



# Higher economic inequality intensifies the financial hardship of people living in poverty by fraying the community buffer

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**The current research investigates whether higher economic inequality disproportionately intensifies the financial hardship of low-income individuals. We propose that higher economic inequality increases financial hardship for low-income individuals by reducing their ability to rely on their community as a buffer against financial difficulties. This may occur, in part, because a frayed community buffer reduces low-income individuals' propensity to seek informal financial support from others. We provide empirical support across eight studies (sample size  $N=1,029,900$ ) from the United States, Australia and rural Uganda, through correlational and experimental data, as well as an instrumental variable analysis. On average across our studies, a 1 s.d. increase in economic inequality is associated with an increase of financial hardship among low-income individuals of 0.10 s.d. We discuss the implications of these results for policies aimed to help people living in poverty buffer against the adverse effects higher economic inequality imposes on them.**

Economic inequality is at high levels around the world. In the United States—the most unequal of all Western nations—the top 20% of households own 84% of the wealth, while the bottom 40% own just 0.3%<sup>1</sup>. While in some countries, particularly in Latin America<sup>2</sup>, economic inequality is stagnating or declining, in others, such as the United States, the growth of economic inequality is accelerating: the share of US wealth concentrated among the top 1% is at a 65-year high, while the combined wealth of the bottom 90% is at a 65-year low<sup>3</sup>.

Prior research finds inconsistent effects on the outcomes of higher economic inequality. While initial studies found a negative effect of economic inequality on subjective well-being<sup>4–6</sup>, subsequent work did not corroborate these results<sup>7–9</sup>, with a recent meta-analysis finding no statistically significant relationship between economic inequality and subjective well-being<sup>10</sup>. Similarly, while initial studies found that higher economic inequality is associated with worse health outcomes<sup>11,12</sup>, subsequent research has not found consistent support<sup>13,14</sup>. Here, we focus on the relationship between economic inequality and financial hardship, given the latter's key influence in predicting well-being, health and other important outcomes<sup>15,16</sup>. Based on extant research, it is unclear for whom and how economic inequality may have adverse outcomes.

In the current research, we propose that economic inequality has a particularly detrimental effect on the financial hardship of low-income individuals, rather than an effect that is equal among all income groups. That is, we predict that the relationship between economic inequality and financial hardship is moderated by income, such that only individuals with less financial resources experience greater financial hardship at higher levels of economic inequality. In the studies we describe below, we contrast the effects

of economic inequality for individuals at lower levels of income with those at median and higher incomes, and propose that the detrimental effect of economic inequality on financial hardship is specific to low-income individuals but does not arise for individuals with greater financial resources.

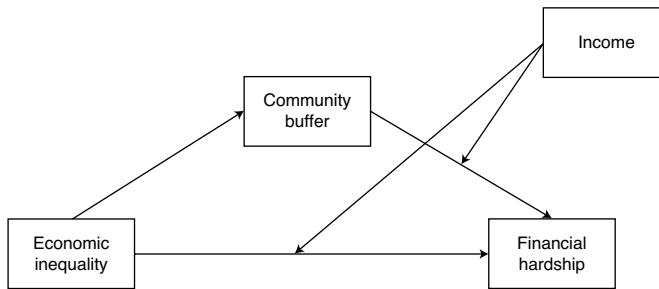
We suggest that this effect occurs because individuals are less able to depend on their community for support at higher levels of economic inequality. Indeed, several prior studies combine to suggest that individuals in communities where economic inequality is higher may rely on community members less<sup>17–20</sup>. This is particularly detrimental for low-income individuals who may depend on their community as a buffer in times of financial difficulty<sup>21–23</sup>. That is, we propose that because community buffers are weakened by higher economic inequality, low-income individuals facing financial difficulties are less able to depend on their community as a buffer in times of financial difficulty, in turn intensifying their financial hardship. Figure 1 illustrates our theoretical model.

A two-pronged empirical approach provides support for our theory. We first establish empirical support for the detrimental effect of higher economic inequality on the financial hardship of low-income individuals (studies 1–4). In these studies, we measured or manipulated economic inequality in correlational and experimental studies; in addition, in study 3 we made use of a natural instrument for economic inequality. We find the same pattern of results regardless of the type or source of data and after the inclusion of relevant control variables: higher economic inequality increases low-income individuals' financial hardship. The second set of studies provide support for a mechanism that explains why higher economic inequality intensifies the financial hardship of people living in poverty (studies 5–7, and Supplementary Study 1). Drawing on correlational and

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**Fig. 1 | Theoretical model.** The relationship between economic inequality and financial hardship is moderated by income, such that the relationship is stronger for low-income individuals. Higher levels of economic inequality also reduce the community buffer, which is particularly detrimental for low-income individuals.

experimental data using online samples, representative US panels and a field study conducted in rural Uganda, we show that greater economic inequality erodes the community buffer, and that the lack of this buffer—which low-income individuals may rely on—in turn intensifies their financial difficulties.

Our strategy of combining various methods and analyses—correlational data, instrumental variable (IV) analysis, lab experiments and field studies—is deliberate. While each approach has its strengths and weaknesses, they complement each other. The correlational studies help expose the underlying mechanisms but cannot rule out reverse causality; the IV analysis and experimental studies provide causal evidence, but the former may lack precision and the latter external validity; and the field data provide external validity, but potentially lack internal rigour. We note that while this strategy has inherent strengths, it also poses a challenge of comparability across studies as the samples and methods vary across them. Table 1 provides an overview of studies.

Given our interest in delineating whether economic inequality disproportionately affects the financial hardship of people living in poverty, we illustrate the effects of economic inequality on financial hardship at low income (specified as 0.5 s.d. below the income median), which we test against the effects at median income and high income (specified as 0.5 s.d. above the income median). We conduct these analyses for all of our studies with the exception of study 6, which was conducted with participants from rural Uganda whom we consider as low income. We note that all results presented below and in the Supplementary Information are based on standardized independent and dependent variables to enable comparisons between studies, whereas Figs. 2 and 3, and Supplementary Fig. 4 show the results with non-standardized output to facilitate comprehension of each individual study. That is, we report standardized beta coefficients throughout our studies, which have standard deviations as their units and thus enable an understanding of effect sizes across them. All tests described below are two-tailed.

## Results

**Higher economic inequality intensifies the financial hardship of people living in poverty.** We first report the results of four studies, which show that higher economic inequality has a particularly detrimental effect on the financial hardship of people living in poverty. Across these studies, we measure economic inequality and income as predictor variables, including through an IV analysis and through experimental manipulation. The Supplementary Information provides full information about the observed main effects of economic inequality and income on financial hardship for each study. Below, we only focus on the interaction between the two, which is the crux of our thesis.

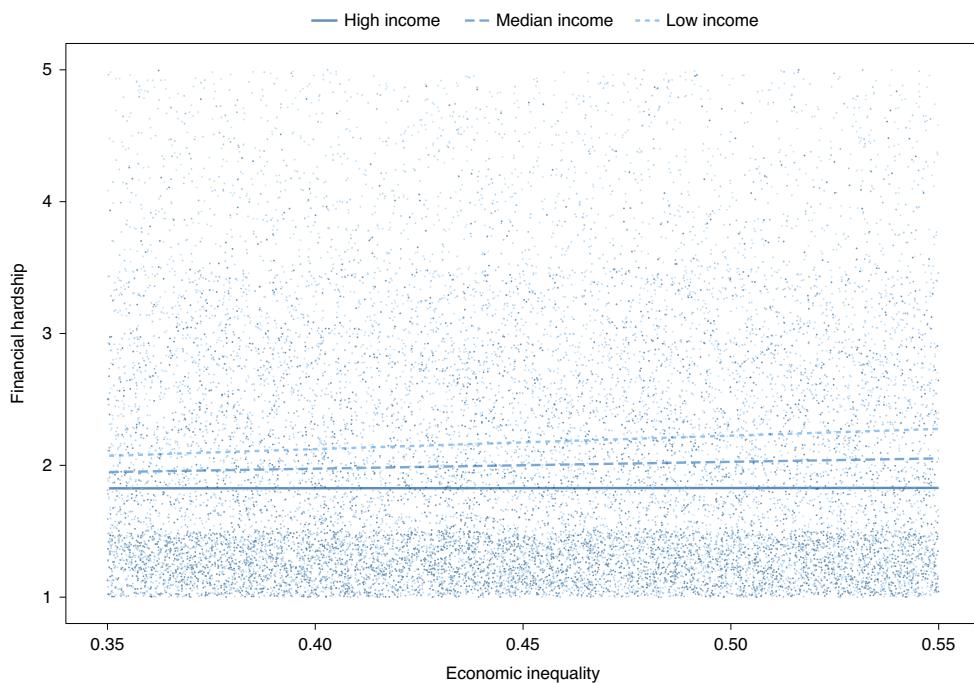
**Table 1 | Overview of studies**

Finding	Study <sup>a</sup>	Sample and analysis	N
Part 1 (main effect): people living in poverty experience greater financial hardship with higher income inequality	1	Correlational study with US individuals (BRFSS)	109,241
	2	Correlational study with US individuals (MTurk)	1,127
	3	IV analysis in Australian panel data (HILDA)	341,170
	4	Experimental study with US individuals (MTurk)	2,509
Part 2 (underlying mechanism): higher economic inequality erodes the community buffer, diminishing an important source of support for people living in poverty	5	Correlational study with US individuals (Qualtrics panel)	1,212
	6	Correlational study with rural Ugandan individuals	2,393
	7	Additional analysis of study 4 data	—
	S1	Correlational study with US individuals (Gallup)	572,248

<sup>a</sup>Eight studies provide evidence for the main effect as well as one underlying mechanism. Further detail on each study can be found in the main text, as well as in the Supplementary Information. In addition, Supplementary Study 1 is reported in the Supplementary Information in full.

**Study 1: individual-level US dataset.** The Behavioral Risk Factor Surveillance System (BRFSS) survey provides data on income, self-reported financial hardship and control variables for 109,241 individuals in the United States. This dataset also records the US counties the survey respondents reside in, allowing us to match each individual to economic inequality data in their county obtained from the US Census Bureau.

We regressed the interaction between economic inequality and income on financial hardship, specifying county as a random intercept, and found a statistically significant interaction effect ( $b = -0.030$ , s.e. = 0.003, 95% confidence interval ( $CI_{95\%}$ ) = [-0.036; -0.025],  $P < 0.001$ ). Subsequent simple slopes analysis showed that the relationship between economic inequality and financial hardship was statistically significant at the low-income level ( $b = 0.031$ , s.e. = 0.010,  $CI_{95\%} = [0.011, .051]$ ,  $P = 0.002$ ), but not at the median-income ( $b = 0.016$ , s.e. = 0.010,  $CI_{95\%} = [-0.036; 0.180]$ ,  $P = 0.103$ ) nor at the high-income level ( $b = 0.0005$ , s.e. = 0.010,  $CI_{95\%} = [-0.020; 0.020]$ ,  $P = 0.959$ ; see Fig. 2). We next reran the analysis including age, gender, unemployment, education, marital status and number of individuals in the household, as well as county-level median income, unemployment, education and percentage of people living under the poverty line as control variables. Similar to our previous results, this analysis yielded a statistically significant interaction effect ( $b = -0.018$ , s.e. = 0.003,  $CI_{95\%} = [-0.024; -0.013]$ ,  $P < 0.001$ ). A simple slopes analysis revealed that the effect of economic inequality on financial hardship was again statistically significant at the low-income level ( $b = 0.028$ , s.e. = 0.013,  $CI_{95\%} = [0.054; 0.004]$ ,  $P = 0.026$ ) but was not statistically significant at the median ( $b = 0.019$ , s.e. = 0.012,  $CI_{95\%} = [0.044; -0.004]$ ,  $P = 0.126$ ) nor high-income level ( $b = -0.010$ , s.e. = 0.012,  $CI_{95\%} = [0.035; -0.013]$ ,  $P = 0.427$ ). These findings provide tentative support for our notion that higher economic inequality is associated with higher levels of financial hardship, but only for low-income individuals. We next explored whether this detrimental effect of economic inequality for low-income individuals held both for actual and perceived economic inequality.



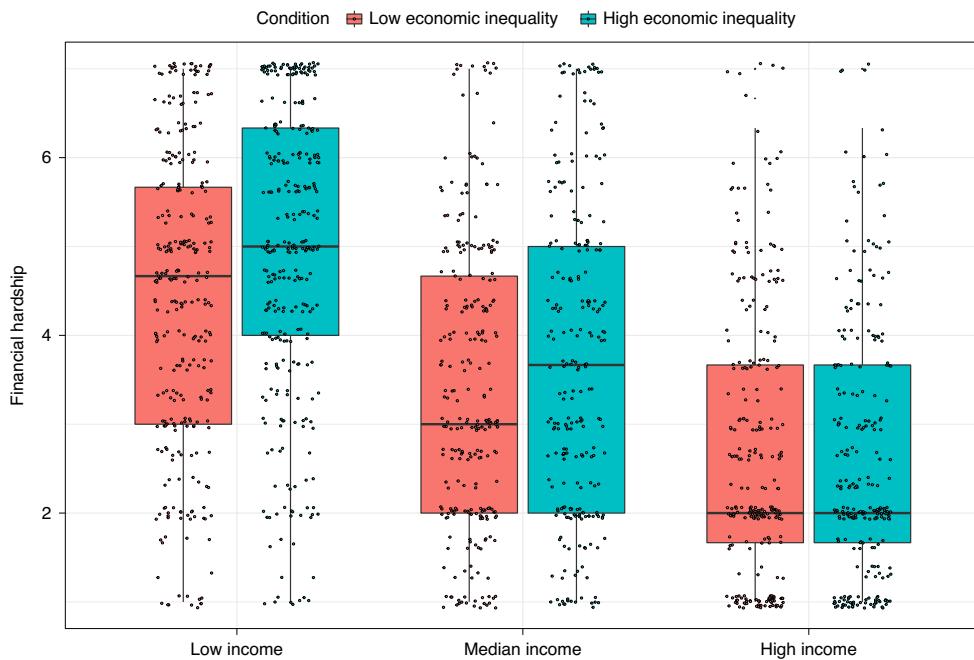
**Fig. 2 | Financial hardship predicted by the interaction of actual economic inequality and income.** The relationship between individuals' financial hardship and actual economic inequality in study 1 ( $N=109,241$ ). Economic inequality is only associated with increased financial hardship at lower levels of income ( $b=0.031$ , s.e. = 0.010,  $CI_{95\%}=[0.011, 0.051]$ ,  $P=0.002$ ), but not at the median-income ( $b=0.016$ , s.e. = 0.010,  $CI_{95\%}=[-0.036; 0.180]$ ,  $P=0.103$ ) nor at the high-income level ( $b=0.0005$ , s.e. = 0.010,  $CI_{95\%}=[-0.020; 0.020]$ ,  $P=0.959$ ).

**Study 2: similar effects for perceived and actual economic inequality.** To test whether our effects remained similar for both actual and perceived economic inequality, we collected data from 1,127 participants recruited through Amazon's Mechanical Turk, an online labour market, who provided information on their perceived economic inequality, income and financial hardship. Following prior research, we assessed perceived economic inequality by asking participants to estimate the average income for each quintile in their ZIP code, and then divided the top by the bottom quintile<sup>24,25</sup>. In addition, we asked participants for their home location, and matched data on actual economic inequality from the US Census Bureau.

We first tested the effects of actual economic inequality. Similar to study 1, we regressed the interaction between actual economic inequality and income on financial hardship, specifying county as a random intercept, and found a marginally significant interaction effect ( $b=-0.049$ , s.e. = 0.028,  $CI_{95\%}=[-0.104; 0.006]$ ,  $P=0.080$ ). We subsequently tested the effects of actual economic inequality on financial hardship at varying income levels. Crucially, subsequent simple slopes analyses revealed that the relationship between actual economic inequality and financial hardship was statistically significant and positive at the low-income level ( $b=0.103$ , s.e. = 0.035,  $CI_{95\%}=[0.034; 0.172]$ ,  $P=0.004$ ), was statistically significant but weaker at median levels of income ( $b=0.079$ , s.e. = 0.030,  $CI_{95\%}=[0.020; 0.138]$ ,  $P=0.008$ ), and was marginally significant at the high-income level ( $b=0.054$ , s.e. = 0.032,  $CI_{95\%}=[-0.009; 0.116]$ ,  $P=0.089$ ). After controlling for age, gender and education as well as county-level median income, unemployment, education and percentage of people living in poverty, the interaction effect of actual economic inequality and income on financial hardship was qualitatively similar ( $b=-0.052$ , s.e. = 0.027,  $CI_{95\%}=[-0.106; 0.001]$ ,  $P=0.059$ ). A simple slopes analysis showed that the relationship between actual economic inequality and financial hardship was statistically significant and positive at low levels of income ( $b=0.104$ ,

s.e. = 0.037,  $CI_{95\%}=[0.176; 0.031]$ ,  $P=0.005$ ), statistically significant and weaker at median levels of income ( $b=0.078$ , s.e. = 0.032,  $CI_{95\%}=[0.141; 0.015]$ ,  $P=0.014$ ), and not statistically significant at high levels of income ( $b=0.051$ , s.e. = 0.034,  $CI_{95\%}=[0.118; -0.015]$ ,  $P=0.129$ ). This pattern of results thus replicates our findings in study 1. (We note that in this study, the results are also statistically significant at median levels of income, an effect that throughout our studies is not as consistent as the effects of economic inequality at low-income levels. We provide further discussion of the more varied results at median-income levels in the 'General discussion' section.)

Next, we explored whether the pattern of results was similar for perceived economic inequality. To do so, we regressed the interaction between perceived economic inequality and income on financial hardship, specifying county as a random intercept, and found a marginally significant interaction effect ( $b=-0.048$ , s.e. = 0.028,  $CI_{95\%}=[-0.104; 0.008]$ ,  $P=0.091$ ). We similarly tested the effects of perceived economic inequality on financial hardship at varying income levels. Similar to before, simple slopes analyses reveal that the relationship between perceived economic inequality and financial hardship was statistically significant and positive at the low-income level ( $b=0.090$ , s.e. = 0.034,  $CI_{95\%}=[0.023; 0.157]$ ,  $P=0.007$ ), was statistically significant but weaker at median levels of income ( $b=0.066$ , s.e. = 0.029,  $CI_{95\%}=[0.009; 0.123]$ ,  $P=0.024$ ), and was not statistically significant at the high-income level ( $b=0.042$ , s.e. = 0.032,  $CI_{95\%}=[-0.059; 0.105]$ ,  $P=0.185$ ). After controlling for age, gender and education, as well as county-level median income, unemployment, education and percentage of people living in poverty, the interaction effect of perceived economic inequality and income on financial hardship was not statistically significant ( $b=-0.041$ , s.e. = 0.028,  $CI_{95\%}=[-0.097; 0.014]$ ,  $P=0.146$ ). Crucially, the results of the simple slopes analysis with control variables revealed that the relationship between perceived economic inequality and financial hardship was statistically significant and positive at low levels of income ( $b=0.072$ ,



**Fig. 3 | Financial hardship predicted by the interaction between the economic inequality condition and income.** The relationship between the economic inequality condition and financial hardship by individuals' incomes in study 4. The relationship between the economic inequality condition and financial hardship was statistically significant and positive at the low-income level ( $b = 0.223$ , s.e. = 0.051,  $CI_{95\%} = [0.123; 0.323]$ ,  $P < 0.001$ ), was weaker but still statistically significant at the median-income level ( $b = 0.143$ , s.e. = 0.044,  $CI_{95\%} = [0.057; 0.228]$ ,  $P = 0.001$ ) and was not statistically significant at the high-income level ( $b = 0.062$ , s.e. = 0.047,  $CI_{95\%} = [-0.029; 0.154]$ ,  $P = 0.183$ ).

s.e. = 0.034,  $CI_{95\%} = [0.138; 0.005]$ ,  $P = 0.035$ ), marginally significant and weaker at median levels of income ( $b = 0.051$ , s.e. = 0.030,  $CI_{95\%} = [0.110; -0.008]$ ,  $P = 0.086$ ), and not statistically significant at high levels of income ( $b = 0.030$ , s.e. = 0.032,  $CI_{95\%} = [0.093; -0.003]$ ,  $P = 0.348$ ).

The results from study 2 thus reveal that across both actual and perceived economic inequality, individuals at the lower end of the income spectrum experience greater financial hardship at higher levels of economic inequality. While extending our findings from actual to perceived economic inequality, these results do not provide evidence of a causal direction, which is the aim of the next two studies.

**Study 3: IV analysis in Australian panel data.** To provide evidence for a causal effect of economic inequality on the financial hardship of low-income individuals, we next conducted an IV analysis. This technique can control for potential endogeneity in observational studies, such as from omitted variables, allowing researchers to draw causal inferences from observational data<sup>26</sup>. For example, omitted variables that affect certain sections of the labour market could simultaneously affect both economic inequality and financial hardship.

Our IV analysis utilized data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, a household-based panel study that collects information about well-being, labour market dynamics and family life in Australia over 17 waves from 2001–2017 ( $N_{\text{observations}} = 341,170$ ). To measure the level of financial hardship experienced by the respondents, we took the standardized inverse of the answers given to the question 'How satisfied are you with your financial situation?' with response options varying from 0 ('Totally dissatisfied') to 10 ('Totally satisfied'), such that higher responses were associated with greater financial hardship in line with our prior studies. We calculated economic inequality as the (standardized) Gini coefficients based on the income distribution of participants in areas categorized by the Australian Statistical

Geography Standard (ASGS) Statistical Area Level 4, the largest sub-state regions in the categorization. Econometric tests of exogeneity on our data strongly support an IV analysis. Specifically, Davidson–Mackinnon tests of exogeneity (see ref. <sup>27</sup>), which test whether an ordinary least squares (OLS) estimator of the model would produce consistent estimates, strongly reject the exogeneity of both economic inequality and its interaction with income when tested individually as well as jointly ( $P < 0.001$  for both tests; see Supplementary Information for details).

As an instrument for economic inequality, following prior research<sup>28</sup>, we made use of the temporary budget repair levy (TBRL), a tax introduced by the Australian government from 2014–2017 that increased the tax rate of high-income taxpayers (that is, those with yearly incomes above A\$180,000) by 2%. The explicit purpose of the tax was to reduce the Australian fiscal budget deficit. A useful feature of this instrument is that we can mechanically ensure that the TBRL does not directly affect financial hardship (that is, that our instrument only affects the dependent variable through our explanatory variable, the 'exclusion criterion') by restricting our analysis to individuals below the tax threshold. Furthermore, the first-stage analysis suggests that the TBRL is a strong (or 'relevant') instrument both for economic inequality ( $b = 0.773$ , s.e. = 0.043,  $CI_{95\%} = 0.689, 0.856$ ,  $P < 0.001$ ) and for the interaction between economic inequality and income ( $b = 0.039$ , s.e. = 0.011,  $CI_{95\%} = [0.017, 0.061]$ ,  $P < 0.001$ ). To test the assumption that our instrument is uncorrelated with the error terms in the main explanatory equation—for example, that the implementation of the tax did not coincide with changes to other macro-level factors that affected economic inequality—we included macroeconomic indicators as controls in our panel IV specifications. We also reran our analyses after splitting the sample by income classes. In all of our robustness checks, the results were statistically significant and consistent (see Supplementary Information for detailed analysis, and for additional discussion about the validity of this measure as an instrument for economic inequality).

The results of the random-effects panel IV estimation including relevant control variables reveal that higher economic inequality intensified the financial hardship of low-income individuals, that is, the interaction between economic inequality and income on financial hardship is statistically significant ( $b = -0.477$ , s.e. = 0.135, CI<sub>95%</sub> = [-0.742, -0.212],  $\chi^2 = 12.44$ ,  $P < 0.001$ ). Subsequent post-hoc IV estimation analysis highlighted that for low-income individuals, economic inequality increases financial hardship ( $b = 0.077$ , s.e. = 0.025, CI<sub>95%</sub> = [0.029, 0.125],  $\chi^2 = 9.76$ ,  $P = 0.002$ ), a relationship that was not statistically significant at the median- ( $b = -0.018$ , s.e. = 0.028, CI<sub>95%</sub> = [-0.072, 0.037],  $\chi^2 = 0.40$ ,  $P = 0.53$ ) or high-income level ( $b = -0.024$ , s.e. = 0.031, CI<sub>95%</sub> = -0.086, 0.037],  $\chi^2 = 0.60$ ,  $P = 0.44$ ). This pattern of results was robust to variations in the parameters used in pruning income, to the inclusion of macroeconomic control variables, and when high-income earners subject to the TBRL were also included in the sample (see Supplementary Information for the results of these analyses). In sum, the IV analysis in study 3 provides tentative causal evidence for the notion that higher economic inequality increases financial hardship for people living in poverty. To provide further causal evidence, we next conducted an experimental lab study.

**Study 4: experimental study.** We designed an experimental study that aimed to provide further evidence for the causal relationship between economic inequality and financial hardship for low-income individuals in a more tightly controlled setting. Analogous to prior studies that presented participants with varying information about the level of economic inequality<sup>29–31</sup>, our aim in this study was to test how people think about their financial situation when placed in the mindset of either low versus high levels of economic inequality. While placing individuals in these varying mindsets may not have long-term effects on how they think about their financial situation, analogous experiments that, for example, place participants in a mindset of financial scarcity have been shown to produce similar outcomes as facing actual financial scarcity<sup>32–34</sup>.

We recruited 2,509 participants from Amazon's Mechanical Turk online labour market who were informed that we had collected data on economic inequality for each US ZIP code. Next, participants were shown two pieces of information: the average level of economic inequality in the US (the richest 10% earn 15.9 times more than the poorest 10%), and a description and visual representation of the level of economic inequality in their ZIP code (for a similar methodology, see ref. <sup>31</sup>).

We subsequently randomly allocated participants to one of two conditions (see Supplementary Information for further details, and Supplementary Figs. 1 and 2 for visual depictions of the experimental materials). Participants in the low economic inequality condition were told that their ZIP code was in the 11th percentile of economic inequality, such that the richest 10% only earn 4.5 times more than the poorest 10%. In contrast, participants in the high economic inequality condition were told that their ZIP code was in the 89th percentile, such that the richest 10% earn 60.4 times more than the poorest 10%. Next, we asked participants to recall three personal experiences where 'they had the feeling that the level of inequality in their ZIP code area was very low [high]'. We then asked participants to respond to three items that measured financial hardship (for example, 'My financial situation is pressing';  $\alpha = 0.96$ ). Finally, we asked participants to report their income and asked them whether they were suspicious of the information about economic inequality provided. In the main analyses, we exclude participants who indicated they were suspicious<sup>35,36</sup>, but the pattern of results remains the same when we include those participants (see Supplementary Information). In addition, we find no statistically significant difference in the number of suspicious participants between the two conditions ( $\chi^2(1) = 0.296$ ,  $P = 0.586$ ).

We regressed financial hardship on the economic inequality condition and income, and found a statistically significant interaction effect ( $b = -0.165$ , s.e. = 0.045, CI<sub>95%</sub> = [-0.253; -9.077],  $P < 0.001$ ). A simple slopes analysis revealed that the relationship between the economic inequality condition and financial hardship was statistically significant and positive at the low-income level ( $b = 0.223$ , s.e. = 0.051, CI<sub>95%</sub> = [0.123; 0.323],  $P < 0.001$ ), was weaker but still statistically significant at the median-income level ( $b = 0.143$ , s.e. = 0.044, CI<sub>95%</sub> = [0.057; 0.228],  $P = 0.001$ ), and was not statistically significant at the high-income level ( $b = 0.062$ , s.e. = 0.047, CI<sub>95%</sub> = [-0.029; 0.154],  $P = 0.183$ ; see Fig. 3). That is, being randomly assigned to the high economic inequality condition was associated with greater financial hardship but only for individuals towards the lower end of the income spectrum. (Indeed, and as reported in the Supplementary Information, when including suspicious participants, the results were no longer statistically significant at the median-income level but remained statistically significant at the low-income level.)

Taken together, studies 1–4 provide empirical support for the prediction that greater economic inequality increases the financial hardship of people living in poverty. This pattern of results is consistent across different datasets and countries, for both perceived and actual economic inequality, and includes support for the causal direction of the effect through an IV analysis and a lab experiment. However, the findings do not shed light on a mechanism underlying economic inequality's detrimental effect on low-income individuals, which we turn to next.

**Economic inequality erodes the buffer of people living in poverty against financial hardship.** Four studies examined whether greater economic inequality reduces the community buffer—whether individuals can rely on community members for support when encountering financial difficulties—and if a reduced community buffer subsequently exacerbates the financial difficulties experienced by low-income individuals (see Supplementary Information for more detail on each study). We begin with study 5, which investigates whether higher economic inequality is associated with a reduced community buffer, and whether this in turn intensifies the financial hardship of people living in poverty.

**Study 5: nationally representative survey in the United States.** A nationally representative sample of 1,212 US participants recruited via a Qualtrics.com panel provided information on their perceived economic inequality, community buffer, income and financial hardship. Similar to study 2, we assessed perceived economic inequality by asking participants to estimate the average income for each quintile in their ZIP code, and then divided the top by the bottom quintile<sup>34,25</sup>. We measured the community buffer using a three-item scale (for example, 'When I run into financial difficulties, I can rely on others to support me';  $\alpha = 0.95$ ), and financial hardship using the same three-item scale as in studies 2 and 4 ( $\alpha = 0.95$ ).

Analogous to our earlier studies, we regressed financial hardship on the interaction between perceived economic inequality and income, and found a statistically significant interaction effect ( $b = -0.083$ , s.e. = 0.029, CI<sub>95%</sub> = [-0.140; -0.026],  $P = 0.004$ ). A simple slopes analysis revealed that the relationship between perceived economic inequality and financial hardship was statistically significant and positive at the low-income level ( $b = 0.084$ , s.e. = 0.034, CI<sub>95%</sub> = [0.018; 0.150],  $P = 0.012$ ), but was not statistically significant at the median income level ( $b = 0.043$ , s.e. = 0.028, CI<sub>95%</sub> = [-0.012; 0.097],  $P = 0.124$ ) or at the high-income level ( $b = 0.001$ , s.e. = 0.029, CI<sub>95%</sub> = [-0.055; 0.058],  $P = 0.968$ ). After controlling for age, gender, education and unemployment, the interaction between perceived economic inequality and income on financial hardship remained statistically significant ( $b = -0.080$ , s.e. = 0.028, CI<sub>95%</sub> = [-0.135; -0.025],  $P = 0.004$ ). A simple slopes analysis showed that the

relationship between perceived economic inequality and financial hardship was statistically significant at the low-income level ( $b=0.107$ , s.e.=0.033, CI<sub>95%</sub>=[0.172; 0.042],  $P=0.001$ ), was statistically significant but weaker at the median-income level ( $b=0.067$ , s.e.=0.027, CI<sub>95%</sub>=[0.120; 0.014],  $P=0.013$ ), and was no longer statistically significant at the high-income level ( $b=0.027$ , s.e.=0.028, CI<sub>95%</sub>=[0.081; -0.028],  $P=0.336$ ). These findings replicate our earlier results.

Next, we regressed the community buffer on perceived economic inequality and found a statistically significant relationship ( $b=-0.079$ , s.e.=0.030, CI<sub>95%</sub>=[-0.139; -0.019],  $P=0.010$ ), such that higher perceived economic inequality is associated with a reduced community buffer. Finally, we tested whether for low-income individuals, the relationship between perceived economic inequality and financial hardship was mediated by the community buffer. We specified a moderated mediation with perceived economic inequality as the independent variable, community buffer as the mediator, financial hardship as the dependent variable, and income as the moderator between the community buffer and financial hardship (10,000 bootstrapped iterations).

We found that for low-income individuals, the path from perceived economic inequality to financial hardship via the community buffer was statistically significant and positive ([0.006; 0.056]), such that higher perceived economic inequality is associated with greater financial hardship through a lower community buffer. This mediation path was statistically significant and positive for individuals at median levels of income ([0.003; 0.041]), but was not statistically significant for individuals at higher levels of income ([−0.002; 0.032]). These results thus provide tentative evidence for one underlying mechanism of the detrimental effect of higher economic inequality for those at the lower end of the income spectrum.

We replicated these findings in a large-scale US survey, and with actual economic inequality, which we report in the Supplementary Information as Supplementary Study 1 ( $N=572,248$ ), and next turn to a test of our hypotheses in a low-income context.

**Study 6: correlational field study in rural Uganda.** As part of a broader study, we recruited 2,393 participants (47% female) from 29 villages in rural Uganda in collaboration with an international non-governmental organization. All participants in this study had very low incomes; for instance, 83.74% of participants lived in housing that had no concrete floor. Enumerators verbally asked participants to respond to four items on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). We measured perceived economic inequality with the item: ‘In my neighborhood, the difference between the poor and rich is very high’; community buffer with the two items, ‘I can rely on others in my community to support me’ and ‘I can turn to others in my local area for help’ ( $\alpha=0.79$ ); and financial hardship with the item, ‘I am in financial difficulty’.

Because all participants in this study are very poor, we directly regressed financial hardship on perceived economic inequality specifying village as a random intercept, and found a statistically significant relationship ( $b=0.132$ , s.e.=0.020, CI<sub>95%</sub>=[0.092; 0.172],  $P<0.001$ ), such that higher perceived economic inequality is related to increased financial hardship. The same analysis including gender and the number of individuals in the respondent’s household as control variables similarly yielded a statistically significant effect ( $b=-0.119$ , s.e.=0.040,  $P=0.003$ ).

Next, we regressed the community buffer on perceived economic inequality and found a statistically significant relationship ( $b=-0.057$ , s.e.=0.021, CI<sub>95%</sub>=[−0.096; −0.017],  $P=0.006$ ), such that higher perceived economic inequality is related to a reduced community buffer. Finally, we tested whether a reduced community buffer mediates the relationship between higher perceived economic inequality and increased financial hardship and found a

statistically significant indirect effect ([0.001, 0.005], 10,000 bootstrapped iterations).

In this field setting, we thus replicate our earlier findings, such that greater economic inequality is associated with higher financial hardship in part by decreasing the community buffer. Taken together, studies 5 and 6, and Supplementary Study 1 provide correlational evidence for the underlying mechanism of higher economic inequality’s detrimental effect on the financial hardship of low-income individuals. Study 7 sought to establish causal evidence for the role of the community buffer in underlying this effect.

**Study 7: extension of prior experimental study.** This study reports the results of analyses including an additional measurement conducted in study 4. After the experimental manipulation, but before participants responded to the dependent variable (financial hardship), participants responded to the same three items assessing their community buffer as in study 5 (for example, ‘When I need money, I can rely on others’) on a seven-point scale (1, strongly disagree, to 7, strongly agree;  $\alpha=0.96$ ).

We first examined whether the economic inequality condition reduced the community buffer, and found that the community buffer is lower in the high economic inequality (mean,  $M=2.29$ , s.d.=1.45) relative to the low economic inequality condition ( $M=2.97$ , s.d.=1.64;  $b=-0.683$ , s.e.=0.077, CI<sub>95%</sub>=[−0.834, −0.532],  $t(1,614)=8.86$ ,  $P<0.001$ ). Next, we tested whether for low-income participants, the relationship between the experimental condition and financial hardship was mediated by the community buffer. We specified a moderated mediation, with the economic inequality condition as the independent variable, community buffer as the mediator, financial hardship as the dependent variable, and income as the moderator between the community buffer and financial hardship (10,000 bootstrapped iterations).

For low-income individuals, the mediation from the economic inequality condition to financial hardship via the community buffer was statistically significant ([0.116; 0.229]). The indirect path for individuals at median levels of income ([0.088; 0.182]), as well as higher income levels ([0.055; 0.140]), was also statistically significant, but in both cases weaker than for low-income individuals. Taken together, studies 5–7 and Supplementary Study 1 provide support for the community buffer as one underlying mechanism of economic inequality’s detrimental effect for low-income individuals.

## Discussion

Across eight studies and with over a million individuals, here we provide evidence that higher economic inequality intensifies the financial hardship of people living in poverty and identify the weakened community buffer as one underlying driver of this effect. In our first four studies, we establish empirical support for the detrimental effect of higher economic inequality on low-income individual’s financial hardship. Notably, our results replicate for both perceived and actual economic inequality; in an IV analysis and an experimental study; and both in online studies and in the field. In four additional studies, we find support for a mechanism underlying this effect, that is, that higher economic inequality weakens the community buffer, a key source of support for low-income individuals in times of financial hardship<sup>33</sup>, in turn intensifying the financial hardship of people living in poverty.

Higher economic inequality may therefore contribute to a vicious, self-perpetuating cycle of increasing poverty for people living in poverty: feeling financially destitute may prompt low-income individuals to engage in detrimental behaviours that may worsen their actual financial situation. While the current research only captures self-reported financial hardship, prior research provides strong evidence for the link between this measure and objective metrics of financial hardship<sup>33,37,38</sup>. People living in poverty, from this perspective, are unable to improve their lot not because of inherent

traits, but because they are less able to rely on their community as a buffer against financial difficulties when faced with higher economic inequality (for further discussion of the ‘deficit model’ of poverty, see ref. <sup>39</sup>).

Across the studies presented here, economic inequality was consistently related to higher financial hardship for low-income individuals, and was not related to financial hardship for high-income individuals. The results at median levels of income are more inconsistent, with some of our studies finding a relationship between economic inequality and financial hardship (for example, study 2 and Supplementary Study 1) while others do not (for example, studies 1 and 3). As a result, while our studies combine to suggest that economic inequality has adverse effects for low- but not high-income individuals, they do not shed light on how economic inequality affects individuals at median income levels. We encourage future research to more closely disentangle when economic inequality has a negative effect on individuals at median income levels, which may depend on, for example, the availability of liquid assets and other kinds of wealth, as well as the access to financial markets<sup>40</sup>.

Additional data collected as part of study 5 sheds further light on why the community buffer is important in reducing the financial hardship of people living in poverty. Consider that individuals who experience financial hardship commonly worry about being stigmatized by others<sup>41</sup>. As a result, they may refrain from seeking help, for fear of being shamed<sup>42</sup>. Conversely, when individuals believe they can rely on other community members more—that is, when they have a stronger community buffer—they may be less worried about being stigmatized by others and, as a result, be more likely to seek them out for financial support<sup>43</sup>. To provide evidence for this notion, we additionally asked participants at the end of study 5 to read the following scenario and respond to the subsequent question on a scale from 1 (not likely at all) to 7 (extremely likely): ‘Imagine you are encountering financial difficulties, and you turn to members of your community for help in overcoming your immediate financial needs. How likely do you think it is that the people you turn to for help will make you feel ashamed for having financial difficulties?’ Analysis reveals that individuals who indicated having a stronger community buffer were less likely to believe others would make them feel ashamed when seeking out financial support (coefficient of correlation  $r = -0.156$ ,  $P < 0.001$ ). This suggests that when the community buffer is stronger, individuals may be more likely to ask for help when encountering financial difficulties because they are less afraid of being stigmatized by others for doing so.

This additional finding highlights that one way a weakened community buffer may intensify the financial hardship of people living in poverty at higher levels of economic inequality is by making it less likely that low-income individuals seek help when encountering financial difficulties<sup>44</sup>. This perspective is aligned with recent research that finds that higher economic inequality is associated with increased perceptions of competitiveness<sup>45</sup>, which may increase status threat and thus make it less likely that individuals reveal a potentially lower status position<sup>46</sup>. Seeking help from others in one’s community, however, represents a crucial step in alleviating financial hardship<sup>47</sup>; indeed, taking on the burden of financial difficulties alone may be associated with additional psychological costs associated with keeping these a secret from others<sup>48</sup>. Future research could further investigate how a weakened community buffer relates to low-income individuals’ tendency to ask for help, and explore potential interventions to minimize the stigma associated with doing so<sup>49</sup>.

We also call attention to additional potential mechanisms that may underlie the detrimental effects of higher economic inequality on the financial hardship of low-income individuals. In the current manuscript, we highlight that a weakened community buffer reflects one mechanism through which our effects operate, but additional channels are likely. For example, based on prior research that finds

that increased economic inequality is associated with perceptions of higher competitiveness<sup>45</sup>, individuals may also be more likely to engage in wealth displays to denote their position in the status hierarchy (see also ref. <sup>50</sup>). Indeed, more visible wealth disparities are associated with more detrimental downstream consequences<sup>51,52</sup>. As a result, at higher levels of economic inequality, individuals may feel greater spending pressure, which may be particularly difficult to bear for those with lower incomes<sup>53</sup>. We encourage future research to further explore these complementary explanations underlying the detrimental effect of higher economic inequality for low-income individuals, and in particular, how differences in the visibility of economic inequality may influence its perception and associated downstream consequences.

Across our studies, we find that a one s.d. increase in economic inequality is associated with an increase of financial hardship among low-income individuals of 0.10 s.d. (effect sizes from studies 1–7, respectively: 0.031 s.d.; 0.103 s.d.; 0.077 s.d.; 0.223 s.d.; 0.084 s.d.; 0.132 s.d. and 0.024 s.d.). To put this effect size in context, we find that this effect is about a seventh of the size of the relationship between income and financial hardship; across our studies, a one s.d. increase in income is associated with a decrease in financial hardship of 0.67 s.d. (excluding study 6, which focused only on low-income participants). Based on this comparison and the s.d. of income in Supplementary Study 1—which contained a large-scale US dataset with 572,248 respondents—the effect of a one s.d. increase in economic inequality on the financial hardship of low-income individuals is roughly equal to a decrease in income of about US\$6,587.

Higher levels of economic inequality may also have real-world consequences for people living in poverty beyond their financial situation<sup>54,55</sup>. For example, consider that one recent study found that truck drivers with higher financial difficulties were more likely to cause avoidable accidents, in part because of the reduced cognitive capacities imposed by their financial hardship<sup>56</sup>, implying that the effects of higher financial hardship may enter the workplace and reduce an individual’s ability to earn a living wage. This is particularly important given that an additional study we conducted (and reported as Supplementary Study 2 in the Supplementary Information) found that people largely underestimate the extent to which higher economic inequality intensifies the financial hardship of low-income individuals, a result that is aligned with research showing that individuals tend to misjudge the structural implications of inequality more broadly<sup>57,58</sup>.

Our findings have implications for theory and policy. First, our results indicate that higher economic inequality is particularly hard on those at the bottom at the income distribution. That is, a more vulnerable subset of the population—those facing financial scarcity—are more likely to be detrimentally affected by higher economic inequality. Second, our theory and results suggest that researchers and policymakers should move beyond a sole focus on low-income individuals and instead focus on low-income communities. For example, policymakers could implement—and researchers could study—changes that give individuals in low-income communities more opportunities to develop stronger community buffers. This can be achieved, for example, by giving community members more say over decision making at the local level, as a recent study has successfully done<sup>23</sup>.

Economic inequality detrimentally affects societies worldwide. Our theory and results highlight that people living in poverty are particularly negatively affected by these developments: higher economic inequality imposes an additional cost carried by people living in poverty.

## Methods

Our research complies with all relevant ethical regulations. Columbia University institutional review board approved the study protocols. Informed consent was obtained from all human participants. Across our studies, no statistical methods

were used to predetermine sample sizes but our sample sizes are larger than those reported in previous publications<sup>4–14</sup>. Data collection and analysis were not performed blind to the conditions of the experiment (study 4); in this study, participants were randomly assigned to the two experimental groups. We disclose whether any subjects were excluded from analyses and note the rationale for the exclusions where relevant.

**Study 1.** In study 1, we investigated the relationship between economic inequality, income and financial hardship in the United States ( $N=109,241$ ).

**Methods.** Economic inequality. We accessed US county-level economic inequality data (measured by the Gini coefficient) from the website of the US Census Bureau using the five-year estimates from the 2008–2012 American Community Survey.

Income. Individual-level income data was obtained from the BRFSS combined landline and cellphone dataset collected between 2009 and 2012, years for which the dataset contained information on the county codes corresponding to respondents' residences. Respondents reported their annual household income by choosing one of eight categories ('Less than US\$15,000', 'Less than US\$20,000', 'Less than US\$25,000', 'Less than US\$35,000', 'Less than US\$50,000', 'Less than US\$75,000', 'US\$75,000 or more'). Household income was coded as the midpoint of the chosen income bin (or US\$120,000 for the highest bin).

Financial hardship. In the same BRFSS survey, participants responded to two items assessing their financial hardship on a five-point scale, with response options (1) 'always', (2) 'usually', (3) 'sometimes', (4) 'rarely' and (5) 'never'. The items were: 'How often in the past 12 months would you say you were worried or stressed about having enough money to pay your rent/mortgage? Would you say you were worried or stressed \_\_\_?' and 'How often in the past 12 months would you say you were worried or stressed about having enough money to buy nutritious meals? Would you say you were worried or stressed \_\_\_?'. We averaged responses to these items for each individual as a measure of financial hardship ( $\alpha=0.82$ ).

Control variables. From the same BRFSS dataset, we obtained information on the respondent's age, gender, employment status, highest level of education, marital status and number of individuals in the household. Furthermore, we also obtained county-level median income, unemployment (unemployment status of civil workforce of the population 16 years and over), education (percentage of people who have at least a high-school education) and percentage of people living under the poverty line from the website of the US Census Bureau using the five-year estimates from the 2008–2012 American Community Survey.

**Study 2.** In study 2, we investigated the relationship between actual and perceived economic inequality, income and financial hardship with US participants.

**Methods.** Participants and design. Participants were recruited via Amazon's Mechanical Turk ( $N=1,127$ ) and were paid US\$0.50 for completing the survey, which was part of a broader project that only recruited full-time employees. We applied the following exclusion criteria to improve data quality, which were the same across all studies where we collected original data through online platforms (that is, here and studies 4 and 5): (1) participants who failed the attention check; (2) participants who indicated an implausible age; (3) participants who provided implausible answers (see 'Perceived economic inequality' section for a detailed explanation). Specific to study 2, we asked participants at the beginning of the survey whether they are willing to commit to provide their best answers to each question. Participants indicating that they are not willing to commit their best answer were also excluded. After all exclusions, our final sample size consisted of 964 individuals (47% female,  $M_{age}=38.09$ ).

**Measures.** Actual economic inequality. We accessed US ZIP code level economic inequality data (measured by the Gini coefficient) from the website of the US Census Bureau using the five-year estimates from the 2012–2016 American Community Survey.

Perceived economic inequality. Participants estimated the average yearly income of each quintile of individuals in their local ZIP code. We calculated the ratio of the estimated income in the top and bottom quintile in their ZIP code for each respondent to approximate the perceived local economic inequality. As this metric is positively skewed, we used log-transformations in the analyses.

We excluded respondents who provided implausible responses to this question, with the same criteria across all studies where we collected original data on perceived economic inequality through online platforms (that is, here and studies 4 and 5): (1) the participant indicated that the top quintile of individuals earned less than the bottom quintile of individuals; (2) the participant stated that the average yearly income is US\$0 in the top quintile; (3) the participant responded that the average yearly income is US\$0 in the bottom quintile; and (4) the 80:20 ratio calculated for the participant exceeded a ratio of 5,000:1.

Income. Participants reported their household income by choosing one of 14 categories ranging from 'Less than US\$10,000' to 'More than US\$200,000'. Household

income was coded as the midpoint of the chosen income bin (or US\$225,000 for the highest bin). We divided the household income by the square root of household size to estimate the per capita income in the respondent's household.

Financial hardship. Participants responded to three items assessing their financial hardship on a seven-point scale ranging from 'Strongly disagree' (1) to 'Strongly agree' (7). The items were: 'My financial situation is pressing', 'I am in financial difficulty' and 'I do not have enough money to make ends meet' ( $\alpha=0.95$ ).

Control variables. Participants also reported their age, gender and highest education level. Furthermore, we also obtained county-level median income, unemployment (percentage of civil workforce unemployment of the population 16 years and over), education (percentage of people who have at least a high-school education) and percentage of people living under the poverty line from the website of the US Census Bureau using the five-year estimates from the 2012–2016 American Community Survey.

**Study 3.** The aim of study 3 was to provide causal evidence for the role of economic inequality in intensifying the financial hardship of low-income individuals. For example, one challenge to identifying causality is that there may be omitted variables, such as shocks to sections of the labour market, that simultaneously drive both inequality and financial hardship. To control for potential endogeneity, we applied an IV analysis on a large panel dataset from Australia ( $N=341,170$ ) to test whether economic inequality disproportionately affects financial hardship for those with lower income.

**Methods.** Data. We used panel data from the HILDA Survey, a household-based panel study that collects information about well-being, labour market dynamics and family life from Australia covering 17 waves from 2001–2017. We only included individuals aged 16 or older, reporting positive income, and living in areas with a sufficient population ( $>500$ ) to reliably estimate local economic inequality, leaving a sample of 262,596, although the results were robust to varying the parameters used for the population cut-off of local areas.

Income. We used personal disposable regular income for the financial year, which the HILDA dataset imputes from multiple survey-based measures. We removed extreme outliers (bottom 1% mainly—those reporting negative incomes—and the top 1%) and, to account for the remaining skewness, took the logarithm of income (positive values only) for our analysis.

Economic inequality. We calculated economic inequality based on the income distribution of participants in areas categorized by the ASGS Statistical Area Level 4, the largest sub-state regions in the categorization. Gini coefficients for each area were calculated using the Stata command `ineqdeco`, and then standardized.

Financial hardship. For our main outcome measure, we used the standardized inverse of the variable measuring answers to the question 'How satisfied are you with your financial situation?', which varied from 0 ('Totally dissatisfied') to 10 ('Totally satisfied').

Control variables. We included participant age, education, gender and employment status. We also included a quadratic term of logged income to capture nonlinearities, and three macroeconomic indicators: logged real GDP, unemployment and inflation.

Instrument. To provide evidence for a causal effect, we employed IV panel regressions. The argument for using IV estimations is econometrically driven by Davidson–Mackinnon tests of exogeneity (see ref. <sup>27</sup>), which tests whether an OLS estimator of the model would produce consistent estimates. The tests strongly reject the exogeneity of both inequality ( $\chi^2(1, 197,885)=244.11, P<0.001$ ) and its interaction with income ( $\chi^2(1, 197,885)=235.92, P<0.001$ ) when tested individually, as well as jointly ( $F(2, 197,884)=123.18, P<0.001$ ). These analyses suggest that employing an IV is preferable, as simple OLS estimates cannot be relied on to capture the causal effect in this dataset.

We made use of a natural instrument for economic inequality in our data. In 2014, the Australian Government introduced the TBRL, increasing the tax rate of high-income taxpayers (gross annual income greater than A\$180,000) by 2%. The aim of this levy was to reduce the national fiscal deficit. (In introducing the bill into the Australian Parliament, the Minister for Finance stated that "It is in the context of the immediate task of budget repair that we are introducing the temporary budget repair levy.") The TBRL was subsequently removed in 2017. We used a dummy variable for whether or not the TBRL was in place during the financial year of reported income as an instrument for lower economic inequality. We used the product of the dummy variable and the income variable as an instrument for the interaction of economic inequality and income.

The TBRL is a valid instrument for several reasons. First, one needs to be able to argue that the TBRL (the instrument) can affect the financial hardship variable only indirectly through economic inequality, without a direct link to financial hardship or a link through any other omitted factor (exclusion criterion,

also known as the 'only-through' criterion). This exclusion restriction is by definition satisfied in our study, as the TBRL was applied only to the rich (with a gross income above A\$180,000) who do not form part of the sample in our main analysis. The TBRL should therefore not be linked to the outcome variable, financial hardship, in any way other than by changing the overall level of economic inequality. We also conducted additional analyses where we include individuals above the tax threshold in the sample (that is, who earn more than A\$180,000), and in these additional analyses the exclusion restriction may still be satisfied under the assumption that those individuals are beyond the risk of financial hardship.

Second, for an instrument to be valid, it is important that the link between the instrument and the endogenous regressor (economic inequality) is sufficiently strong (relevance criterion). As the tax only affects individuals at the top of the income distribution, the level of economic inequality (calculated as the difference in after-tax income between the rich and the poor) will drop mechanically in the years when the tax is levied. Pairwise correlations suggest that the tax is a relevant instrument for economic inequality both directly ( $\rho = 0.22, P < 0.001$ ) and in the interaction with logged income ( $\rho = 0.15, P < 0.001$ ). We also find more detailed empirical support for this statement in our first-stage results, which we detail further below. Despite satisfying these criteria, it could be that the instrument is picking up some other factor that occurred during these years and is correlated with economic inequality. To control for this, we add macro-level economic control variables, including unemployment, gross domestic product and inflation, and our results remain robust as described below.

**Study 4.** The aim of study 4 was to provide causal evidence for the relationship between economic inequality and financial hardship using a more tightly controlled experimental design.

**Methods.** Participants. We recruited 2,509 participants via Amazon's Mechanical Turk who were paid US\$1.00. We applied the same exclusion criteria to improve data quality in all studies where we collected original data through online platforms (that is, here and studies 2 and 5). Participants were excluded who (1) missed the attention check or (2) indicated an implausible age. Furthermore, we excluded respondents who provided implausible responses to the 'perceived economic inequality' measure with the same criteria as before: (1) participants who indicated that the top quintile of individuals earned less than the bottom quintile of individuals; (2) participants who stated that the average yearly income is US\$0 in the top quintile; (3) participants who responded that the average yearly income is US\$0 in the bottom quintile; and (4) participants for whom the calculated 80:20 ratio exceeded a ratio of 5,000:1. In this study, 16 participants (2% of recruited sample) met these exclusion criteria. The final sample size consisted of 2,317 individuals.

We also included a question at the end of the study that asked participants whether they were suspicious about the information presented to them. While our primary analysis focuses on participants who did not indicate being suspicious (1,619 individuals, 60.3% female,  $M_{age} = 37.22$ ), we also subsequently report analyses including these participants, which yield qualitatively similar results. We also tested whether the number of suspicious participants differed as a function of their random assignment to conditions and find no significant difference ( $X^2(1) = 0.296, P = 0.586$ ). That is, participants were equally likely to be suspicious in either low economic inequality or high economic inequality condition.

**Design and variables.** Participants were first informed that we collected data on the economic inequality for each ZIP code. Based on their IP addresses, the ZIP code of each respondent was tracked and displayed on the screen. Participants were asked to confirm that this ZIP code was accurate, or to provide us with the correct ZIP code if it was no. Afterwards, participants were informed that data on economic inequality of their local ZIP code area was being retrieved.

Participants were subsequently randomly assigned to the low economic inequality or high economic inequality condition. Respondents in both conditions were shown information regarding the average level of inequality in the United States, as well as a description and visual representation of economic inequality in their ZIP code area. We varied the information content in each condition. Participants in the low economic inequality condition were told that their ZIP code is in the 11th percentile of economic inequality, such that the richest 10% earned only 4.5 times more than the poorest 10% (see Supplementary Fig. 1). In contrast, participants in the high economic inequality condition were told that their ZIP code was in the 89th percentile, such that the richest 10% earned 60.4 times more than the poorest 10% (see Supplementary Fig. 2). Finally, all participants were asked to recall three personal experiences where 'they had the feeling that the level of inequality was very low/high' in their ZIP code area.

**Income.** We asked participants to report their household income before taxes in the previous year by choosing one of 12 categories ranging from 'Less than US\$10,000' to 'More than US\$150,000'. Household income was coded as the midpoint of the chosen income bin (or US\$175,000 for the highest bin).

**Financial hardship.** We used the same three-item financial hardship measure as in study 1 ( $\alpha = 0.96$ ).

**Manipulation check.** As a manipulation check, participants were asked to estimate the average yearly income of each quintile of individuals in their local ZIP code.

We calculated the ratio of the estimated income in the top and bottom quintile in their ZIP code for each respondent to approximate the perceived local economic inequality. As this metric is positively skewed, we used log-transformations in the analyses, same as before.

**Study 5.** The goal of study 5 was to investigate the role of community buffer in the relationship of financial hardship and economic inequality in the United States.

**Methods.** Participants and design. As part of a broader study, we recruited a nationally representative US sample (across age, gender and income) through a Qualtrics.com online panel ( $N = 1,212$ ). Participants were paid US\$5.00 for responding to the survey. We applied the same exclusion criteria to improve data quality in all studies where we collected original data through online platforms (that is, here and studies 2 and 4). Participants were excluded who (1) missed the attention check or (2) indicated an implausible age. Furthermore, we excluded respondents who provided implausible responses to the 'perceived economic inequality' measure, same as before: (1) participants who indicated that the top quintile of individuals earned less than the bottom quintile of individuals; (2) participants who stated that the average yearly income is US\$0 in the top quintile; (3) participants who responded that the average yearly income is US\$0 in the bottom quintile; and (4) participants for whom the calculated 80:20 ratio exceeded a ratio of 5,000:1. The final sample size consisted of 1,062 individuals (54% female,  $M_{age} = 46.66$ ).

**Perceived economic inequality.** Same as before, participants estimated the average yearly income of each quintile of individuals in their local ZIP code. We calculated the ratio of the estimated income in the top and bottom quintile in their ZIP code for each respondent to approximate the perceived local economic inequality. As this metric is positively skewed, we used log-transformations in the analyses.

**Income.** Participants reported their household income by choosing one of seven categories ranging from 'Less than US\$25,000' (1) to 'More than US\$200,000' (7). Household income was coded as the midpoint of the chosen income bin (or US\$225,000 for the highest bin). Similar to study 2, we divided the household income by the square root of household size to estimate the per capita income in the respondent's household.

**Financial hardship.** We used the same three-item financial hardship measure as in study 1 and 4 ( $\alpha = 0.95$ ).

**Community buffer.** We measured the extent to which participants could rely on their community with three statements: 'When I need money, I can rely on others', 'When my financial situation is pressing, I can turn to others for help' and 'When I run into financial difficulties, I can rely on others to support me'. Participants responded on a seven-point scale (1, strongly disagree, to 7, strongly agree;  $\alpha = 0.95$ ).

**Control variables.** Participants also reported their age, gender, education and employment status.

**Study 6.** Study 6 was designed to further examine the key role of the community buffer in a field setting.

**Methods.** Participants and design. As part of a broader study, we collected data from 2,393 participants (47% female) in rural Uganda in collaboration with an international non-governmental organization (The Water Trust). Due to the high illiteracy rate of participants, all questions were responded to verbally to a trained enumerator on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

**Perceived economic inequality.** We assessed economic inequality with the following item, 'In my neighborhood, the difference between the poor and rich is very high.'

**Financial hardship.** We measured financial hardship with the following item, 'I am in financial difficulty.'

**Community buffer.** We captured the community buffer with two items, 'I can rely on others in my community to support me' and 'I can turn to others in my local area for help' ( $r = 0.79$ ).

**Control variables.** We obtained information on the respondent's gender and the number of individuals in the respondent's household.

**Results.** **Agreement of economic inequality across villages.** To test the validity of the economic inequality measure in this context, we checked whether individuals in the same village agreed about the level of economic inequality in their village. We conducted a Kruskal-Wallis  $H$  test, which revealed that there is substantial agreement among people in the same village on the level of economic inequality Ugandan villages ( $\chi^2(28) = 176.18, P < 0.001$ ). Supplementary Fig. 3 depicts the means and the s.d. of economic inequality across villages.

**Study 7 (extension of study 4).** Study 7 aimed to investigate whether the community buffer mediated the effect of economic inequality on increased financial hardship for low-income individuals.

**Design and variables.** As part of the data collection reported in study 4, we also measured the community buffer, as follows:

**Community buffer.** After the experimental manipulation, but before participants responded to the dependent variable (that is, financial hardship), participants responded to the same three items assessing their community buffer as study 5 (for example, ‘When I need money, I can rely on others’) on a seven-point scale (1, strongly disagree, to 7, strongly agree;  $\alpha=0.96$ ).

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

## Data availability

Data are available on the Open Science Framework at the following link: <https://osf.io/a3qy8/>. We note that the data providers did not allow us to share the data for study 3 and Supplementary Study 1. Access to data for study 3 is restricted by the National Centre for Longitudinal Data (NCLD), and can be obtained by submitting a request to the NCLD. Access to data for Supplementary Study 1 is restricted by Gallup, and can be obtained for purchase from Gallup.

## Code availability

The code to reproduce the analyses presented in the current research is available on the Open Science Framework at the following link: <https://osf.io/a3qy8/>.

Received: 21 January 2019; Accepted: 3 March 2020;

Published online: 30 March 2020

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### Acknowledgements

We thank C. Prottas for his help in data collection for study 6, and O. Hauser and G. Neszveda for useful discussions. We are also grateful to the Hungarian Fulbright Committee for their support. The authors received no specific funding for this work.

### Author contributions

J.M.J. and B.S. contributed to this manuscript equally and are listed alphabetically. J.M.J. and B.S. conceived of the idea and designed the studies. J.M.J., B.S., M.L. and D.S. collected the data and performed the analysis. J.M.J. and B.S. wrote the paper, and M.L., D.S., J.P. and E.U.W. provided critical revisions.

### Competing interests

The authors declare no competing interests.

### Additional information

**Supplementary information** is available for this paper at <https://doi.org/10.1038/s41562-020-0849-2>.

**Correspondence and requests for materials** should be addressed to J.M.J. or B.S.

**Peer review information** Primary Handling Editor: Aisha Bradshaw

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Data collection

Data was collected through Qualtrics.com

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# Behavioural & social sciences study design

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## Study description

- Study 1: Correlational Study with U.S. Individuals (BFRSS)
- Study 2: Correlational Study with U.S. Individuals (MTurk)
- Study 3: Instrumental Variable Analysis in Australian Panel Data (HILDA)
- Study 4: Experimental Study with U.S. Individuals (MTurk)
- Study 5: Correlational Study with U.S. Individuals (Qualtrics Panel)
- Study 6: Correlational Study with Rural Ugandan Individuals
- Study 7: Additional Analysis of Study 4 Data
- Study S1: Correlational Study with U.S. Individuals (Gallup)

## Research sample

- Study 1: Accessed via the BFRSS survey
- Study 2: Recruited via MTurk
- Study 3: Accessed via the HILDA survey
- Study 4: Recruited via MTurk
- Study 5: Recruited via Qualtrics.com
- Study 6: Recruited through a local field partner in Uganda
- Study 7: Recruited via MTurk (extension of Study 4)
- Study S1: Accessed via the Gallup Survey

## Sampling strategy

- Studies 1, 3, 6, and S1: Data was collected by an outside entity that set the sample size.
- Studies 2 (N = 1127), 4/7 (N = 2509), and 5 (N = 1212): Sample size was aimed to be least 1,000 participants in correlational Studies 2 and 5, and to 2,500 for Study 4, to ensure adequate statistical power given prior effect sizes.

## Data collection

- Studies 1, 3, 6, and S1: Data was collected by an outside entity.
- Studies 2 (N = 1127) and 4/7 (N = 2509): Data was collected via Amazon's Mechanical Turk
- Study 5: Data was aimed to be nationally representative, and therefore recruited via a Qualtrics.com panel.

## Timing

- For Studies 1, 3, 6, and S1, we had no influence over data collection.
- Study 2 data was collected in summer/fall of 2019. Study 4/7 and Study 5 data was collected in fall/winter of 2017.

## Data exclusions

- We report the results for all participants who were excluded from our studies, and how this affects our results, in the SI Appendix.

## Non-participation

- We report the results for all participants who dropped out of studies, and how this affects our results, in the SI Appendix.

## Randomization

- Participants were only randomly allocated to different conditions in Study 4/7.

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## Population characteristics

See above.

## Recruitment

For Studies 1, 3, 6, and S1, we had no influence over data collection.

For Studies 2 and 4, we recruited participants from Amazon's Mechanical Turk. For Study 5, we recruited participants via a Qualtrics.com panel.

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