ORIGINAL RESEARCH REPORT

Does Belief in Free Will Increase Support for Economic Inequality?

Brett Mercier[*], Dylan Wiwad[†], Paul K. Piff[*], Lara B. Aknin[‡], Angela R. Robinson[*] and Azim Shariff[§]

Does belief in free will increase support for economic inequality? Five studies using diverse measures and methods tested this question. Study 1 finds belief in free will is associated with increased support for inequality. Study 2 manipulates belief in free will and does not find evidence that this changes support for inequality. Studies 3 and 4 find that people are more willing to support inequality in a hypothetical universe where free will exists compared to one where it does not (dz = 0.10–0.13), indicating that people believe the existence of free will justifies inequality. However, a between-subjects design in Study 5 fails to replicate this finding. Overall, our results suggest that if belief in free will increases support for economic inequality, the effect is likely small and potentially sensitive to the methods used to detect it.

In 2017, as Jeff Bezos became the richest person in the world with a net worth of over 100 billion dollars, 21% of American children were living in poverty (Au-Yeung, 2018; OECD, 2019). Though many people are outraged by this level of inequality, others seem unconcerned (Dunn, 2018). What separates those who support economic inequality from those who oppose it? We hypothesize that belief in free will is one factor contributing to support for inequality and present several studies empirically testing this hypothesis.

Attitudes Towards Inequality
A large body of research suggests that beliefs about the fairness of inequality determine whether people support it (Franks & Scherr, 2018; Sears & Funk, 1991). Survey research finds that people who believe inequality results from differences in effort or ability tend to support inequality, and those who believe inequality results from luck tend to oppose it (Kluegel & Smith, 1986). Similarly, lab experiments which create inequality between participants find that people are more supportive of inequality created based on merit, and more opposed to inequality created based on luck (Rustichini & Vostroknutov, 2014).

Research on economic mobility – the frequency with which individuals change their position in an income distribution – also provides evidence that perceptions of fairness shape attitudes towards inequality. People want less government action to reduce inequality when they believe social mobility is high, but only if they believe mobility is accessible to everyone in society (Alesina & Ferrara, 2005). Similarly, when people are told their country has high mobility, support for inequality increases, an effect partially mediated by the perception that inequality results from differences in effort (Shariff, Wiwad, & Aknin, 2016).

Thus, support for inequality is higher when people believe that economic disparities result from individuals' choices and behaviors. Building on this finding, we test whether the belief that choices and behaviors are the product of free will also influences support for inequality.

Free Will
Most laypeople think of free will as the ability to make choices and act in accordance with one's desires, especially in the absence of external constraints (Feldman, 2017; Monroe & Malle, 2010). For example, when asked to describe a time when they acted out of free will, people often describe situations where they overcame external influences on their behavior (Stillman, Baumeister, & Mele, 2011). Although most people believe in free will, the strength of this belief varies (Monroe & Malle, 2010; Sarkissian et al., 2010). This variation influences judgments, particularly those related to perceptions of personal responsibility. For example, when asked to

* Department of Psychological Science, University of California, Irvine, Social and Behavioral Sciences Gateway Irvine, CA, US

† Department of Psychology, Kellogg School of Management, Northwestern University, Evanston, IL, US

‡ Department of Psychology, Simon Fraser University, University Drive, Burnaby, BC, CA

§ Department of Psychology, University of British Columbia, West Mall, Vancouver, BC, CA

Corresponding author: Brett Mercier (bmercier@uci.edu)

explain the behavior of others, people with a stronger belief in free will are more likely to endorse dispositional explanations than situational explanations (Genschow, Rigoni, & Brass, 2017). Similarly, belief in free will plays an important role in attributions of responsibility for immoral or criminal actions. Forces that are perceived to limit capacity for choice, such as drug addiction or mental illness, are believed to mitigate immoral actions because they diminish one's ability to act freely (de Mamani et al., 2015; Sadava, Agnus, & Forsyth, 1980; Vonasch, Clark, Lau, Vohs, & Baumeister, 2017). People with a strong belief in free will are more likely to support harsher punishment for criminals, likely because they believe people are free to choose whether or not to commit crimes (Martin, Rigoni, & Vohs, 2017; Shariff et al., 2014).

As discussed above, attitudes towards inequality are influenced by beliefs about the extent to which individuals' choices determine their economic outcomes. By engendering the belief that individuals are responsible for their economic station, belief in free will might increase support for economic inequality. Consistent with this, past research has found that thinking about choice increases acceptance of wealth inequality, suggesting belief in free will may have similar effects (Savani & Rattan, 2012). Similarly, encouraging people to make situational attributions for poverty decreases support for economic inequality, likely because situational causes are believed to be outside of personal control (Piff et al., 2020).

Thus, published research indicates belief in free will probably increases support for economic inequality. However, many studies manipulating belief in free will (e.g., Vohs & Schooler, 2008) or related concepts (e.g., the concept of choice; Savani & Rattan, 2012) have small sample sizes, which increases the risk of false positives (Ioannidis, 2005). Additionally, several attempts to replicate research on belief in free will have been unsuccessful (Monroe, Brady, & Malle, 2016; Nadelhoffer et al., 2019; Open Science Collaboration, 2015). Thus, adequately powered research is needed to help clarify the consequences of belief in free will.

Present Research
Across five studies, we tested whether belief in free will increases support for economic inequality. Study 1 tested whether, controlling for demographic factors, belief in free will correlates with support for economic inequality. Study 2 tested whether manipulating belief in free will changes support for economic inequality. In Studies 3–5, we asked participants how much they would support inequality in a universe with free will and a universe without free will.

Study 1
Study 1 tested whether people who believe in free will are more likely to support inequality. We predicted that, controlling for age, gender, income, political ideology, and political party identification,[1] belief in free will would correlate with greater support for economic inequality. Study 1 was not preregistered.

Method
We recruited 619 participants through Amazon's Mechanical Turk. Data were originally collected for another study, which determined the sample size. Participants first completed the Support for Economic Inequality Scale (Wiwad et al., 2019), a five-item measure (e.g. "Economic inequality is not a problem") with Likert response options ranging from 1 = "Strongly Disagree" to 7 = "Strongly Agree" ($M = 2.72$, $SD = 1.46$, $\alpha = .92$). Next, embedded within a larger survey (all measures reported in supplementary materials), participants completed the Free Will subscale of the Free Will Inventory (Nadelhoffer, Shepard, Nahmias, Sripada, & Ross, 2014), a seven-item measure (e.g. "People always have free will") with Likert response options ranging from 1 = "Strongly Disagree" to 7 = "Strongly Agree" ($M = 4.88$, $SD = 1.21$, $\alpha = .87$). Finally, participants completed a demographic form, which included measures of political ideology ($M = 3.41$, $SD = 1.80$, on a scale from 1 = "Very Liberal" to 7 = "Very Conservative"), political party identification (270 Democrat, 202 Independent, 122 Republican, 24 Other) household income ($M = 5.30$, $SD = 3.56$, on a scale starting at 1 = "under $20,000" and increasing by $10,000 until 15 = "150,000 +"), gender (326 Female, 290 Male, 1 "Other", 1 "Prefer not to say"), and age ($M = 36.01$, $SD = 11.33$).

Results
Analyses which were not Preregistered
To test our hypothesis, we conducted a regression with support for inequality as the dependent variable and belief in free will as the independent variable. Belief in free will was associated with increased support for economic inequality ($\beta = 0.27$, $p < .001$), even when income, gender, age, political ideology, and party identification were included as covariates ($\beta = 0.11$, $p = .001$; See **Table 1**).

Discussion
Study 1 found that people who believe in free will are more likely to support inequality. To test whether this association occurs because belief in free will causes support for inequality, we shifted to experimental methods in Study 2.

Study 2
Study 2 tested whether manipulating belief in free will would change support for economic inequality. We preregistered several predictions for Study 2. Most relevant to the current framing of this paper, we predicted that participants who watched a video arguing that free will exists (*Pro Free Will* condition) would support inequality more than participants who watched a video arguing free will does not exist (*Anti Free Will* condition). Additionally, although it is less relevant to the current framing of this paper, we also predicted that participants in the *Pro Free Will* condition would support meritocracy more than participants in the *Anti Free Will* condition. Finally, we preregistered that a secondary analysis would test whether support for redistribution was higher in the *Anti Free Will* condition.

We preregistered several planned analyses for Study 2. Specifically, we indicated that the above predictions would be tested using t-tests to compare conditions. Because we had directional predictions, we specified that these t-tests would be one-tailed. We also specified

Table 1: Results of Multiple Regression Analysis on Support for Inequality.

	Model 1: Only Free Will				Model 2: With Covariates			
	F	Adj. *R*²	*β*	SE	*F*	Adj. *R*²	*β*	SE
Model	47.19	.07			45.74	.37		
Belief in Free Will			0.27	0.04 (*p* <.001)			0.11	0.03 (*p* = .002)
Income							0.09	0.03 (*p* = .008)
Gender (Female)							−0.09	0.07 (*p* = .160)
Age							−0.08	0.03 (*p* = .024)
Political Ideology							0.47	0.03 (*p* < .001)
Party Identification (Independent)							0.07	0.08 (*p* = 0.41)
Party Identification (Republican)							0.34	0.13 (*p* = .008)
Party Identification (Other)							0.25	0.19 (*p* = 0.20)

Note: *β* denotes a standardized beta coefficient. The gender variable has "Male" as the reference category, and excludes participants reporting "Other" or "Prefer not to say". The party identification variable has "Democrat" as the reference category. Higher scores on the "Political Ideology" variable indicate greater political conservatism.

that, as a manipulation check, we would test whether belief in free will was higher in the *Pro Free Will* than in the *Anti Free Will* condition. Finally, we specified that we would test whether the expected differences between conditions in support for inequality and meritocracy were mediated by greater belief in contextual explanations for inequality. We specified this mediation analysis because past research has found that belief in free will leads to a focus on dispositional rather than situational influences on behavior (Genschow et al., 2017). Thus, it would be reasonable to assume that an effect of belief in free will on support for inequality or meritocracy would be caused by a change in endorsement of contextual over dispositional explanations for inequality.

The sample size for Study 2 was determined by a power analysis conducted in R (R Core Team, 2017) using the "pwr" package (Champely, 2017). We targeted 90% power to detect at least a conventionally small effect size (*d* = .20, α = .05, one tailed test).[2] This analysis indicated 858 participants would be required. Prior experience with MTurk led us to expect that roughly 15% of participants would fail an attention check, so we increased our sample by 15% to 1,010. Target sample size, hypotheses, and planned analyses were preregistered (https://aspredicted.org/6wm3s.pdf). In Study 2 (and all studies in this paper), we used the TurkPrime research platform (Litman, Robinson, & Abberbock, 2017) to exclude participants from previous studies.

Method
We recruited 1010 participants through Amazon's Mechanical Turk. Participants were randomly assigned to watch one of two videos. The *Anti Free Will* video (*n* = 524) argued against the existence of free will and described a psychology experiment which found that unconscious brain activity can predict hand movements before conscious awareness of intentions to perform these movements (Libet, 1985). The *Pro Free Will* video (*n* = 486) argued that free will exists and described an ostensibly real psychology experiment which found that conscious intentions to make

a hand movement always occur before unconscious brain activity. Other than the direction of the argument (for or against free will) the videos were closely matched in content (both videos describe the same experimental procedure) and length (*Anti Free Will*: 2:57, *Pro Free Will*: 2:42; see supplementary materials for video scripts). Following the video, participants completed the following measures:

Support for Economic Inequality
Support for inequality was measured using the Support for Inequality Scale (Wiwad et al., 2019) which is described in Study 1 (*M* = 2.83, *SD* = 1.48 α = .94).

Support for Meritocracy
Support for meritocracy was measured using the Support for Meritocracy Scale (Horberg, Kraus, & Keltner, 2013), a seven-item measure (e.g. "It is okay for some people to have better lives if they earned it") with Likert response options ranging from 1 = "Strongly Disagree" to 7 = "Strongly Agree" (*M* = 4.53, *SD* = 1.16, α = .77).

Explanations for Economic Inequality
We used a scale measuring explanations for economic inequality from Kraus, Piff, and Keltner (2009). This measure included a list of 12 explanations for inequality, seven of which were contextual (e.g. "Differences in inheritance") and five of which were dispositional (e.g. "Differences in how hard people work"). Participants were asked to indicate how important they think each of the factors is in contributing to the current level of economic inequality on a five-point Likert scale ranging from 1 = "not important" to 5 = "very important". Following Kraus et al. (2009), we reverse coded the dispositional items and combined them with the contextual items to create a composite measure of endorsement of contextual explanations (*M* = 2.78, *SD* = 0.67, α = .83).

Support for Redistribution
Participants completed a three-item measure of support for redistribution (e.g., "The government should take

measures to reduce differences in income levels") adopted from World Values Survey (World Values Survey Association, 2012). Participants indicated their agreement with each item on a seven-point Likert scale ranging from 1 = "Strongly Disagree" to 7 = "Strongly Agree" (M = 5.02, SD = 1.53, α = .84).

Free Will
Participants completed the Free Will subscale of the Free Will Inventory (Nadelhoffer et al., 2014), which is described in Study 1 (M = 4.79, SD = 1.32, α = .89).

Attention Check
Participants were asked to recall the main argument made in the video from a list of several possible options: "people do have free will", "people do not have free will", "global warming is occurring", "global warming is not occurring", "the earth is the center of the universe", and "the earth is not the center of the universe."

The items for these measures, and for all measures used in this paper, are included in the supplemental materials. Participants first completed the measures of support for inequality, support for meritocracy, and explanations for economic inequality, which were presented in random order. Next, participants completed the measures of support for redistribution and belief in free will, the attention check, and a demographic form. After excluding participants who failed the attention check (17%), our final sample (N = 836) provided an 80% chance to detect effects of size d = 0.20 or greater.

Results
As recommended by Ruxton (2006) we used unequal variance t-tests to compare differences in means. Similarly, we calculated Cohen's d using a pooled standard deviation with sphericity correction for unequal variances. Mediation analyses were conducted using the "mediation" package (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014) for R (R Core Team, 2017).

Preregistered Analyses
Belief in free will was higher in the *Pro Free Will* condition (M = 4.96, SD = 1.27) than in the *Anti Free Will* condition (M = 4.63, SD = 1.35), indicating that our manipulation was effective, t(831.66) = 3.56, p <.001, d = 0.25, 95% CI [0.11, 0.38].

We predicted that, as a result of the free will manipulation, support for inequality would be higher in the *Pro Free Will* condition than in the *Anti Free Will* condition. Contrary to this prediction, we did not find evidence that support for inequality was higher in the *Pro Free Will* condition (M = 2.86, SD = 1.48) than in the *Anti Free Will* condition (M = 2.81, SD = 1.49), t(833.97) = 0.35, p = 0.347, d = 0.03, 95% CI [–0.11, 0.16].[3] Furthermore, we did not find evidence that the data were consistent with a mediation model where the manipulation had an indirect effect on support for inequality through endorsement of contextual explanations for inequality (B = 0.02, p = .786).

We also predicted that support for meritocracy would be higher in the *Pro Free Will* condition than the *Anti Free Will* condition. Contrary to this prediction, we did not find evidence that support for meritocracy was greater in the *Pro Free Will* condition (M = 4.52, SD = 1.14) compared to the *Anti Free Will* condition (M = 4.55, SD = 1.20), t(832.67) = –0.46, p = .678, d = –0.03, 95% CI [–0.17, 0.11]. Likewise, we did not find evidence that the data were consistent with a mediation model where the manipulation had an indirect effect on support for meritocracy through endorsement of contextual explanations for inequality, B = 0.01, p = .836.

Finally, we did not find evidence that support for redistribution was lower in the *Pro Free Will* condition (M = 5.05, SD = 1.52) than in the *Anti Free Will* condition (M = 4.99, SD = 1.54), t(834) = 0.574, p = .717, d = 0.04, 95% CI [–0.10, 0.18].

Analyses that were not Preregistered
Although not part of our preregistered analysis plan, we also tested for an effect controlling for demographic differences between conditions, as this can increase statistical power (Meyvis & Van Osselaer, 2018). Using a regression with income, sex, age, and political ideology as covariates, we found no evidence that support for inequality differed across conditions (β = –.06, p = .444). This indicates that even when using covariates to increase statistical power, we still find no evidence for a difference in support for inequality between conditions. Finally, as in Study 1, a regression found that belief in free will was associated with support for inequality (β = 0.27, p <.001), even when income, sex, age, and political ideology were included as covariates (β = 0.08, p = .003).

Discussion
Although our manipulation produced a small change in belief in free will (d = .25), we did not find evidence that support for inequality differed across conditions. Thus, our prediction that changing belief in free will would change support for economic inequality was not supported. However, our failure to find an effect does not necessarily indicate that an effect does not exist. For example, it is possible that a true effect exists, but we lacked the statistical power to detect it. Although we detected a change in participants' belief in free will (our manipulation check), our initial power analysis failed to account for the fact the we expected the manipulation to first change participants' belief in free will, and this change in belief to in turn affect participants' support for inequality. Because participants only changed their belief in free will a small amount, any subsequent change in their support for inequality would likely be even smaller and require an even larger sample to detect (see Kenny & Judd, 2014, who discuss an analogous problem with power to detect a total effect in mediation models).

To illustrate this concretely, in Study 2 the manipulation had a small (d = 0.25) effect on belief in free will. In a regression model in Study 2, we find that belief in free will and support for inequality are associated at an unstandardized coefficient of B = 0.10, controlling for several covariates. If we use B = 0.10 as our best estimate of the true effect of belief in free will on support for

inequality, we should expect the $d = 0.25$ effect on belief in free will to translate to only a $d = 0.03$ change in support for inequality ($0.25*0.10 = 0.03$). Study 2 had only a 15% chance to detect an effect this size ($d = .03$, $\alpha = .05$, n = 836, one-tailed test).

Put another way, Study 2 had 80% power to detect a $d = 0.2$ difference in support for inequality between conditions. Because the change in belief in free will was only $d = 0.25$, the effect of belief in free will on support for inequality would need to be $B = 0.80$ to produce a $d = 0.20$ change in support for inequality across conditions ($0.25*0.8 = 0.20$). Thus, despite having a large sample, Study 2 was underpowered unless belief in free will has a large effect on support for inequality (e.g. $B \geq 0.80$), making it difficult to interpret the null result.

Study 3

Study 2 was not able to achieve adequate statistical power, in part because we were only able to produce a small change in participants' belief in free will. In Study 3, we attempted to test our hypothesis without trying to change the extent which participants believed in free will. To do this, we modified a thought experiment from Nichols and Knobe (2007). We asked participants to imagine two different universes: a deterministic universe where behaviors are the inevitable consequence of the events that precede them, and an indeterministic universe where behavior is not an inevitable consequence of past events. Because lay conceptions of free will involve free choices unconstrained by the past environment, we expected participants to believe free will does not exist in the deterministic universe. Thus, we predicted that participants would report greater support for inequality in the indeterministic universe compared to the deterministic one, which would indicate that people believe the existence of free will justifies inequality. Study 3 was not preregistered.

Method

We recruited 450 participants for Study 3 through MTurk following an unrelated study (which determined the sample size). We excluded eight participants for failing an attention check, leaving 442 participants (240 female, 198 male, 4 other; M_{age} = 39.54, SD = 11.40). This sample provided 80% power to detect an effect of size $dz = 0.13$ or greater at $\alpha = .05$ (two-tailed, paired t-test).

We asked participants to imagine two different universes: a deterministic universe where human decisions are the predetermined result of everything that occurred before them, and a universe where human actions are not predetermined by prior events (see supplementary materials for full text). Following this, we asked participants to indicate which universe is most similar to our own. Finally, for our universe, the deterministic universe, and the indeterministic universe, we asked participants how acceptable they think it is that "some people have a great deal of money, status, and resources, while others have very little." Participants responded on 10-point scales ranging from 1 = "not at all acceptable" to 10 = "completely acceptable."

Results

Analyses which were not Preregistered

Consistent with past research (Nichols & Knobe, 2007), most participants (83%) believed our universe is more like the indeterministic universe than the deterministic universe. Confirming our predictions, a paired t-test revealed that participants reported greater support for inequality in the indeterministic universe ($M = 5.77$, $SD = 2.65$) than in the deterministic universe ($M = 5.43$, $SD = 2.65$), $t(435) = 2.70$, $p = .007$, $dz = 0.13$, 95% CI [0.03, 0.22].[4] Participants also indicated greater support for inequality in our universe ($M = 5.79$, $SD = 2.65$) compared to the deterministic universe, $t(436) = 3.00$, $p = .003$, $dz = 0.14$, 95% CI [0.05, 0.24].

Study 4

Study 3 demonstrated that when people consider both a deterministic and indeterministic universe, they believe inequality would be less justified in the deterministic universe. Although we assumed this result occurred because people in the deterministic universe are believed to have less free will, Study 3 did not test this assumption. To test this, Study 4 was a replication of Study 3 with additional questions about the amount of free will people in each universe have. We predicted that Study 4 would replicate Study 3, and that participants would believe there is less free will in the deterministic universe than in the indeterministic universe. Hypotheses, sample size, and analysis plan were preregistered (https://aspredicted. org/ct3py.pdf).

Method

We preregistered a target sample size of 858 participants to be collected through MTurk (sample size was determined for a separate study which participants completed after Study 4). However, some participants were partway through the survey when the target sample size was reached (MTurk stops allowing signups for a survey based on the number of completions, and anyone partway through a survey when the target number of completions is reached can finish the survey). Once all participants finished the survey, we ended with 906 participants, slightly exceeding our preregistered target sample size. We excluded 72 participants for failing an attention check, leaving 834 participants (448 female, 369 male, 3 other; M_{age} = 36.78, SD = 12.28). This sample provided 80% power to detect effects of size $dz = 0.09$ or larger at $\alpha = .05$ (one-tailed, paired t-test). The materials were identical to Study 3, with the addition of two questions which asked participants to indicate how much free will they believed people in each of the hypothetical universes have (1 = "No free will", 10 = "Complete free will").

Results

Preregistered Analyses

As expected, participants believed that people in the indeterministic universe ($M = 7.90$, $SD = 1.95$) had more free will than those in the deterministic universe ($M = 2.95$, $SD = 2.37$), $t(822) = 40.63$, $p < .001$, $dz = 1.41$, 95% CI [1.32, 1.51]. Most participants (82%) again believed

that our universe is more like the indeterministic universe than the deterministic universe. As predicted, participants again indicated greater support for inequality in the indeterministic universe (M = 5.56, SD = 2.83) than in the deterministic universe (M = 5.27, SD = 2.96), t(831) = 3.02, p = .001, dz = 0.10, 95% CI [0.03, 0.17]. Participants also indicated greater support for inequality in our universe (M = 5.61, SD = 2.84) compared to the deterministic universe, t(831) = 3.92, p = <.001, dz = 0.13, 95% CI [0.07, 0.20].

Discussion

Replicating Study 3, participants in Study 4 reported less support for inequality in a deterministic universe than in an indeterministic universe. Study 4 also confirmed that participants believed people in the deterministic universe have less free will than those in the indeterministic universe. These results demonstrate that people would be less willing to support inequality in a universe without free will, indicating that people believe the existence of free will justifies economic inequality.

Study 5

Study 4 shows that when people consider both a deterministic universe without free will and an indeterministic universe with free will, they believe inequality is more acceptable in the universe with free will. Studies 3 and 4 used a within-subjects study design, where each participant compared the two universes. Between-subjects designs, where each participant only encounters one set of stimuli, occasionally produce different effects than within-subjects designs (Birnbaum, 1999; Hsee, 1998). To test the robustness of our effect, Study 5 employed a between-subjects design where each participant only considered one hypothetical universe. We predicted that Study 5 would replicate the findings of Studies 3 and 4.

We used the "fabs" R package (Biesanz, 2016) to estimate the distribution of plausible parameter values for the population effect size (based on the observed effect size in Study 3[5]) and to determine the sample size required for 80% power across this distribution. This analysis indicated 1677 participants would be required. Hypotheses, sample size, and analysis plan were preregistered (https://aspredicted.org/656mk.pdf).

Method

We recruited 1806 participants through MTurk (as in Study 4, we oversampled because the target sample was reached while some participants were partway through the survey). We excluded 19 participants for failing an attention check and 181 participants for spending less than 5 seconds on the page with the universe description, leaving 1606 participants (862 female, 738 male, 6 other; M_{age} = 37.65, SD = 12.30). This sample provided 80% power to detect effects of size d = 0.12 or greater (α = .05, one-tailed test).

The procedure was identical to Study 4 except participants were randomly assigned to read about one of the two hypothetical universes, rather than both. Because participants only read about one universe, to increase clarity we added a short introduction informing participants that they would be asked to imagine a universe somewhat similar to our own. Following the description and before any other measures, participants were asked to indicate how similar the universe they read about was to our own universe on a scale from 1 = "Not at all similar" to 10 = "Very similar."

Results

Preregistered Analyses

As expected, participants believed people in the indeterministic universe (M = 7.86, SD = 2.15) had more free will than those in the deterministic universe (M = 4.39, SD = 3.24), t(1382.1) = 25.26, p <.001, d = 1.26, 95% CI [1.11, 1.41]. Similar to past studies, the indeterministic universe was seen as more similar to our universe (M = 7.56, SD = 2.32) than the deterministic universe (M = 5.87, SD = 2.80), t(1543.2) = 13.14, p <.001, d = 0.67, 95% CI [0.51, 0.80]. Contrary to our predictions, we did not find evidence that participants believed inequality was more acceptable in the indeterministic universe (M = 5.79, SD = 2.83) than in the deterministic universe (M = 5.70, SD = 2.89), t(1601.4) = 0.60, p = 0.276, d = .03, 95% CI [–0.11, 0.17].

Analyses that were not Preregistered

Although not part of our preregistered analysis plan, we performed an additional test of our hypothesis by using a regression to compare conditions, controlling for age, sex, and political ideology.[6] This analysis did not find evidence that inequality was more acceptable in the indeterministic universe than in the deterministic universe (β = –0.04, p = .363). Finally, we did not find evidence that participants who read about the indeterministic universe believed inequality was more acceptable in this universe relative to our own universe (M = 5.66, SD = 2.82), t(797) = 0.67, p = .505, d_{av} = 0.01, 95% CI [–0.06, 0.08].

Discussion

Contrary to our predictions, Study 5 did not find evidence that participants believed inequality is more acceptable in a universe with free will compared to one without. Why the discrepancy between the null effects of this between-subjects study, and those of the within-subjects designs of Studies 3–4? Different results among within- and between-subjects designs typically occur when a between-subject design changes the reference point for judgment. For example, Birnbaum (1999) finds that when participants in a between-subjects design are asked to rate the "largeness" of a number, they rate 9 as larger than 221. This occurs because, in a between-subjects design 9 is compared to single digit numbers, while 221 is compared to 3-digit numbers. In a within-subjects design, the conditions are compared to each other, and 221 is judged as larger than 9.

In Study 5, the between-subjects design makes it unclear what participants compared the universe without free will to. If they compared it to something other than a universe with free will (the comparison from Studies 3 and 4), this could explain why we did not find an effect.

However, in Study 5, after the description of each universe we asked participants how similar each universe was to our own. This should have made participants compare the universe to our own universe (which most participants believe is similar to the indeterministic universe), making the comparison similar to Studies 3 and 4.

It is also possible that the within-subjects design in Studies 3 and 4 made the research hypothesis transparent to participants, creating demand characteristics. If Study 5 removed these demand characteristics by using a between-subjects design, this could explain the failure to find an effect. If correct, this would mean the effects in Studies 3 and 4 are due to demand effects rather than a real relationship between belief in free will and support for inequality. However, contrary to this explanation, research has found that participants in within-subjects designs are rarely able to guess researchers' hypotheses, and when they do it has little effect on the results (Lambdin & Shaffer, 2009). Additionally, because the effect in Study 5 was in the predicted direction (d = .03), it is not clear whether it provides evidence against the effects from past studies. To determine this, we used a Bayesian analysis to test whether Study 5 is more consistent with a null effect or the effect observed in Study 4. We used JASP (JASP Team, 2019) to calculate a Bayes Factor comparing the likelihood of the data under a null model (point estimate of d = 0) to an alternative model centered around the effect size from Study 4 ($\sim N (0.10, .07)$). This analysis produced BF_{01} = 0.49, indicating the data are 2.1 times more likely to occur under a null model. Based on benchmarks for interpreting Bayes Factors (Lee & Wagenmakers, 2013) this provides "anecdotal" evidence in support of a null effect—the lowest benchmark of evidence above no evidence. Additionally, using our prior (the effect from Study 4) and the data from Study 5, we calculated a posterior distribution estimating the most likely effect size. This distribution had a median effect size of d = 0.06, with a 95% credible interval ranging from 0.01 to 0.14. Thus, the data appear most consistent with a real effect that is very small.

General Discussion

Does belief in free will increase support for economic inequality? Across five studies, our results suggest the answer is probably yes, although the effect is likely too small to have much practical or theoretical importance. In Study 1, we found that people who believe in free will are more likely to support economic inequality, even when controlling for demographic differences. In Study 2, we manipulated participants' belief in free will, and did not find evidence that this manipulation resulted in significant differences in support for inequality. Yet, the design of Study 2 had low power to detect an overall change in support for inequality, in part because our manipulation only produced a small change in belief in free will (d = 0.25). Studies 3 and 4 found that people believe inequality is more acceptable in a hypothetical universe where free will exists, relative to a universe where it does not. Although a small effect (dz = 0.10–0.13), this finding indicates that people see the existence of free will as at providing at least some justification for inequality. Study 5 attempted

to replicate Studies 3–4 using a between-subjects design instead of a within-subjects design and did not find a statistically significant effect. However, a Bayesian analysis indicates Study 5 provides only weak evidence for a null effect relative to a prior based on the effect from Study 4 (BF_{01} = 0.49). Additionally, a posterior estimate based on this analysis indicates the effect is likely between d = 0.01–0.14 (median estimate: d = 0.06).

Although the statistical significance of the effects varied across the studies in this paper, the effect sizes indicate a consistent set of results. In all 5 studies, including those which found a statistically significant effect, the observed effect sizes were extremely small. These small effects suggest that belief in free will has limited value to those seeking to understand or change support for economic inequality. Although small effect sizes can be meaningful, especially when aggregated across repeated judgements (Funder & Ozer, 2019), comparing our findings to similar research suggests they are relatively unimportant. When we observed significant effects (Study 3: dz = 0.13; Study 4: dz = 0.11), these effects were smaller than other research on belief in free will (e.g. Genschow et al., 2017: d = 0.19–0.41) and other research attempting to change attitudes towards inequality. To pick one relevant comparison, Piff et al. (2020) demonstrate that an online game simulating the experience of living in poverty can decrease support for economic inequality, with effects larger than those observed here (d = 0.20–0.48). Comparing these results to our findings suggests that attributions about the immediate causes of poverty have a larger impact on support for inequality than beliefs about the existence of free will. This conclusion is consistent with research arguing that beliefs about a specific individual's capacity for choice have a greater impact on blame than general beliefs about free will (Monroe et al., 2016). Thus, future research on support for inequality will likely benefit from a focus on beliefs about specific individuals or groups, rather than beliefs about abstract concepts like free will.

Our findings somewhat conflict with Savani and Rattan (2012), who find that priming choice produces large changes in attitudes towards inequality (d = 0.59–0.73). It is possible there is a distinction between the concept of choice and belief in free will that leads choice to have a larger effect on support for inequality. However, because Savani and Rattan (2012) use small sample sizes (n = roughly 23–37 per condition), their effects could be inflated by publication bias (Ioannidis, 2008), which would explain why they are larger than those observed here.

In sum, our results suggest belief in free will plays a relatively minor role in determining attitudes towards inequality. Future research might help clarify some of the mixed results on this topic, such as the difference between our findings and Savani and Rattan (2012), or the different results for between- and within-subjects designs. However, all else being equal, small effects have less practical and theoretical value than large effects, and require larger sample sizes to study. Because our findings suggest very small effects, we encourage researchers to carefully consider their opportunity costs before

conducting further research on the link between belief in free will and support for inequality.

Data Accessibility Statement

All study data, R code for analysis, preregistrations, supplementary text, and study materials are available on the Open Science Framework at the following link: https://osf.io/zmygv/.

Notes

[1] Our initial prediction did not include controlling for party identification, which was added in response to a suggestion from an anonymous reviewer. Adding party identification did not affect the relationship between free will and support for inequality. Party identification is not included as a covariate in subsequent studies because it was only measured in Study 1.

[2] Throughout the paper, we use one-tailed tests whenever we have a preregistered directional prediction.

[3] An exploratory analysis found the manipulation increased support for inequality among conservatives, but not liberals. However, a follow-up study failed to replicate this finding, suggesting it was a false positive. We report the exploratory analyses and the follow-up study in the supplementary materials.

[4] We report dz as the effect size for paired-t tests. A detailed description of dz, including the formula, can be found in Lakens (2013).

[5] Although the manuscript presents Study 4 first, Study 5 was conducted before Study 4. Thus, the power analysis for Study 5 is based on Study 3.

[6] Unlike previous studies, income is not included as a covariate because it was not measured in Study 5.

Additional File

The additional file for this article can be found as follows:

· **Supplemental Materials.** Full text of all survey materials and a description of additional statistical analyses. DOI: https://doi.org/10.1525/collabra.303.s1

Competing Interests

The authors have no competing interests to declare.

Author Contributions

· Contributed to conception and design: BM, DW, PKP, LBA, ARR, AS
· Contributed to acquisition of data: BM, DW, PKP, AS
· Contributed to analysis and interpretation of data: BM, DW, PKP, AS
· Drafted and/or revised the article: BM, DW, PKP, LBA, ARR, AS
· Approved the submitted version for publication: BM, DW, PKP, LBA, ARR, AS

References

Alesina, A., & **Ferrara, E. L.** (2005). Preferences for Redistribution in the Land of Opportunities. *Journal of Public Economics, 89,* 897–931. DOI: https://doi.org/10.1016/j.jpubeco.2004.05.009

Au-Yeung, A. (2018). How Jeff Bezos Became The Richest Person In America And The World. Retrieved from Forbes website: https://www.forbes.com/sites/angelauyeung/2018/10/03/how-jeff-bezos-became-the-richest-person-in-the-world-2018-forbes-400/#4b2e1bee1bee

Birnbaum, M. H. (1999). How To Show That 9 is Larger Than 221: Collect Judgments in a Between-Subjects Design. *Psychological Methods, 4*(3), 243–249. DOI: https://doi.org/10.1037//1082-989X.4.3.243

Champely, S. (2017). *pwr: Basic Functions for Power Analysis.* Retrieved from https://cran.r-project.org/package=pwr

de Mamani, W. A. G., Gurak, K., Maura, J., de Andino, M. A., Weintraub, M. J., & **Mejia, M. G.** (2015). Free Will Perceptions and Psychiatric Symptoms in Patients with Schizophrenia. *Journal of Schizophrenia Research, 2*(2), 1–5. DOI: https://doi.org/10.1111/jpm.12293

Dunn, A. (2018). Partisans are divided over the fairness of the U.S. economy – and why people are rich or poor. Retrieved from Pew Research Center website: pewresearch.org/fact-tank/2018/10/04/partisans-are-divided-over-the-fairness-of-the-u-s-economy-and-why-people-are-rich-or-poor/

Feldman, G. (2017). Making Sense of Agency: Belief in Free Will as a Unique and Important Construct. *Social and Personality Psychology Compass, 11*(1), 1–15. DOI: https://doi.org/10.1111/spc3.12293

Franks, A. S., & **Scherr, K. C.** (2018). Economic Issues Are Moral Issues. *Social Psychological and Personality Science,* 1–10. DOI: https://doi.org/10.1177/1948550618772821

Funder, D. C., & **Ozer, D. J.** (2019). Evaluating Effect Size in Psychological Research: Sense and Nonsense. *Advances in Methods and Practices in Psychological Science, 2*(2), 156–168. DOI: https://doi.org/10.1177/2515245919847202

Genschow, O., Rigoni, D., & **Brass, M.** (2017). Belief in Free Will Affects Causal Attributions When Judging Others' Behavior. *Proceedings of the National Academy of Sciences, 114*(38), 201701916. DOI: https://doi.org/10.1073/pnas.1701916114

Horberg, E. J., Kraus, M. W., & **Keltner, D.** (2013). Pride Displays Communicate Self-Interest and Support for Meritocracy. *Journal of Personality and Social Psychology, 105*(1), 24–37. DOI: https://doi.org/10.1037/a0032849

Hsee, C. K. (1998). Less is Better: When Low-value Options are Valued More Highly than High-value Options. *Journal of Behavioral Decision Making, 11*(2), 107–121. DOI: https://doi.org/10.1002/(SICI)1099-0771(199806)11:2<107::AID-BDM292>3.3.CO;2-P

Ioannidis, J. P. A. (2005). Why Most Published Research Findings are False. *PLoS Medicine, 2*(8), 0696–0701. DOI: https://doi.org/10.1371/journal.pmed.0020124

Ioannidis, J. P. A. (2008). Why most Discovered True Associations are Inflated. *Epidemiology, 19*(5), 640–648. DOI: https://doi.org/10.1097/EDE.0b013e31818131e7

JASP Team. (2019). *JASP (Version 0.10.2).*

Kenny, D. A., & **Judd, C. M.** (2014). Power Anomalies in Testing Mediation. *Psychological Science*, *25*(2), 334–339. DOI: https://doi.org/10.1177/0956797613502676

Kluegel, J. R., & **Smith, E. R.** (1986). *Beliefs about inequality: Americans' views of what is and what ought to be.* New York: Routledge.

Kraus, M. W., Piff, P. K., & **Keltner, D.** (2009). Social class, sense of control, and social explanation. *Journal of Personality and Social Psychology*, *97*(6), 992–1004. DOI: https://doi.org/10.1037/a0016357

Lakens, D. (2013). Calculating and Reporting Effect Sizes to Facilitate Cumulative Science: A Practical Primer for t -tests and ANOVAs. *Frontiers in Psychology*, *4*, 1–12. DOI: https://doi.org/10.3389/fpsyg.2013.00863

Lee, M. D., & **Wagenmakers, E. J.** (2013). *Bayesian Data Analysis for Cognitive Science: A Practical Course.* Cambridge University Press.

Libet, B. (1985). Unconscious Cerebral Initiative and the Role of Conscious Will in Voluntary Action. *Behavioral and Brain Sciences*, *8*, 529–566. DOI: https://doi.org/10.1017/S0140525X00044903

Litman, L., Robinson, J., & **Abberbock, T.** (2017). TurkPrime.com: A versatile crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods*, *49*(2), 433–442. DOI: https://doi.org/10.3758/s13428-016-0727-z

Martin, N. D., Rigoni, D., & **Vohs, K. D.** (2017). Free Will Beliefs Predict Attitudes Toward Unethical Behavior and Criminal Punishment. *Proceedings of the National Academy of Sciences*, *114*(28), 7325–7330. DOI: https://doi.org/10.1073/pnas.1702119114

Meyvis, T., & **Van Osselaer, S. M. J.** (2018). Increasing the Power of your Study by Increasing the Effect Size. *Journal of Consumer Research*, *44*(5), 1157–1173. DOI: https://doi.org/10.1093/jcr/ucx110

Monroe, A. E., Brady, G. L., & **Malle, B. F.** (2016). This Isn't the Free Will Worth Looking For: General Free Will Beliefs Do Not Influence Moral Judgments, Agent-Specific Choice Ascriptions Do. *Social Psychological and Personality Science*, *8*(2), 191–199. DOI: https://doi.org/10.1177/1948550616667616

Monroe, A. E., & **Malle, B. F.** (2010). From Uncaused Will to Conscious Choice: The Need to Study, Not Speculate About People's Folk Concept of Free Will. *Review of Philosophy and Psychology*, *1*(2), 211–224. DOI: https://doi.org/10.1007/s13164-009-0010-7

Nadelhoffer, T., Shepard, J., Crone, D., Everett, J. A. C., Earp, B. D., & **Levy, N.** (2019). Does Encouraging a Belief in Determinism Increase Cheating? Reconsidering the Value of Believing in Free Will. *OSF Preprints.* DOI: https://doi.org/10.31219/osf.io/bhpe5

Nadelhoffer, T., Shepard, J., Nahmias, E., Sripada, C., & **Ross, L. T.** (2014). The Free Will Inventory: Measuring Beliefs about Agency and Responsibility. *Consciousness and Cognition*, *25*, 27–41. DOI: https://doi.org/10.1016/j.concog.2014.01.006

Nichols, S., & **Knobe, J.** (2007). Moral Responsibility and Determinism: The Cognitive Science of Folk Intuitions. *Nous*, *41*(4), 663–685. DOI: https://doi.org/10.1111/j.1468-0068.2007.00666.x

OECD. (2019). *Poverty rate (indicator).* Retrieved from https://data.oecd.org/inequality/poverty-rate.htm

Open Science Collaboration. (2015). Estimating the Reproducibility of Psychological Science. *Science*, *349*(6251), aac4716–aac4716. DOI: https://doi.org/10.1016/j.jpubeco.2004.05.009

Piff, P. K., Wiwad, D., Robinson, A. R., Aknin, L. B., Mercier, B., & **Shariff, A. F.** (2020). Shifting Attributions for Poverty Motivates Opposition to Inequality and Enhances Egalitarianism. *Nature Human Behaviour.* Advance online publication. DOI: https://doi.org/10.1038/s41562-020-0835-8

R Core Team. (2017). *R: A language and environment for statistical computing.* Vienna, Austria.: R Foundation for Statistical Computing.

Rustichini, A., & **Vostroknutov, A.** (2014). Merit and Justice: An Experimental Analysis of Attitude to Inequality. *PLoS ONE*, *9*(12), 1–19. DOI: https://doi.org/10.1371/journal.pone.0114512

Ruxton, G. D. (2006). The Unequal Variance t-test is an Underused Alternative to Student's t-test and the Mann–Whitney U test. *Behavioral Ecology*, *17*(4), 688–690. DOI: https://doi.org/10.1093/beheco/ark016

Sadava, S. W., Agnus, L., & **Forsyth, R.** (1980). Perceived Mental Illness and Diminished Capacity for Responsibility: A Study of Attributions. *Social Behavior and Personality*, *8*(2), 129–136. DOI: https://doi.org/10.2224/sbp.1980.8.2.129

Sarkissian, H., Chatterjee, A., De brigard, F., Knobe, J., Nichols, S., & **Sirker, S.** (2010). Is Belief in Free Will a Cultural Universal? *Mind and Language*, *25*(3), 346–358. DOI: https://doi.org/10.1111/j.1468-0017.2010.01393.x

Savani, K., & **Rattan, A.** (2012). A Choice Mind-Set Increases the Acceptance and Maintenance of Wealth Inequality. *Psychological Science*, *23*(7), 796–804. DOI: https://doi.org/10.1177/0956797611434540

Sears, D. O., & **Funk, C. L.** (1991). The Role of Self-Interest in Social and Political Attitudes. *Advances in Experimental Social Psychology*, *24*, 1–91. DOI: https://doi.org/10.1016/S0065-2601(08)60327-5

Shariff, A. F., Greene, J. D., Karremans, J. C., Luguri, J. B., Clark, C. J., Schooler, J. W., … Vohs, K. D. (2014). Free Will and Punishment: A Mechanistic View of Human Nature Reduces Retribution. *Psychological Science*, *25*(8), 1563–1570. DOI: https://doi.org/10.1177/0956797614534693

Shariff, A. F., Wiwad, D., & **Aknin, L. B**. (2016). Income Mobility Breeds Tolerance for Income Inequality: Cross-National and Experimental Evidence. *Perspectives on Psychological Science*, *11*(3), 373–380. DOI: https://doi.org/10.1177/1745691616635596

Stillman, T. F., Baumeister, R. F., & **Mele, A. R.** (2011). Free Will in Everyday Life: Autobiographical Accounts of Free and Unfree Actions. *Philosophical Psychology*, *24*(3), 381–394. DOI: https://doi.org/10.1080/09515089.2011.556607

Vohs, K. D., & Schooler, J. W. (2008). The Value of Believing in Free Will: Encouraging a Belief in Determinism Increases Cheating. *Psychological Science*, *19*(1), 49–54. DOI: https://doi.org/10.1111/j.1467-9280.2008.02045.x

Vonasch, A. J., Clark, C. J., Lau, S., Vohs, K. D., & Baumeister, R. F. (2017). Ordinary People Associate Addiction with Loss of Free Will. *Addictive Behaviors*

Reports, *5*, 56–66. DOI: https://doi.org/10.1016/j.abrep.2017.01.002

Wiwad, D., Mercier, B., Maraun, M. D., Robinson, A. R., Piff, P. K., Aknin, L. B., & Shariff, A. F. (2019). The Support for Economic Inequality Scale: Development and Adjudication. *PLoS One*, *14*(6), 1–29. DOI: https://doi.org/10.1371/journal.pone.0218685