It collects analytical results from independent empirical studies to form an integrated finding. Meta-analysis not only helps researchers determine an average relationship (that is, effect size), but it also allows them to explore which factors may moderate the relationship. This meta-analysis explores whether the relationship between inequality and prosocial behaviour depends upon characteristics of the studies, participants, the way prosocial behaviour and inequality were assessed, and the discipline of the publication outlet.

Study characteristics moderators include study design, type of study, study quality and data collection year.

(1) Study design. Study design involves the general methods and procedures used in data collection. In this meta-analysis, we classified studies into two overarching designs: experimental or non-experimental. Experimental studies randomly assigned participants to groups (for example, high versus low inequality based on tokens given), and then measured prosocial behaviour (for example, number of tokens shared). As such, they have more control than the real world and can allow for causal inferences, but may be limited in external validity. Non-experimental designs often used nationally representative data, and thus have higher external validity, because they are based on naturally occurring data (for example, differences in income inequality across groups). However, they cannot demonstrate causal relationships. Experimental and non-experimental studies may have different relationships between economic inequality and prosocial behaviour.

(2) Type of study. The overarching study designs (experimental versus non-experimental) were further broken down into specific commonly used study types in our dataset. Within experimental studies, one type involves groups contributing to a common pot (that is, public goods games) and another type involves individuals sharing an endowment with a stranger (that is, dictator games). Non-experimental studies also come in different forms. For example, researchers can follow individuals over time (that is, longitudinal/panel studies), use a single-timepoint survey (that is, cross-sectional/correlational study) or combine several cross-sectional surveys (that is, pooled cross-sectional data). These study types are heterogeneous, and may produce variability in the relationship. For example, perhaps the group nature of public goods games makes them more sensitive to inequality than dictator games, and longitudinal studies can control for time-invariant confounders better than cross-sectional studies[65]. Thus, we examined type of study as a moderator.

(3) Study quality. Higher-quality studies have indicators of scientific rigour and excellence, which increases confidence in the study findings. These include construct validity (that is, validity and reliability of measures), internal validity (that is, the extent that causal conclusions can be made, for example, experimental designs often have more internal validity than correlational data), external validity (that is, the generalizability of the results, for example, using nationally representative samples of participants has more external validity) and statistical validity (that is, whether the study report provides accurate quantitative estimates of the intervention's impact). It is possible that higher-quality studies might have different effect sizes than lower-quality studies[66]. Thus, we included it as a moderator.

(4) Data collection year. Economic inequality is rising in many countries since the 1980s (ref. 67). In recent years, compared with more distant past years, it is possible that there is more awareness of economic inequality and greater impacts of it, due to longer-term or more severe exposure. Thus, prosocial responses to economic inequality may be different across time.

Participant characteristic moderators include country, percentage of females and average age of participants.

(1) Country. Different countries have unique economic, historical, political, cultural and social characteristics, and there is wide variation in inequality rates internationally[67]. Because it is possible that the relationship between economic inequality and prosocial behaviour varies by country or region, we also explored country-related indicators as moderators.

(2) Percentage of females. Gender is an important factor in prosocial behaviour[68,69], although empirical results are mixed about whether males or females are more prosocial[70]. Previous studies on charitable giving and volunteering have shown that females score higher in prosocial values, but males have more social capital and human resources[69,71], which helps explain the mixed findings about gender and prosocial behaviour. Thus, we examined gender proportion as an additional moderator.

(3) Average age of participants. Age is also an important factor in prosocial behaviour[72,73]. Relative to younger people, older adults have been exposed to economic inequality for a longer time, and may be more aware of its existence. Thus, their prosocial responses to economic inequality differ from young people.

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Table 1 | Univariate moderation tests of categorical and continuous variables for the relationship between economic inequality and prosocial behaviour

Moderator	k_{study}	k_{effect}	*r*/*β*	*z*	*P*	95% CI
Average effect size (random effect)	100	192	−0.064**	−2.908	0.004	−0.106 to −0.021
Categorical variables						
Study design ($Q(1)=1.81$, $P=0.178$)						
Experiment	42	67	−0.096**	−2.954	0.003	−0.159 to −0.032
Non-experiment	60	125	−0.041	−1.480	0.139	−0.095 to 0.013
Type of study ($Q(4)=4.05$, $P=0.399$)						
Public goods game	29	46	−0.088*	−2.182	0.029	−0.166 to −0.009
Dictator game	5	11	−0.184**	−2.577	0.010	−0.316 to −0.044
Longitudinal	11	25	−0.057	−1.059	0.290	−0.160 to 0.048
Cross-sectional	43	82	−0.043	−1.364	0.173	−0.103 to 0.019
Pooled cross-sectional	7	16	−0.047	−0.824	0.410	−0.156 to 0.064
Country ($Q(1)=1.52$, $P=0.218$)						
Cross-national	20	42	−0.108*	−2.568	0.010	−0.188 to −0.026
Within-national	81	150	−0.053*	−2.290	0.022	−0.099 to −0.008
Continent ($Q(4)=10.44$, $P=0.034$)						
Africa	4	8	0.021	0.253	0.801	−0.142 to 0.183
Asia	8	21	−0.217***	−3.671	<0.001	−0.326 to −0.102
North America	44	78	−0.019	−0.750	0.453	−0.068 to 0.030
Oceania	5	6	−0.044	−0.584	0.559	−0.189 to 0.103
Western Europe	19	34	−0.062	−1.649	0.099	−0.134 to 0.012
Country group ($Q(1)=0.98$, $P=0.323$)						
WEIRD	68	121	−0.036	−1.697	0.090	−0.077 to 0.006
Non-WEIRD	13	29	−0.088	−1.921	0.069	−0.181 to 0.007
Type of prosocial behaviour ($Q(2)=4.51$, $P=0.105$)						
Charitable giving	72	124	−0.077**	−3.262	0.001	−0.122 to −0.031
Volunteering time	37	53	−0.053	−1.908	0.056	−0.108 to 0.001
Informal help	11	15	0.018	0.381	0.703	−0.074 to 0.109
Measure of prosocial behaviour ($Q(4)=7.41$, $P=0.116$)						
Incidence	39	74	−0.034	−1.215	0.224	−0.090 to 0.021
Amount	49	74	−0.051	−1.945	0.052	−0.103 to 0.000
Proportion	15	22	−0.140***	−3.589	0.000	−0.214 to −0.064
Frequency	9	12	−0.129*	−2.415	0.016	−0.232 to −0.025
Number	5	10	−0.141*	−2.025	0.043	−0.272 to −0.005
Source of prosocial behaviour ($Q(1)=0.02$, $P=0.876$)						
Self-report	45	90	−0.067*	−2.240	0.025	−0.125 to −0.008
Observation/actual behaviour	57	102	−0.061*	−2.221	0.026	−0.115 to −0.007
Unit of analysis of prosocial behaviour ($Q(5)=7.44$, $P=0.190$)						
Individual/household level	56	101	−0.046	−1.681	0.093	−0.099 to 0.008
Group level	15	22	−0.082	−1.444	0.149	−0.192 to 0.029
Organizational level	4	6	−0.015	−0.254	0.799	−0.129 to 0.099
Community/local level	12	28	−0.053	−0.847	0.397	−0.174 to 0.070
State/provincial/regional level	8	10	−0.067	−0.998	0.318	−0.196 to 0.064
Country level	10	25	−0.202***	−3.403	0.001	−0.313 to −0.087
Type of economic inequality ($Q(2)=0.41$, $P=0.814$)						
Endowment inequality	37	59	−0.063	−1.742	0.082	−0.133 to 0.008
Income inequality	59	125	−0.066*	−2.312	0.021	−0.122 to −0.010
Wealth inequality	3	5	−0.005	−0.049	0.961	−0.189 to 0.180

Table 1 (continued) | Univariate moderation tests of categorical and continuous variables for the relationship between economic inequality and prosocial behaviour

Moderator	k_{study}	k_{effect}	r/β	z	P	95% CI
Measure of economic inequality ($Q(5)=5.25$, $P=0.386$)						
Gini index	44	87	−0.059	−1.946	0.052	−0.118 to 0.000
Dispersion ratio	12	21	−0.084	−1.778	0.076	−0.176 to 0.009
Top share	4	8	−0.070	−1.262	0.207	−0.177 to 0.039
Perception of inequality	3	4	−0.075	−0.589	0.556	−0.313 to 0.172
Dummy: inequality versus equality	30	46	−0.065	−1.652	0.098	−0.142 to 0.012
Dummy: high inequality versus low inequality	8	13	−0.215**	−3.171	0.002	−0.339 to −0.083
Unit of analysis of economic inequality ($Q(3)=4.17$, $P=0.243$)						
Group level	38	60	−0.059	−1.667	0.096	−0.127 to 0.101
Community/local level	28	59	−0.019	−0.493	0.622	−0.093 to 0.056
State/provincial/regional level	14	26	−0.088	−1.900	0.057	−0.178 to 0.003
Country level	24	47	−0.121**	−3.136	0.002	−0.196 to −0.046
Discipline of the outlet ($Q(6)=0.80$, $P=0.992$)						
Economics	44	87	−0.068*	−2.007	0.045	−0.134 to −0.002
Psychology	4	9	−0.092	−0.782	0.434	−0.312 to 0.138
Sociology	8	11	−0.072	−0.913	0.361	−0.224 to 0.083
Public administration/policy	10	15	−0.002	−0.028	0.978	−0.148 to 0.144
Political science	6	14	−0.048	−0.520	0.603	−0.226 to 0.133
Philanthropic studies	4	7	−0.078	−0.654	0.513	−0.303 to 0.155
Interdisciplinary	17	39	−0.055	−0.995	0.320	−0.161 to 0.053
Continuous variables						
Study quality	100	192	−0.159	−1.846	0.065	−0.328 to 0.010
Year of data collection (single-year studies)	72	137	−0.077	−0.715	0.475	−0.288 to 0.134
Year of data collection (all studies)	99	188	−0.089	−1.023	0.306	−0.259 to 0.081
Percentage of female participants	40	70	−0.145	−0.791	0.429	−0.504 to 0.214
Age	37	68	0.293	1.600	0.110	−0.066 to 0.651

Notes. (1) k_{study}, number of studies; k_{effect}, number of effect sizes; r, Pearson's r-based effect size; β, standardized coefficient; 95% CI, 95% confidence interval; z, z test statistic; P, P value of z test. (2) r is used for categorical moderators, while β is used for continuous moderators. (3) For categorical moderators with multiple options, only those with at least three effect sizes from at least three articles are included in the analysis. (4) *$P<0.05$, **$P<0.01$, ***$P<0.001$ (two-sided).

We examined whether participant age moderated the relationship between economic inequality and prosocial behaviour.

Moderators related to prosocial behaviour include the type, measure, source and unit of analysis of prosocial behaviour.

(1) Type of prosocial behaviour. Prosocial behaviour is a multifaceted construct. It includes charitable giving and volunteering, which indirectly benefit recipients through non-profit organizations, and more informal and spontaneous everyday helping behaviours directed towards friends and strangers (for example, dropping off food, giving a ride and assisting with household tasks)[74,75]. All are important forms of prosocial behaviour, and they are interconnected[76], but inherently different. Given that inequality is a financial indicator, it is possible that it could affect financial giving in different ways than volunteering for non-profits or informally helping people nearby. Thus, we examined whether economic inequality has different relationships with charitable giving, volunteering time and informal help.

(2) Measure of prosocial behaviour. These different types of prosocial behaviour are often measured in different ways, for example, by their incidence (yes or no), the amount of money or time given, the proportion of income (for charitable giving), the frequency (for example, how many times per year) or the number of beneficiaries (recipients or organizations). The specific operationalization of prosocial behaviour may influence the relationship between economic inequality and prosocial behaviour; thus, we examined its potential moderating role.

(3) Source of prosocial behaviour. This includes participants' self-reports versus actual behaviour observed by researchers. Self-reports are often used in non-experimental studies (for example, surveys), whereas behavioural observations are often found in experimental studies (for example, public goods games). Self-reports may be biased by respondents' social desirability or recall errors[77], and thus, it is possible that the relationship between economic inequality and prosocial behaviour may be different in self-reported versus behavioural studies.

(4) Unit of analysis of prosocial behaviour. Researchers can measure prosocial behaviour at different levels, ranging from the individual or household level, to the group level (for example, for experiments) or organizational level, and in different locations, such as the local level, regional level (for example, state/province) and country level. Although a recent review noted that 'different mechanisms might operate on different geographic scales,'[35] (p. 14) it also noted that 'considerations of spatial scale… are absent from almost all included studies.'[35] (p. 24). Since this could affect the relationship between economic in-

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Table 2 | Univariate moderation tests of categorical and continuous variables for the relationship between economic inequality and charitable giving

Moderator	k_{study}	k_{effect}	*r*/*β*	*z*	*P*	95% CI
Average effect size (random effect)	72	124	−0.091	−1.918	0.055	−0.182 to 0.002
Categorical variables						
Study design ($Q(1)=2.38$, $P=0.123$)						
Experiment	41	65	−0.143*	−2.463	0.014	−0.253 to −0.029
Non-experiment	33	59	−0.023	−0.360	0.719	−0.149 to 0.103
Type of study ($Q(3)=2.78$, $P=0.427$)						
Public goods game	29	46	−0.148*	−2.021	0.043	−0.286 to −0.004
Dictator game	5	11	−0.189	−1.737	0.082	−0.386 to 0.025
Longitudinal	7	19	−0.060	−0.556	0.578	−0.265 to 0.150
Cross-sectional	24	33	−0.029	−0.381	0.703	−0.175 to 0.119
Country ($Q(1)=6.75$, $P=0.009$)						
Cross-national	12	14	−0.351**	−3.174	0.002	−0.532 to −0.139
Within-national	60	110	−0.040	−0.811	0.418	−0.137 to 0.057
Continent ($Q(4)=7.50$, $P=0.112$)						
Africa	3	6	0.039	0.364	0.716	−0.171 to 0.246
Asia	7	17	−0.190**	−2.783	0.005	−0.316 to −0.057
North America	32	59	0.001	0.023	0.982	−0.060 to 0.062
Oceania	4	4	0–0.061	−0.639	0.523	−0.241 to 0.125
Western Europe	15	24	−0.066	−1.430	0.153	−0.156 to 0.025
Country group ($Q(1)=1.63$, $P=0.202$)						
WEIRD	51	90	−0.026	−1.031	0.303	−0.077 to 0.024
Non-WEIRD	9	20	−0.112	−1.805	0.071	−0.231 to 0.010
Measure of prosocial behaviour ($Q(2)=4.51$, $P=0.105$)						
Incidence	21	28	−0.049	−0.814	0.416	−0.165 to 0.069
Amount	49	72	−0.084	−1.168	0.093	−0.181 to 0.014
Proportion	15	22	−0.183**	−2.815	0.005	−0.303 to −0.056
Source of prosocial behaviour ($Q(1)=0.004$, $P=0.947$)						
Self-report	19	26	−0.095	−1.269	0.204	−0.237 to 0.052
Observation/actual behaviour	55	98	−0.090	−1.745	0.081	−0.188 to 0.011
Unit of analysis of prosocial behaviour ($Q(5)=6.73$, $P=0.242$)						
Individual/household level	40	63	−0.093	−1.564	0.119	−0.201 to 0.023
Group level	15	22	−0.099	−1.019	0.308	−0.283 to 0.091
Organizational level	4	5	−0.034	−0.295	0.768	−0.256 to 0.191
Community/local level	7	20	0.044	0.286	0.775	−0.249 to 0.329
State/provincial/regional level	3	4	−0.014	−0.113	0.910	−0.244 to 0.218
Country level	8	10	−0.266**	−2.612	0.009	−0.444 to −0.068
Measure of economic inequality ($Q(4)=5.12$, $P=0.275$)						
Gini index	25	41	−0.082	−1.142	0.253	−0.219 to 0.059
Dispersion ratio	5	7	−0.074	−0.700	0.484	−0.275 to 0.133
Top share	3	7	−0.090	−0.868	0.385	−0.286 to 0.113
Dummy: inequality versus equality	30	46	−0.064	−0.882	0.378	−0.203 to 0.078
Dummy: high inequality versus low inequality	8	13	−0.325**	−2.916	0.004	−0.510 to −0.110
Unit of analysis of economic inequality ($Q(3)=8.52$, $P=0.036$)						
Group level	38	60	−0.059	−0.937	0.349	−0.180 to 0.064
Community/local level	13	29	0.030	0.280	0.779	−0.177 to 0.235
State/provincial/regional level	8	17	−0.099	−0.920	0.358	−0.301 to 0.112
Country level	14	18	−0.302**	−3.282	0.001	−0.460 to −0.125

Table 2 (continued) | Univariate moderation tests of categorical and continuous variables for the relationship between economic inequality and charitable giving

Moderator	k_{study}	k_{effect}	r/β	z	P	95% CI
Discipline of the outlet ($Q(5)=1.41$, $P=0.923$)						
Economics	40	77	−0.119	−1.805	0.071	−0.245 to 0.010
Psychology	3	5	−0.200	−0.811	0.418	−0.600 to 0.280
Sociology	3	3	−0.026	−0.108	0.914	−0.464 to 0.422
Public administration/policy	8	9	0.003	0.021	0.983	−0.292 to 0.297
Philanthropic studies	3	3	0.069	0.278	0.781	−0.394 to 0.504
Interdisciplinary	10	22	−0.034	−0.255	0.799	−0.285 to 0.222
Continuous variables						
Study quality	72	124	−0.195*	−2.196	0.028	−0.369 to −0.021
Year of data collection (single-year studies)	59	95	−0.143	−1.144	0.253	−0.389 to 0.102
Year of data collection (all studies)	71	120	−0.166	−1.498	0.134	−0.385 to 0.051
Percentage of female participants	29	42	−0.108	−0.367	0.714	−0.687 to 0.470
Age	25	40	0.305	1.218	0.223	−0.186 to 0.797

Notes. (1) k_{study}, number of studies; k_{effect}, number of effect sizes; r, Pearson's r-based effect size; β, standardized coefficient; 95% CI, 95% confidence interval; z, z test statistic; P, P value of z test. (2) r is used for categorical moderators, while β is used for continuous moderators. (3) For categorical moderators with multiple options, only those with at least three effect sizes from at least three articles are included in the analysis. (4) *$P<0.05$, **$P<0.01$, ***$P<0.001$ (two-sided).

equality and prosocial behaviour, we examined unit of analysis as a potential moderator.

Moderators related to economic inequality include the type, measure and unit of analysis of economic inequality.

(1) Type of economic inequality. Income inequality and wealth inequality are real-world economic inequality variables, while in experiments, there is also endowment inequality, when participants are assigned to different amounts of tokens during experiments. Certain types of inequality may be more related to prosocial behaviour than others, which we also explore in the current study.

(2) Measure of economic inequality. The specific operationalization of economic inequality (for example, Gini index, dispersion ratio, top share and so on) is an important issue in research on the determinants and consequences of economic inequality. In fact, different inequality measures have different sensitivity to changes over time depending on what part of the income or wealth distribution is changing[67]. Therefore, there may be variation in the relationship between economic inequality and prosocial behaviour based on the inequality measure.

(3) Unit of analysis of economic inequality. Researchers measure economic inequality at different levels. Relative to inequality at more macro levels such as the state or country levels, inequality may be more salient at the community or group levels. Research has demonstrated that different levels of economic inequality may be correlated with prosocial behaviour in different ways[15,19,30]. Thus, prosocial responses to inequality may differ depending upon the level of economic inequality assessment.

Finally, there is a wide range of disciplines that examine the relationship between inequality and prosocial behaviour, such as economics, psychology, sociology and public administration. Different disciplines have their preferred academic traditions, paradigms and methodologies, which might influence the relationship between inequality and prosocial behaviour. Thus, we examined discipline as a potential moderator.

Taken together, this study examines whether economic inequality is positively, negatively or insignificantly related to prosocial behaviour on average, and also examines which factors may help to explain the mixed findings in previous studies. We contribute to current research in three ways. First, by synthesizing the mixed results in previous studies, this meta-analysis provides a quantitative estimate of the average relationship between economic inequality and prosocial behaviour. Second, by exploring the potential factors influencing this relationship, this meta-analysis can help account for variations in effect sizes in previous studies. Finally, by systematically reviewing previous studies on the relationship, this meta-analysis can help identify the limitations or gaps of previous studies and provide directions for future research. More practically, understanding the relationship between economic inequality and prosocial behaviour, and factors that may explain it, may help to uncover potential pathways to increase prosocial behaviour in the future.

Results

We identified 100 eligible articles (with 192 effect sizes and over 2.5 million participants) for the meta-analysis (86 journal articles, 2 book chapters, 7 unpublished articles, 5 dissertations; Fig. 2 summarizes the literature search and inclusion process). These articles represented a wide variety of countries, data collection years, research designs, indicators of economic inequality, and forms of prosocial behaviour, thus enhancing this study's external validity. We have confidence that our rigourous process has yielded a systematic sample to explore the relationship between economic inequality and prosocial behaviour. All materials needed to reproduce the results can be found on the Open Science Framework (https://osf.io/e3fzb/?view_only=8f4d58a84b694bba98b6173b879381d8).

Average results

Table 1 reports the average effect size and moderation analysis results for the relationship between economic inequality and prosocial behaviour in general. Random-effects meta-analysis shows that higher economic inequality was associated with less prosocial behaviour on average, $r = -0.064$, $P = 0.004$ (two-tailed test), 95% confidence interval −0.106 to −0.021. The 95% prediction interval ranged from −0.450 to 0.343, which means that the relationship between economic inequality and prosocial behaviour was negative in some studies and positive in others. In addition, the Q-statistic indicated that there was much heterogeneity ($Q(191) = 11{,}192.948$, $P < 0.001$) and the I^2-statistic showed that 99.82% of heterogeneity cannot be attributed to sample error. Thus, it was appropriate to use random-effects meta-analysis. The variance components (sigma-between 0.201, sigma-within 0.072)

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Table 3 | Univariate moderation tests of categorical and continuous variables for the relationship between economic inequality and volunteering time

Moderator	k_{study}	k_{effect}	r/β	z	P	95% CI
Average effect size (random effect)	37	53	−0.062*	−2.570	0.010	−0.109 to −0.015
Categorical variables						
Type of study ($Q(2)=0.26$, $P=0.880$)						
Longitudinal	3	5	−0.093	−1.171	0.242	−0.245 to 0.063
Cross-sectional	28	37	−0.064*	−2.149	0.032	−0.122 to −0.006
Pooled cross-sectional	6	11	−0.044	−0.769	0.442	−0.155 to 0.068
Country ($Q(1)=0.24$, $P=0.625$)						
Cross-national	15	21	−0.048	−1.229	0.219	−0.123 to 0.028
Within-national	22	32	−0.072*	−2.285	0.022	−0.133 to −0.010
Continent ($Q(1)=0.36$, $P=0.548$)						
North America	15	18	−0.053	−1.868	0.062	−0.108 to 0.003
Western Europe	4	8	−0.021	−0.470	0.638	−0.108 to 0.066
Measure of prosocial behaviour ($Q(2)=3.22$, $P=0.200$)						
Incidence	24	34	−0.038	−1.255	0.210	−0.096 to 0.021
Frequency	8	11	−0.120*	−2.549	0.011	−0.210 to −0.028
Number	5	6	−0.133**	−2.812	0.005	−0.224 to −0.041
Unit of analysis of prosocial behaviour ($Q(3)=13.46$, $P=0.004$)						
Individual/household level	21	31	−0.014	−0.596	0.551	−0.062 to 0.033
Community/local level	4	6	−0.206***	−3.571	<0.001	−0.314 to −0.094
State/provincial/regional level	6	6	−0.196**	−2.600	0.009	−0.335 to −0.049
Country level	6	9	−0.085	−1.232	0.218	−0.218 to 0.050
Measure of economic inequality ($Q(1)=0.01$, $P=0.914$)						
Gini index	28	39	−0.069**	−2.690	0.007	−0.120 to −0.019
Dispersion ratio	9	11	−0.068*	−2.294	0.022	−0.125 to −0.010
Unit of analysis of economic inequality ($Q(2)=0.61$, $P=0.738$)						
Community/local level	14	23	−0.056	−1.534	0.125	−0.128 to 0.016
State/provincial/regional level	9	9	−0.075*	−2.171	0.030	−0.142 to −0.007
Country level	15	21	−0.064	−1.923	0.055	−0.129 to 0.001
Discipline of the outlet ($Q(4)=0.88$, $P=0.927$)						
Economics	3	6	−0.007	−0.085	0.932	−0.170 to 0.156
Sociology	7	7	−0.069	−1.246	0.213	−0.177 to 0.040
Public administration/policy	3	5	−0.056	−0.658	0.510	−0.221 to 0.111
Political science	6	11	−0.023	−0.348	0.728	−0.153 to 0.107
Interdisciplinary	10	14	−0.080	−1.626	0.104	−0.175 to 0.017
Continuous variables						
Study quality	37	53	−0.095	−0.621	0.534	−0.393 to 0.204
Year of data collection (single-year studies)	22	30	0.230	0.091	0.928	−0.473 to 0.519
Year of data collection (all studies)	37	53	−0.015	−0.088	0.930	−0.342 to 0.312
Percentage of female participants	15	22	−0.355	−1.482	0.139	−0.824 to 0.115
Age	13	22	−0.263	−1.542	0.123	−0.598 to 0.071

Notes. (1) k_{study}, number of studies; k_{effect}, number of effect sizes; r, Pearson's r-based effect size; β, standardized coefficient; 95% CI, 95% confidence interval; z, z test statistic; P, P value of z test. (2) r is used for categorical moderators, while β is used for continuous moderators. (3) For categorical moderators with multiple options, only those with at least three effect sizes from at least three articles are included in the analysis. (4) *$P<0.05$, **$P<0.01$, ***$P<0.001$ (two-sided).

suggested that between-study variance was higher than within-study variance.

Moderation analyses

Study characteristics. As can be seen in Table 1, the results were not significantly moderated by study design ($Q(1)=1.81$, $P=0.178$), type of study ($Q(4)=4.05$, $P=0.399$), or study quality (continuous) ($k_{study}=100$, $k_{effect}=192$, $\beta=-0.159$, $P=0.065$, 95% confidence interval −0.328 to 0.010, sigma-between 0.788, sigma-within 0.590), nor did the relationship between economic inequality and prosocial behaviour significantly change over time, whether for single-year studies ($k_{study}=72$, $k_{effect}=137$, $\beta=-0.077$, $P=0.475$, 95% confidence interval −0.288 to

Table 4 | Applying Bonferroni correction to multiple moderation tests

Type of prosocial behaviour	Significant moderator	Original *P* value	Bonferroni-corrected *P*-value threshold	Conclusion
Prosocial behaviour in general	Continent	0.034	0.003	Not significant moderator
Charitable giving	Country Unit of analysis of economic inequality Study quality	0.009 0.036 0.028	0.003	Not significant moderator
Volunteering time	Unit of analysis of prosocial behaviour	0.004	0.004	Significant moderator

0.134, sigma-between 0.882, sigma-within 0.670) or for all studies (k_{study} = 99, k_{effect} = 188, β = −0.089, P = 0.306, 95% confidence interval −0.259 to 0.081, sigma-between 0.783, sigma-within 0.576). Thus, the effects were similar across study designs, study types, different levels of study quality, and time.

Participant characteristics. We analysed country as a moderator in several ways, and found no evidence of differences when comparing cross-national to within-national studies (Q(1) = 1.52, P = 0.218), or when comparing Western, educated, industrialized, rich and democratic (WEIRD) countries with non-WEIRD countries (Q(1) = 0.98, P = 0.323). However, continent emerged as a significant moderator (Q(4) = 10.44, P = 0.034), such that data collected from Asia had a significant negative relationship (k_{study} = 8, k_{effect} = 21, r = −0.217, P < 0.001, 95% confidence interval −0.325 to −0.102), whereas data from Africa, North America, Oceania and Western Europe did not. We report other country-related results in Supplementary Information. Supplementary Table 1 reports the average relationship between economic inequality and prosocial behaviour for individual countries, and Supplementary Table 2 examines the moderating roles of gross national income and Hofstede's cross-cultural indicators.

We did not find evidence that the percentage of females within each sample (k_{study} = 40, k_{effect} = 70, β = −0.145, P = 0.429, 95% confidence interval −0.504 to 0.214, sigma-between 0.946, sigma-within 0.474), and average age (k_{study} = 37, k_{effect} = 68, β = 0.293, P = 0.110, 95% confidence interval −0.066 to 0.651, sigma-between 1.089, sigma-within 0.563) significantly moderated the inequality and prosocial behaviour relationship.

Prosocial behaviour. None of the prosocial behaviour moderators emerged as significant (Table 1): not type (Q(2) = 4.51, P = 0.105), measure (Q(4) = 7.41, P = 0.116), source (Q(1) = 0.02, P = 0.876), nor unit of analysis (Q(5) = 7.44, P = 0.190).

Economic inequality. None of the economic inequality moderators was significant: not type (Q(2) = 0.41, P = 0.814), measure (Q(5) = 5.25, P = 0.386), nor unit of analysis (Q(3) = 4.17, P = 0.243).

Discipline of the outlet. Nor was the relationship between economic inequality and prosocial behaviour significantly related to the journal's discipline (Q(6) = 0.80, P = 0.992).

Bonferroni correction for multiple tests. For overall prosocial behaviour, we tested 18 moderators and thus, applied the Bonferroni correction to adjust the P-value threshold. This was calculated by dividing the original threshold (P = 0.05) by 18, to obtain a new P value of 0.003. When applying this correction, there were no longer any significant moderators for overall prosocial behaviour.

Multiple moderators. Please note that, in addition to conducting moderation tests for each potential moderator separately, we also conducted multiple testing with all moderators included. However, because there were not enough studies/low power to test for multivariate effects given the large number of potential moderators, we do not report multiple testing in the main text. For details, see Supplementary Table 3.

Economic inequality and charitable giving

Given that most empirical studies on the relationship between economic inequality and prosocial behaviour focus on formal charitable giving and formal volunteering time, we conducted separate analyses examining how economic inequality relates to charitable giving and volunteering.

We first examined the relationship between economic inequality and charitable giving (Table 2). On average, there was only a marginally significant relationship between economic inequality and charitable giving (r = −0.091, P = 0.055, 95% confidence interval −0.182 to 0.002). Its 95% prediction interval ranged from −0.705 to 0.602, meaning that the relationship between economic inequality and charitable giving was negative in some studies and positive in others. High levels of heterogeneity (Q = 4808.147, P < 0.001, I^2 = 99.92%) confirmed the appropriateness of random-effects meta-analysis. The variance components (sigma-between 0.386, sigma-within 0.101) suggested that between-study variance was higher than within-study variance.

Of all the categorical moderators tested in the meta-analysis, only two significantly moderated the relationship between economic inequality and charitable giving. First, the relationship varied by country (cross-national versus within-national analyses) (Q(2) = 6.75, P = 0.009). There was a negative relationship between economic inequality and charitable giving for cross-national studies (k_{study} = 12, k_{effect} = 14, r = −0.351, P = 0.002, 95% confidence interval −0.532 to −0.139), but the relationship was not significant for within-national studies (k_{study} = 60, k_{effect} = 110, r = −0.040, P = 0.418, 95% confidence interval −0.137 to 0.057).

Second, the relationship depended upon the unit of analysis of economic inequality (Q(3) = 8.52, P = 0.036). The relationship was significant for country-level economic inequality (k_{study} = 14, k_{effect} = 18, r = −0.302, P = 0.001, 95% confidence interval −0.460 to −0.125), but the relationship was not significant for group-level (k_{study} = 38, k_{effect} = 60, r = −0.059, P = 0.349, 95% confidence interval −0.180 to 0.064), community/local-level (k_{study} = 13, k_{effect} = 29, r = 0.030, P = 0.779, 95% confidence interval −0.177 to 0.235) and state/provincial/regional-level economic inequality (k_{study} = 8, k_{effect} = 17, r = −0.099, P = 0.358, 95% confidence interval −0.301 to 0.112).

In terms of continuous moderators, only study quality significantly moderated the relationship between economic inequality and charitable giving (k_{study} = 72, k_{effect} = 124, β = −0.195, P = 0.028, 95% confidence interval −0.369 to −0.021, sigma-between 0.904, sigma-within 0.318), with higher-quality studies having smaller effect sizes.

For overall charitable giving, we tested 16 moderators and, thus, applied the Bonferroni correction to adjust the P-value threshold: 0.05/16 = 0.003. When applying this correction, there were no longer any significant moderators for charitable giving.

Economic inequality and volunteering time

As shown in Table 3, random-effects meta-analysis found a significantly negative relationship between economic inequality and volunteering

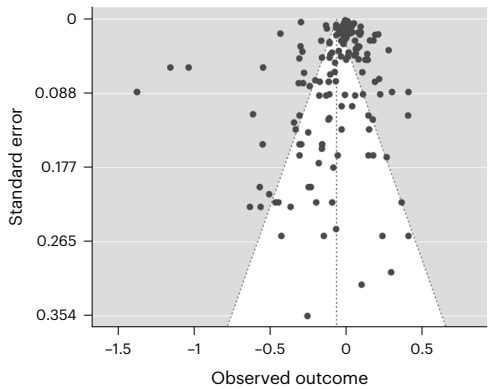

Fig. 3 | Funnel plot. Observed outcome refers to the effect size of the relationship between economic inequality and prosocial behaviour.

time ($r = -0.062$, $P = 0.010$, 95% confidence interval −0.109 to −0.015). Its 95% prediction interval ranged from −0.316 to 0.200, meaning that the relationship between economic inequality and volunteering time was negative in some studies and positive in others. High levels of heterogeneity ($Q = 8080.710$, $P < 0.001$, $I^2 = 99.74\%$) confirmed the appropriateness of random-effects meta-analysis. The variance components (sigma-between 0.133, sigma-within 0.009) suggested that between-study variance was higher than within-study variance.

Of all the moderators, only the unit of analysis of prosocial behaviour significantly moderated the relationship ($Q(3) = 13.46$, $P = 0.004$). Economic inequality negatively related to community/local-level volunteering ($k_{study} = 4$, $k_{effect} = 6$, $r = -0.206$, $P < 0.001$, 95% confidence interval −0.314 to −0.094) and state/provincial/regional-level volunteering ($k_{study} = 6$, $k_{effect} = 6$, $r = -0.196$, $P = 0.009$, 95% confidence interval −0.335 to −0.049), whereas it was not significantly related to individual/household-level volunteering ($k_{study} = 21$, $k_{effect} = 31$, $r = -0.014$, $P = 0.551$, 95% confidence interval −0.062 to 0.033) and country-level volunteering ($k_{study} = 6$, $k_{effect} = 9$, $r = -0.085$, $P = 0.218$, 95% confidence interval −0.218 to 0.050).

For overall volunteering, we tested 13 moderators and, thus, applied the Bonferroni correction to adjust the P-value threshold: 0.05/13 = 0.004. When applying this correction, the unit of analysis of prosocial behaviour remained a significant moderator (Table 4).

Publication bias

We deployed several approaches to test and remedy potential publication bias. The first was using the funnel plot and trim-and-fill approach[78]. As shown in Fig. 3, the distribution in the funnel plot was roughly asymmetric. We used the trim-and-fill approach to assess the symmetry and adjust for any bias. However, results showed that the number of samples and the average effect size remained the same, indicating that there was not substantial publication bias. Next, the Egger's test was used to check publication bias[79]. The Egger's test results suggested a potential concern of publication bias ($z = -3.32$, $P = 0.001$). We also examined whether there was a significant difference in effect sizes between published and unpublished studies, but publication status was not a significant moderator, $Q(1) = 0.24$, $P = 0.627$. Hence, we argue that publication bias was not a serious issue in our meta-analysis.

Discussion

In the face of rising economic inequality in the world[67], researchers have been increasingly interested in its potential implications. Prosocial behaviour plays an important role in society. Although it is important to explore the relationship between them, so far, although a recent systematic literature review examined this question[35], a meta-analysis can help to quantify average effect sizes and identify moderators. Our meta-analysis builds on recent research and contributes to this current debate by synthesizing empirical studies from different disciplines. Specifically, the meta-analysis examined: (1) whether economic inequality positively, negatively or insignificantly relates to prosocial behaviour, and (2) which factors moderate the relationship.

On average, we found negative relationships between economic inequality and prosocial behaviour in general, and volunteering time in particular. Both are small according to Cohen's[80] classifications. However, there was no significant relationship between inequality and charitable giving. Taken together, these findings align with a recent review that found that, in the face of economic inequality, people on average may not increase their prosocial behaviour in response to increasing social needs[35]. Instead, in line with the conclusions of a recent review, we found that people on average may reduce it slightly. Although this meta-analysis cannot test explanations, we speculate that this reduced prosocial behaviour may be because economic inequality reduces social trust, increases government social spending, decreases available resources for the less advantaged, and enlarges the sense of entitlement among the rich, among other potential reasons (Main).

The average effect size between economic inequality and prosocial behaviour is one key finding, yet the strong degree of heterogeneity within previous studies is also important. As shown in the prediction intervals, the relationship between economic inequality and prosocial behaviour generally (and charitable giving and volunteering specifically) were negative in some studies and positive in others. Scholars can best understand the relationship between economic inequality and prosocial behaviour only if they consider both the average negative relationship and the strong heterogeneity of effect sizes.

Most moderators were not significant, especially after applying the Bonferroni correction, thus demonstrating the difficulty in explaining this heterogeneity. It is possible that there are many moderators, but with small, incremental effects that did not reach traditional levels of significance. As more future research on this topic is added, we anticipate better understanding variation in the relationship between economic inequality and prosocial behaviour.

Only one moderator reached significance after correcting for multiple testing. For volunteering, the unit of analysis of prosocial behaviour was the only significant moderator. Mid-level assessments (community/local level; state/provincial/regional level) of prosocial behaviour had significant negative relationships, while the other levels were not significant. These results align with a recent review, which suggested that 'different mechanisms might operate on different geographic scales[35] (p.14). Thus, future researchers should consider and justify unit of analysis in their measurements.

While our meta-analysis provides a systematic review of empirical studies that examine the relationship between economic inequality and prosocial behaviour, some limitations are important to note. First, our meta-analysis on the relationship between economic inequality and prosocial behaviour may have overrepresented studies on charitable giving. Of the 192 samples, the majority (64.58%; $k = 124$) were about charitable giving, whereas only 27.60% ($k = 53$) were about volunteering and 7.81% ($k = 15$) were about informal helping behaviour. Second, this meta-analysis is biased by the large number of studies on income inequality. Income inequality and wealth inequality are interconnected, but distinct, types of economic inequality. According to the World Inequality Report 2018, globally, wealth inequality is higher than income inequality 68. Yet, of the 192 samples included in the meta-analysis, 65.10% ($k = 125$) focus on income inequality, whereas only 2.60% ($k = 5$) focus on wealth inequality. Finally, it is also important to empirically test potential mechanisms linking economic inequality with prosocial behaviour, which is unfortunately not possible to do in the current meta-analysis due to lack of enough existing studies.

To address the above limitations, we encourage researchers to examine how economic inequality relates to different types of prosocial behaviour, especially volunteering time and informal helping

behaviour, differentiate the role of income inequality versus wealth inequality in prosocial behaviour, and empirically test potential mechanisms linking economic inequality with prosocial behaviour in the future. In addition, future research can explore how different origins of economic inequality relate to prosocial behaviour. As argued by Chiang and Chen[81] (p. 74), 'inequality is a cause as much as an effect: Inequality influences human behaviour, yet at the same time, it also reflects individuals' choices in the allocation of social wealth'. Inequality itself may stem from a mix of factors (for example, chance, competition, choice, ability and power). Identifying different sources of economic inequality can help to determine whether there is indeed a relationship between economic inequality and prosocial behaviour or whether such a relationship is influenced by confounding factors. In fact, some previous experimental studies have explored the role of different origins of economic inequality[81–84]. Future research, especially experimental studies, can further examine how different origins of economic inequality relate to prosocial behaviour. It is also important to note that many non-experimental studies on economic inequality and prosocial behaviour often employ economic inequality data from social surveys. Although social survey data reflect economic inequality in the real world, they cannot allow researchers to isolate and test implications of different origins of economic inequality. Therefore, economic inequality in non-experimental studies is a mix of different origins, and we should keep this in mind when interpreting such results.

Conclusion

How does economic inequality relate to prosocial behaviour? In this study, we conducted a meta-analysis to systematically synthesize empirical studies. We found the relationship varies from being negative to positive depending upon the study, but on average there is a small, negative relationship between economic inequality and prosocial behaviour. Moderator tests demonstrated that the results were generally robust across study characteristics, participants, measures of prosocial behaviour and inequality, and publication disciplines. The fact that economic inequality tends to be associated with less prosocial behaviour should perhaps make us wonder if the societal costs of inequality are worth it.

Method

Literature search and inclusion criteria

This meta-analysis was pre-registered on the Open Science Framework on September 2020 (https://osf.io/5d7yu/?view_only=64152ace4ce14c0787927922359718b7). Reviewers recommended that we add new key terms related to wealth inequality and also that we use multi-level analysis to adjust for interdependence of some outcomes, hence the pre-registration was updated in October 2022. We first conducted a literature search to identify existing studies on economic inequality and prosocial behaviour, with the following steps:

First, we conducted database searches in Social Science Citation Index and EBSCO Host for peer-reviewed journal articles using the following search strings: (inequal* OR 'income gap' OR 'income disparity' OR gini OR 'income differen*' OR 'income discrepancy') AND (donat* OR charit* OR philanthrop* OR prosocial OR 'civic engagement' OR 'social capital' OR 'public good' OR altruis* OR volunt* OR cooperat* OR 'nonprofit organization' OR 'not-for-profit organization' OR 'nongovernmental organization' OR foundation OR 'civil society organization'). The search was limited to studies written in English. This search was concluded in June 2020. Using the same search strings, we also searched ProQuest Dissertations and Theses for master theses and doctoral dissertations in November 2020. Following a reviewer's suggestion, we updated our search to include ('wealth gap' OR 'wealth disparity' OR 'wealth differen*' OR 'wealth discrepancy'), along with the same prosocial behaviour key terms, up to 2020 to match with our original key terms.

Second, we performed a backward search to examine the references of the articles identified in the first step and a forward search using Google Scholar to check for citations of these articles to locate other relevant publications. Backward search can find some older articles, while forward search can find some newer ones. Both search strategies helped us identify other possible articles missed in the database search. This stage was completed in August 2020.

Third, we contacted authors of the eligible articles under two circumstances. First, when we found that eligible articles had missing data for effect size calculation during the coding process, we contacted the corresponding authors to ask them to provide more information. If authors did not reply within two weeks, we sent a reminder. Overall, of the 44 emails sent to the authors, 22 (50%) authors responded to our request, but only 16 (36.36%) authors provided the requested data. The other reason we contacted authors was to request further work. To find more articles, especially unpublished ones, we sent emails to the authors who had at least two articles included in this meta-analysis to request their other work satisfying our inclusion criteria. This stage was closed in March 2021.

Finally, we sent out some public calls for published and unpublished data on some listservs (for example, Society for Personality and Social Psychology, Association for Research on

Nonprofit Organizations and Voluntary Action). The entire literature search was concluded in March 2021.

Studies were eligible if they fulfilled the following criteria.

(1) Articles included empirical studies using quantitative methods. Literature reviews, theoretical articles and qualitative studies were excluded from the meta-analysis.
(2) Articles provided quantitative measures of economic inequality. These measures could be income/wealth inequality, actual/perception of economic inequality, and different indicators to measure economic inequality.
(3) Articles provided quantitative measures of prosocial behaviour. Prosocial behaviour is a broad and multifaceted term, but in this meta-analysis we focused on three forms: charitable giving within a lab or to a non-profit organization, volunteering time within a lab or to a non-profit organization, and informal helping behaviours of other kinds.
(4) Articles provided enough statistical information to estimate effect sizes. If original articles did not report some important information, we contacted the authors. If the authors replied and provided the requested information, those articles were included. But if the authors did not reply or did not provide requested information in their responses, we had to exclude those articles.

After screening abstracts, we obtained 170 relevant articles. Of the 170 relevant articles, 18 were excluded because they did not include quantitative measures of economic inequality[24,85–101]; 33 were excluded because they did not include quantitative measures of prosocial behaviour[102–134]; 3 were excluded because they only provided economic models but without empirical analyses[135–137]; 2 were excluded because they used simulation data rather than data collected from the real world[138,139]; and 14 were excluded because we could not calculate effect sizes due to lack of data[8,42,140–151]. During the selection process, the first author screened all the articles retrieved and the second author randomly selected 10% to check the appropriateness of inclusion or exclusion of an article (per cent agreement was 97.06%). Any difference was resolved with discussion. Finally, we obtained 100 eligible studies[2–7,9–23,25–34,47,81–84,152–215].

Coding of effect size

Effect sizes are standard measures of the relationship between two variables of interest. There are different types of effect sizes in meta-analysis, such as Cohen's *d*-based effect size, Pearson's *r*-based effect size, and odds-based effect size. In this meta-analysis, we first estimated Cohen's *d* or Pearson's *r* based on different reporting information

in the eligible articles, and then transformed Cohen's *d* into Pearson's *r* so that there was a unified measure of the relationship between economic inequality and prosocial behaviour. Supplementary Table 4 presents the different methods used to calculate effect sizes.

Overall, the methods we used can be classified into three types. First, for experimental studies, researchers (1) either reported the mean, standard deviation and sample size of treatment and control groups (2) or reported the statistical test of the mean difference of treatment and control groups (for example, *t*-statistic, *z*-statistic and *F*-statistic). Under such circumstance, Cohen's *d* was appropriate. Second, for some non-experimental studies, researchers reported zero-order correlations between economic inequality and prosocial behaviour, in which case Pearson's *r* without covariates was used. Finally, for some non-experimental studies, researchers often reported regression results controlling for several confounding factors rather than zero-order correlations. To reduce the loss of eligible studies, Pearson's *r* with covariates was extracted from these studies.

For individual study risk of bias, one reviewer assessed all studies for bias using an adapted version of the Study Design and Implementation Assessment Device (DIAD) approach[216]. We created four criteria (see Supplementary Table 5) that addressed the four validity types outlined in the DIAD (construct, internal, external, statistical). Each of these was based on directly observable features of the study methodology, which allowed for an objective assessment approach. Scores were summed to obtain an overall quality score. A second reviewer then used the same tool to assess a random 10% of the samples (per cent agreement was 95%). Any difference was resolved with discussion.

Moderator coding

We identified five types of potential moderators in an attempt to account for potential variations in the effect sizes: study characteristics, participant characteristics, moderators related to prosocial behaviour, moderators related to economic inequality, and the discipline of the outlet.

Study characteristics. Study design was coded as experimental (for example, laboratory public goods games or dictator games) or non-experimental (for example, surveys in the form of panel data, time series data or cross-sectional data).

Type of study was coded as public goods game, other experimental study, panel study, cross-sectional study, time series study and pooled cross-sectional study.

Four aspects of study quality were coded: construct validity (that is, did the study use valid and reliable measures), internal validity (that is, to what extent can conclusions about causal relationships be made), external validity (that is, was the data based on nationally representative samples of participants) and statistical validity (that is, could accurate estimates of the intervention's impact be derived from the study report). For coding instructions, see Supplementary Table 5. The first author coded all articles, and then the second author randomly selected 10% for checking. Any difference was resolved with discussion. We had a high level of inter-rater agreement (construct validity 94.74%, internal validity 89.47%, external validity 100% and statistical validity 100%).

Regarding year of data collection, the wide range of time periods of eligible studies made it possible to explore the influence of the year of data collection on the results. Non-experimental studies often reported the year of economic inequality data. Some experimental studies reported the year of data collection, while others did not. To estimate the year of data collection, we used standard procedures from previous meta-analyses[217,218].

Participant characteristics. The studies in this meta-analysis were from many different countries. A large number of studies focus on the United States, but there were many studies from other countries (Supplementary Table 1), and some that conducted cross-national analyses. We examined the role of country from different perspectives. We first compared whether focusing on a specific country (within-national) versus conducting cross-national analyses affected the relationship between economic inequality and prosocial behaviour. Second, excluding cross-national studies, we explored if the relationship differed across continents (Africa, Asia, North America, Oceania and Western Europe). Note that there were not enough data from other regions (for example, South America and Eastern Europe); we included regions with at least three data points. Finally, we explored if the relationship varied between WEIRD countries and non-WEIRD countries[219,220].

For studies that reported this information, we created a continuous moderator to represent the percentage of females.

Average age of participants was added as a continuous moderator.

Prosocial behaviour. We coded prosocial behaviour as charitable giving, volunteering time or informal helping behaviour.

Measure of prosocial behaviour was coded as incidence, amount, proportion or frequency of prosocial behaviour, and number of recipients/organizations.

Source of prosocial behaviour was coded as self-report versus behavioural observation.

Unit of analysis of prosocial behaviour was coded as individual or household level, group level (mainly for experiments), organizational level, community or local level, state or provincial or regional level, and country level.

Economic inequality. Type of economic inequality was coded as endowment inequality, income inequality and wealth inequality.

In the current meta-analysis, non-experimental studies most often used the Gini index to measure economic inequality; however, some studies used a dispersion ratio, top income share, or perceptions of inequality. Experimental studies used comparisons between inequality versus equality, or high inequality versus low inequality. Thus, we coded the operationalization of the measure accordingly and examined whether it moderated the effect.

Unit of analysis of economic inequality was coded at the group level (for example, experiments), community or local level, state or provincial or regional level, and country-level.

Discipline of the outlet. Discipline of the outlet was coded as economics, psychology, sociology, public administration/policy, political science, philanthropic studies and interdisciplinary. For published journal articles, we used the discipline of the journals, but for other articles (book chapters, unpublished articles and theses/dissertations) we used the discipline of the first or only author.

Analytical strategy

After extracting data from the eligible articles, we used the 'metafor' package in R programming to conduct the meta-analysis[221]. As described before, Pearson's *r* was used for the meta-analysis. Following the recommendations in Card[64] and Ringquist[65], Pearson's *r* was first transformed into Fisher's *z* in the analyses and then converted back to Pearson's *r* for ease of interpretation. There are mainly two models for the meta-analysis: fixed-effect meta-analysis and random-effects meta-analysis. The fixed-effect model assumes a constant population effect size can be estimated from the individual effect size and is more appropriate for a meta-analysis with low heterogeneity in the data. However, the random-effects model assumes that the population effect size is a normally distributed random variable and can produce more reliable estimates in the face of high heterogeneity. Because the eligible articles were expected to be different in many ways (for example, research design, country, disciplines, and measure of key variables), the random-effects model was more appropriate for this meta-analysis. In addition, given that the effect sizes in this meta-analysis were not

independent because of more than one effect size was extracted from the same study, this meta-analysis used the three-level random-effects meta-analysis model[222].

The analytical process followed three steps. First, we deployed the three-level random-effects model to estimate the weighted average effect size at the average level. The effect sizes were winsorized at the 0.01 level because of the existence of outliers[223]. The weight for each effect size was the inverse of its variance. At this stage, we also assessed the heterogeneity of the eligible studies by reporting two indicators: Q-statistic and I^2-statistic. The Q-statistic provides a test for identifying random effects in a large number of effect sizes. The null hypothesis is that the variation in effect size is no greater than that from the sample error. When the null hypothesis is rejected, it means the variation in effect size can be attributed to factors other than the sample error. Although the Q-statistic informs us the existence of heterogeneity, it does not allow researchers to assess the degree of the heterogeneity. Unlike the Q-statistic, the I^2-statistic can indicate the magnitude of the heterogeneity. The I^2-statistic ranges from 0 to 1, and a larger value means more heterogeneity cannot be attributed to the sample error.

Second, to explain the substantial differences of the effect sizes in the data, we also conducted moderator analyses. Specifically, a series of univariate moderation tests were used for the relationship between economic inequality and prosocial behaviour in general as well as the relationship between economic inequality and charitable giving and volunteering time specifically. We also applied Bonferroni corrections to adjust for multiple moderator tests.

In addition, publication bias is an important issue in a meta-analysis. It is known that not all studies have an equal opportunity to be published. Studies that find insignificant results or are inconsistent with the prevailing theories are less likely to be published in peer-reviewed journals[65]. Without taking publication bias into consideration, this will lead to biased estimates on the relationship between economic inequality and prosocial behaviour. Therefore, we employed three methods to test and remedy potential publication bias. The first was using the funnel plot and trim-and-fill approach[78]. Following that, Egger's test was used to check publication bias[79]. The third method was using moderation analyses to test whether there were significant differences in the effect sizes between published and unpublished studies.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

This meta-analysis was pre-registered on the Open Science Framework. The raw and processed data are publicly available on the Open Science Framework (https://osf.io/e3fzb/?view_only=8f4d58a84b694bba98b6173b879381d8).

Code availability

The code (written in R) used to analyse the relevant data is provided on the Open Science Framework website (https://osf.io/e3fzb/?view_only=8f4d58a84b694bba98b6173b879381d8). All materials needed to reproduce the analyses are available at this link. Note that the analysis was first transformed into Fisher's z, then converted back to Pearson's r, for ease of interpretation.

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Author contributions

Y.Y. conceptualized the research questions, screened the literature, extracted the data, conducted data analysis and wrote the first draft of the paper. S.K. conceptualized the research questions, screened the literature, checked the data extraction, assisted with literature review, did reliability coding and revised the paper.

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The authors declare no competing interests.

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Sampling strategy	The number of studies included in the meta-analysis was determined by the literature search and full data availability to report effect sizes.
Data collection	First, we conducted database searches in Social Science Citation Index (SSCI) and EBSCO Host for peer-reviewed journal articles. Second, we performed a backward search to examine the references of the articles identified in the first step and a forward search using Google Scholar to check for citations of these articles to locate other relevant publications. Third, we contacted authors of the eligible articles. Finally, we sent out some public calls for published and unpublished data on some listservs.
Timing	The entire literature search was concluded in March 2021. The data analysis was concluded in August 2021. We updated data analyses in 2022 as per reviewers' suggestions.
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