Does Improved Upward Social Mobility Foster Frustration and Conflict?

A Large-Scale Online Experiment Testing Boudon's Model

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Abstract:

The rise of populism has reignited scholarly interest in the paradox of societal advancement leading to frustration and social tension. Globalization and digitalization have increased social opportunities for parts of the population, but a substantial portion of society feels disadvantaged, resulting in discontent. This study, rooted in Boudon's model of relative deprivation, examines the mechanisms that fuel this frustration. We conducted an online experiment involving 2,114 US-based MTurk participants, in which we manipulated the availability of status positions to create varying degrees of upward social mobility. We also varied group sizes to ensure robustness. We assessed relative deprivation with structural, subjective, and behavioral measures. For example, frustration was measured using the "joy-of-destruction game," in which subjects had to make the costly decision to destroy part of another player's winnings. Contrary to the model's prediction, we found that the proportion of individuals who were worse off, the losers, decreased consistently as mobility increased. This outcome can be attributed to overentry in conditions of low mobility and underentry in conditions of intermediate or high mobility. The losers displayed increased frustration and hostility towards noncompetitors and winners. Intriguingly, winners also exhibited heightened hostility. However, at the aggregate level, hostile behavior did not surge as conditions improved. In our exploratory analyses at the individual level, we identified several distinct patterns. Risk-tolerant individuals and women were more likely to enter competition. Conversely, those with advanced education levels showed a decreased inclination to competitiveness. Risk-tolerant individuals reported greater feelings of frustration and displayed increased hostility. This effect was also observed particularly among politically right-leaning individuals.

Keywords: antisocial behavior, conflict, competition, frustration, relative deprivation, social inequality, social mobility, social status

Introduction

Alexis de Tocqueville’s assertion, derived from the French Revolution, that societal progress can incite frustration and conflict has been a topic of enduring interest (Goldhammer and Elster, 2011). Comprehensive analysis of historic data suggests that an increase in educational opportunities and a consequent oversupply on the labor market can promote social conflict (Turchin, 2012; Turchin and Korotayev, 2020). A related phenomenon was observed in a study on social mobility in the US Army (Stouffer et al., 1950). Promotion opportunities were evaluated worst in those branches that offered the highest objective chances for promotion: a cross-sectional equivalent to the effect of improving conditions coinciding with growing frustration over time.

Whereas the accuracy of de Tocqueville's historical narrative is not the focus of this discussion, the proposition that social advancement can foster frustration has become a cornerstone concept of broad interest within the social sciences. The recent rise in right-wing populism has been examined from this perspective (Goodwin, 2014; Inglehart and Norris, 2017; Rydgren, 2012; Smith, 1995). Globalization and digitalization, while driving economic growth and creating job opportunities, are also believed to have exacerbated social inequality. Since the 1970s, labor market polarization has increased, with job opportunities rising at the top of the income distribution but stagnating and even decreasing in the middle (Agénor and Aizenman, 1997; Alderson and Nielsen, 2002; Autor et al., 2006; Frey and Osborne, 2017; Oesch, 2015; Van Reenen, 2011). This dichotomy of progress for some and stagnation if not decline for others may foster frustration among those “left behind” (Goodwin, 2014; Smith, 1995; Steiner et al., 2023; Swank, 2003). Populist movements leverage the frustration of the left behind to gain power (Cutts et al., 2019; Ford and Goodwin, 2014; Gidron and Hall, 2017; Goodwin, 2014; Meuleman et al., 2020; Rico et al., 2017; Rodrik, 2018; Rydgren, 2012; Smith, 1995).

The frustration of those left behind is elucidated by relative deprivation (Meuleman et al., 2020; Tutić and von Hermanni, 2018). Relative deprivation pertains to an individual’s sense of disadvantage in comparison to others, a perception often accompanied by feelings of resentment and entitlement (Smith et al., 2012). Such perceptions can erode social trust (Dunn et al., 2012; Freeman et al., 2014) and may incite antisocial behavior or a desire for retaliation against those viewed as oppressors (Gurr, 2015; Marx, 2020; Skarlicki and Folger, 1997).

However, the established theory of relative deprivation concentrates primarily on individuals. Explaining the phenomenon of escalating frustration amidst improving conditions requires a theory that can reconcile social structure with the widespread occurrence of frustration. One such theory is Boudon's game-theoretical model (Boudon, 1977). This model links the prevalence of relative deprivation to the opportunities for upward mobility within a social system such as a society or an organization. In essence, the model predicts, under certain assumptions, an inverted U-shaped trajectory of relative deprivation and consequent frustration over time as mobility improves.

Despite its potential significance to social sciences, research applying Boudon's model remains sparse. Initial research has mathematically demonstrated that the primary implications of the model remain stable when the underlying micro-assumptions are varied (Kosaka 1986; Raub 1984). Recent research has extended the model through agent-based modeling, suggesting that local network social comparisons (Manzo, 2011) and low entry costs into status competition (Otten, 2020) both amplify the effect of improving mobility on relative deprivation.

Berger and Diekmann (2015) conducted the initial experimental assessment of the model and observed either static or reduced frustration as opportunities enhanced. This finding is at odds with the model's prediction of an inverted U-shaped trajectory of relative deprivation and the intuitive expectation of its decline with rising upward mobility. Inequity aversion, which may reduce competitiveness in Boudon's model, offers a partial explanation for this inconsistency (Otten, 2022).

Previous experimental studies primarily used student samples and were conducted in small groups of six. Additionally, relative deprivation and the accompanying frustration were gauged from participant self-reports or were simply assumed to be present in the losers of competition without incorporating behavioral measures for validation (Berger and Diekmann, 2015; Otten, 2022).

To address these limitations, we conducted an online experiment on Amazon Mechanical Turk (MTurk) to test the model's prediction of a U-shaped path of relative deprivation under improving mobility with a large, diverse sample of US citizens (N = 2,114). Participants competed for status positions within groups that offered varying numbers of such positions, resulting in three distinct mobility levels: low, intermediate, and high. We also varied group size for robustness. Following the competition, we employed three metrics: a structural measure assessing the relative frequency of losers within a group (termed "prevalence of relative deprivation"), a subjective measure of relative deprivation gauged using a Likert-type scale (referred to as "subjective frustration"), and a behavioral measure derived from the joy-of-destruction game (named "behavioral hostility"). In this game, participants have the opportunity to decrease the earnings of other group members, albeit at a personal expense (Abbink and Sadrieh, 2009). This measure is relevant because variation in antisocial behavior within the game has been correlated with the intensity of competition for limited resources in everyday life (Prediger et al., 2014).

Section 2 of this paper outlines the model and our hypotheses. Section 3 details the experiment. Section 4 presents the results, and Section 5 concludes with a discussion.

The Model

The model starts with a group of N players who simultaneously decide whether to compete for one of k prizes or status positions.[1] These positions are limited. There are more players than positions ($N > k$). Entering the competition requires an investment fee (C), akin to obtaining an academic degree as a prerequisite for applying for a well-paid position in the labor market. The competition game assigns each player a status position: high, low, or intermediate. Successful competitors, the winners, secure the desired position and receive a high payoff, calculated as the value of the prize minus the investment fee ($B - C = \alpha$). These winners hold a higher social status than their group members. Those who are outcompeted, the losers, have paid their investment fee but receive nothing in return, resulting in a low payoff (γ) and corresponding status position. Lastly, those who opt out of competition, the noncompetitors, receive an intermediate payoff (β) and hold an intermediate status (Figure 1).

Boudon's model crucially assumes that only the losers experience relative deprivation (Boudon, 1977). This is because the losers, having invested the same fee as the winners, consider the winners as their reference group. However, unlike the winners, they receive nothing in return for their investment, leading to a state of relative deprivation. An example would be university graduates who fail to secure suitable employment, an outcome that has been linked to relative deprivation and subsequent frustration (Peiró et al., 2010; Turchin, 2010). In contrast, the noncompetitors, who have not paid an investment fee, do not consider the winners as their reference group, and therefore do not experience relative deprivation.

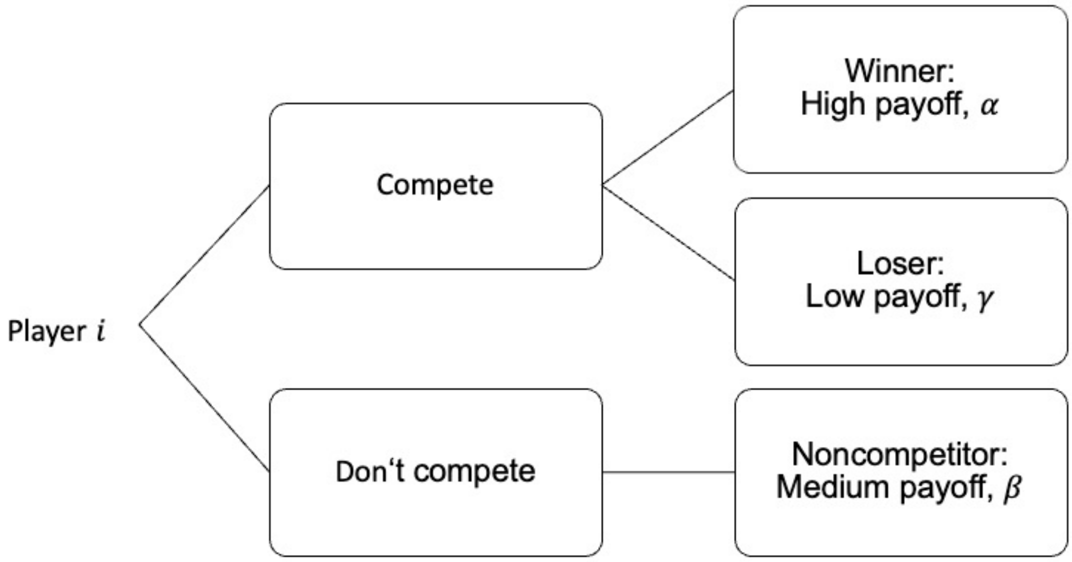

Figure 1. Individual decision situation. Each player has the option to compete or abstain from competition. Successful competitors, or winners, receive a high payoff (α). Unsuccessful competitors, or losers, receive a low payoff (γ). Players who choose not to compete, or noncompetitors, receive a medium payoff (β). The likelihood of success for those entering competition is contingent on the number of positions available and the total number of competitors. This figure is a modification of the original presented in Berger and Diekmann's (2015) study.

The model's central implication is that in specific conditions, an increase in relative deprivation prevalence with improving social mobility emerges as the unintended consequence of individuals' strategic decisions. Increasing mobility, represented in the model by a growing number of positions (k), increases the expected benefit of entering competition. Consequently, additional positions tempt additional players to compete. When the number of additional competitors grows faster than the number of additional positions, the number of relatively deprived losers increases. Thus, increasing mobility boosts the relative deprivation prevalence.

The following discussion details how the effect of increasing relative deprivation with increasing social mobility derives from the model. The starting point is the following question: When should rational actors enter the competition, and when should they stay out? Intuitively, when the number of competitors matches or undershoots the number of positions, it is best to compete. Unfortunately, before the decisions are made, none of the N players knows how many of the others will enter the competition. However, given the high payoff (α), the low payoff (γ), and the number of positions (k), a rational actor can derive the expected utility of competing for a given number of competitors (n) with equation (1). The payoff of the other strategy, not competing, is β, no matter how many actors enter competition. With this information, a payoff matrix can be constructed from the perspective of a focal player (i) for a given number of positions (k) (Figure 2).

$$E(k,n) = \begin{cases} \frac{k}{n}\alpha + \frac{n-k}{n}\gamma & \text{for } k < n \\ \alpha & \text{for } k \geq n. \end{cases} \tag{1}$$

From a game-theoretical perspective, the competition game outlined here can give rise to two distinct strategic situations. If the expectation of competing exceeds β, even if every actor enters competition, competing becomes the dominant strategy. A rational actor will always compete in this case, which implies that every single group member enters the competition. Consequently, the entire group ends relatively deprived except those obtaining positions. That is, the relative deprivation prevalence simply amounts to $1 - k/N$.

		Number of other competitors (n – 1)				
		0	1	2	…	$N-1$
Player i	Compete	$E(k,0)$	$E(k,1)$	$E(k,2)$	…	$E(k,N-1)$
	Don't compete	β	β	β	…	β

Figure 2. Payoff matrix from the perspective of focal player i. The expectation of competing depends on the total number of competitors and is given by equation (1). The payoff of not competing is β, no matter how many group members enter competition. This figure is a modification of the original presented in Berger and Diekmann's (2015) study.

When no dominant strategy exists, things become more complicated. This is the case when the expectation of competing exceeds β, up to a certain threshold of competitors, n^*, and undershoots β thereafter. In principle, it would then be best to reach an agreement about which n^* members of a group should compete and which $N - n^*$ should not. However, assuming homogeneous players and the absence of communication or other means of coordination, such a solution, called an asymmetric Nash equilibrium in pure strategies, cannot be realized. Another possibility is a mixed strategy solution, which according to Harsanyi and Selten's (1988) axioms is the rational choice in a symmetrical game. That is, each player chooses to compete with an optimal probability, p^*, and stays out of competition with probability $1 - p^*$,). To derive p^*, the overall expected utility of competing for a given number of positions, k, and all possible permutations of competitors, is equated with the payoff of not competing, β. Solving for p in equation (2) yields the optimal probability, p^*.

$$E(Compete) = \sum_{n=1}^{N} \binom{N-1}{n-1} p^{n-1} (1\text{-}p)^{N-n} E(k,n) = \beta \qquad (2)$$

This probability also equals the expected proportion of individuals entering competition. That means that the relative deprivation prevalence amounts to $p^* - \frac{k}{N}$.

Figure 3 summarizes the model predictions for groups of 20 and the payoffs $\alpha = 2, \beta = 1$, and $\gamma = 0.55$. With one position available, 15% of the group (or three individuals) are expected to enter competition, resulting in a relative deprivation prevalence of 10% (two losers). As the number of status positions grows, the number of competitors grows even faster. For this reason, relative deprivation increases with the number of positions up to a certain point. As soon as competing becomes a dominant strategy ($k = 7$), and everyone enters competition, additional positions can only diminish relative deprivation. From that point onward, relative deprivation decreases monotonically, approximating zero when virtually everyone gains a status position. From these predictions, we derive our main hypothesis: The association between the relative deprivation prevalence and mobility take the form of an inverted U: the inverted U hypothesis.

It is worth noting that the association between mobility and relative deprivation does not necessarily take this form but depends strongly on the exact model parameters. Conditions that favor increasing deprivation with increasing number of positions include a low entry fee into the competition and a large differential between the winners' and losers' payoffs. For a systematic analysis of those conditions, see Raub (1984). We provide the Matlab code used to derive our predictions in part 1 of the online supplementary materials (OSM).

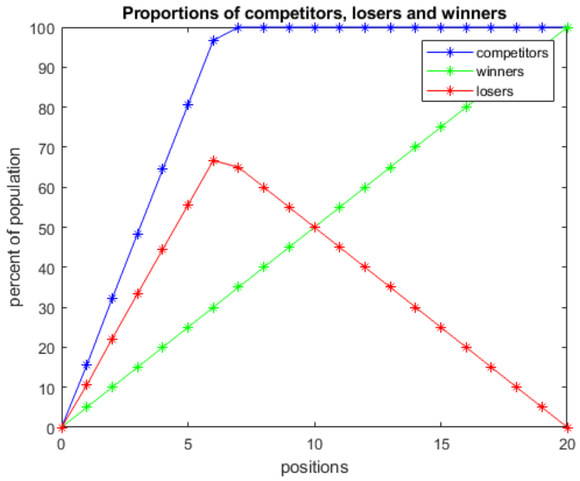

Figure 3. Point predictions for groups of 20, and the payoffs $\alpha = 2$, $\beta = 1$, $\gamma = 0.55$. Predicted share of competitors, winners, and losers per group, depending on the number of positions k.

Methods

Experimental Treatments and Design

We conducted an online experiment using MTurk, a platform previously used for social science research (Arechar et al., 2018). Online lab-style experiments offer advantages over conventional physical labs by allowing larger, more diverse samples and potentially reducing social desirability bias due to the lack of in-person experimenter presence (Belot et al., 2015; Krupnikov and Levine, 2014). The study took place in the summer of 2020.

Our experiment incorporated two treatment dimensions: mobility and group size. Depending on the mobility treatment condition, the competition offered either a low, intermediate, or high number of positions (Table 1). Group size was either small groups of 6 participants or large groups of 20.

By varying mobility – the number of available status positions per group – we aim to examine if relative deprivation assumes an inverted U-shape with increasing mobility, as predicted. The second treatment dimension, group size, allows a robustness check of the results, because the model predicts the same qualitative pattern independently of group size. Groups of six have been used in previous experiments (e.g., Berger and Diekmann, 2015). Larger groups of twenty offer a broader scope for treatment effects to arise. The number of positions available per treatment was chosen strategically to optimize the likelihood of detecting an increase in losers when mobility improves. We began by selecting both the minimum (k = 1) and a near-maximum number of status positions (k = 5 for groups of six, k = 15 for groups of 20). For the intermediate mobility treatment, we identified the number of positions at which the model predicts the highest number of losers. This number signifies a critical juncture at which the allure of competition becomes so pronounced that it becomes the dominant strategy, prompting the entire group to enter competition. Table 1 summarizes the design, including the predicted shares of competitors and losers per treatment.

Table 1. Experimental treatments including model predictions (percent, set in italics)

	Small groups (6 individuals)			**Large groups** (20 individuals)		
	Positions	*Competitors*	*Losers*	Positions	*Competitors*	*Losers*
Low mobility	1	*53.1*	*36.5*	1	*15.6*	*10.6*
Intermediate mobility	2	*100*	*66.7*	7	*100*	*65.0*
High mobility	5	*100*	*16.7*	15	*100*	*25.0*

Notes: High payoff: USD 2, medium payoff: USD 1, low payoff: USD 0.55.

Experimental Procedure

The experiment consisted of two parts (Table 2). The first part involved a single round of the competition game. In the second part, participants received feedback about their status after the competition and the relative shares of winners, losers, and noncompetitors in their groups. This feedback was immediately followed by the measures of relative deprivation.

In the first part of the experiment, each participant was randomly assigned to a group of either 6 or 20 members, and each group was randomly assigned to either the low, intermediate, or high mobility treatment. Participants then completed a sociodemographic background questionnaire. They were informed about the size of their group and the number of positions available in their group. They learned that the competition would result in three types of players, each with a different payoff: winners received a high payoff of USD 2, losers a low payoff of USD 0.55, and noncompetitors a medium payoff of USD 1. The payoffs were expressed in money points (MP) during the experiment, with USD 1 corresponding to 100 MP. Furthermore, participants were awarded USD 0.50 for both the first and second parts.

After reading the instructions, they underwent a comprehension check. On average, participants answered 86% of the questions accurately, and any incorrect responses were rectified. For a detailed overview of the test, refer to the instructions in OSM2.

Subsequently, participants chose whether to participate in the competition.

Table 2. Experimental procedure

First part	1.	Questionnaire on sociodemographic background
	2.	Competition game (prevalence of relative deprivation)
Second part	1.	Joy-of-destruction game (behavioral hostility)
	2.	Subjective frustration (satisfaction, frustration, fairness)

The second part of the experiment began once every member of a group had made their decisions. The competitors were informed about their status as a winner or loser, and all the participants learned about the number of winners, losers, and noncompetitors in their group. Subsequently, we measured subjective and behavioral proxies of relative deprivation. We measured behavioral hostility using the joy-of-destruction game (Abbink and Sadrieh, 2009). In this game, each participant decided whether or not to reduce the payoff of a randomly chosen participant in their group. Participants indicated the amount of money (up to 10 MP) they would be willing to pay depending on whether the randomly selected person was a winner, loser, or noncompetitor. The selected person's payoff would then be reduced by five times the amount indicated. This method produces an incentive-compatible metric for antisocial behavior, contingent on the potential target's status (winner, loser, or noncompetitor). We also assessed subjective indicators of relative deprivation on a Likert-type scale from 0 to 10. These indicators included frustration with the competition, satisfaction with the competition outcome, and perceived fairness of the competition.

In finalizing our design, we opted for a survey format over a real-time interaction format. This decision was informed by the known susceptibility of real-time online experiments to substantial dropout rates, which can reach up to 18% (Arechar et al., 2018). To mitigate this susceptibility, we allowed participants to read instructions, make decisions, and complete questionnaires at their own pace. The participants were then disconnected immediately after completion. Once all members of a group had completed the first part, a random mechanism selected one or more winners, depending on the specific treatment. Subsequently, all group members were invited to part two by email, typically after 20 minutes.

Despite these measures, we experienced significant dropouts. The primary reason was a longer than anticipated time lag between the two parts of the experiment. In most groups, participants received an invitation to part two approximately 20 minutes after the conclusion of part one. However, in some groups, particularly those in the high-mobility treatment with a large number of winners, the waiting time was considerably longer. This led to a pronounced dropout rate in the high-mobility treatment conditions. We address the limitations arising from this dropout in the discussion section. Table SVIII in OSM3 details the dropouts for each treatment condition.

Sample

Our net sample comprised 2,114 US-American MTurk workers, 48.01% female and 51.99% male, with an average age of 39.49 years. Descriptive statistics are presented in OSM3 Table SVI. Table 3 lists the number of groups and individuals (in parentheses) completed per treatment.

Table 3. Numbers of groups per treatment

	Low mobility	Intermediate mobility	High mobility	Total
Groups of 6 (individuals)	30 (180)	29 (174)	20 (120)	79 (474)
Groups of 20 (individuals)	30 (600)	30 (600)	22 (440)	82 (1640)
Total	60 (780)	59 (774)	42 (560)	161 (2,114)

Note: Numbers refer to groups (individuals in parentheses).

Measures

After the competition, we used three measures. First, we determined the percentage of losers in each group as a structural metric (called "prevalence of relative deprivation"). Next, we gauged participants' behavioral hostility towards winners, losers, and noncompetitors through the joy-of-destruction game (called "behavioral hostility"). Lastly, we evaluated "subjective frustration" by averaging scores from three scales: satisfaction with the competition outcome (reversed), frustration with the competition, and perceived fairness of the competition. Each scale ranged from 0 (not at all) to 10 (completely). We then constructed a subjective frustration index by averaging the scores from these three scales (Cronbach's α = 0.68; refer to OSM III Table SIV for additional details).

Results

We observed significant pairwise correlations at the individual level between the three dependent measures (loser = 1, 0 otherwise, subjective frustration, and behavioral hostility) for groups of 6 and 20 participants. These correlations were statistically significant at least at the 5% level, as shown in Table 4. The relationships between loser status and feelings of frustration were moderate to strong, with point-biserial correlations just under 0.6. The correlations between loser status and behavioral hostility and between frustration and hostility were notably smaller, with values ranging between 0.1 and 0.2.

Table 4. Pairwise correlations between the dependent measures.

	Groups of six			Groups of twenty		
	Loser	Subjective frustration	Behavioral hostility	Loser	Subjective frustration	Behavioral hostility
Loser		0.59***	0.21***		0.58***	0.16***
Subjective frustration			0.10*			0.20***

Prevalence of relative deprivation

To examine the inverted-U hypothesis, we analyzed the entry into competition and the resulting prevalence of relative deprivation, represented by the share of losers per group. We employed logit models with Competing or Loser as dependent variables and three treatment dummies as predictors: intermediate mobility and high mobility, with low mobility as the reference category. We also constructed extended models with additional predictors: female (with male as reference category), age, and risk preference on a scale from 0 for risk averse, to 10 for risk seeking (Dohmen et al., 2011). All models were computed with robust standard errors and were clustered at the group level. We report only the average marginal effects (AMEs) from the restricted model here because the results from the extended model, reported in the Supplementary Online Materials (OSM3-Table SI), were closely comparable.[2]

Figure 4 summarizes the results. The general pattern that higher numbers of winning places led to higher numbers of participants entering the competition holds for both small groups (panel a of Figure 4) and large groups (panel b of Figure 4). Using the low-mobility treatment condition as a reference, we find that for small groups with intermediate mobility, AME = 0.098, $z = 1.96$, $p < 0.05$; and with high mobility, AME = .172, $z = 3.50$, $p < 0.001$. For large groups with intermediate mobility, AME = .148, $z = 5.32$, $p < 0.001$; and with high mobility, AME = 0.266, $z = 9.13$, $p < 0.001$. The entry rates observed are indicated in the note to Figure 4.

Interestingly, we notice significant overentry in conditions of low mobility and underentry in conditions of intermediate or high mobility compared to rationality predictions. Under low mobility, 66.1% and 58.2% of participants enter competition, thus exceeding the predicted rates of 53.1% and 15.6%, respectively. Conversely, under intermediate mobility, the competition entry rates are 75.9% and 73.0%, falling short of the predicted 100% for each group. [1] However, note that overentry is excluded by definition from the dominant strategy case.

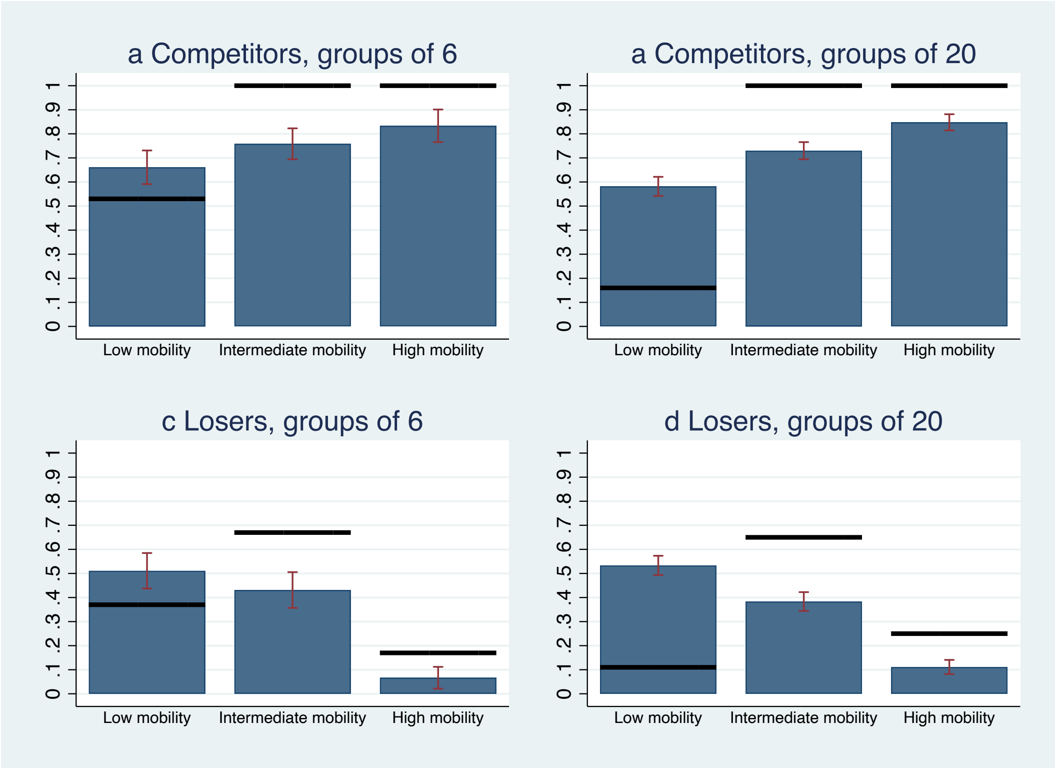

Figure 4. Shares of competitors and losers as a function of upward social mobility. Red lines represent 95% confidence intervals, and black horizontal lines indicate predictions. **a** Shares of competitors per group in groups of 6. Low mobility, 0.66 (predicted, 0.53); intermediate mobility, 0.76 (predicted, 1.0); high mobility, 0.83 (predicted, 1.0). **b** Shares of competitors per group in groups of 20. Low mobility, 0.58 (predicted, 0.16); intermediate mobility, 0.73 (predicted, 1.0); high mobility, 84.7 (predicted, 1.0). **c** Shares of losers per group in groups of 6. Low mobility, 0.51 (predicted, 0.37); Intermediate mobility, 0.43 (predicted, 0.67); high mobility, 0.07 (predicted, 0.17). **d** Shares of losers per group in groups of 20. Low mobility, 0.53 (predicted 0.11); intermediate mobility, 0.38 (predicted, 0.65); high mobility, 0.11 (predicted, 0.25). The sample sizes are n = 474 for groups of 6 and n = 1640 for groups of 20.

Due to the discrepancy between predicted and actual competitiveness, the shares of losers in the groups do not peak as expected in the intermediate-mobility treatment. Instead, the shares of losers in both small and large groups consistently decrease as mobility increases (Figure 4b and c). For small groups with intermediate mobility, AME = -0.15, z = -5.30., p < 0.001; and with high mobility, AME = -.444, z = -11.64, p < 0.001. For large groups with intermediate mobility, AME = -.167, z = -6.33, p < 0.001; and with high mobility, AME = –.422, z = -15.36, p < 0.001 (SOM3-Table III).

In summary, we observed an overentry in competition within the low-mobility treatment, juxtaposed with an underentry in the intermediate-mobility treatment. Consequently, the shares of losers exceed predictions in the low-mobility treatments and fall short in the intermediate-mobility treatments. Therefore, contrary to the model's prediction of an inverted U-shaped trend in relative deprivation prevalence, we found that the percentage of losers consistently decreases with increasing mobility.

Our findings are qualitatively consistent in both small and large groups, though the effects of the treatment are larger in the larger groups. This is likely attributable to two factors: the lower sample size in the small-group treatments, which reduces statistical power, and the fact that larger groups enable a wider range of treatment variation. For example, the difference in the number of positions offered in the low-mobility treatment versus the intermediate-mobility treatment is only one position in small groups, but it increases to six positions in large groups.

Subjective frustration

We constructed ordinary least squares (OLS) regression models with subjective frustration as the dependent variable to achieve two primary objectives. Firstly, we sought to examine a fundamental micro assumption that individuals who lose in a competition experience a higher degree of frustration than those who do not compete or those who win. Secondly, we sought to scrutinize the inverted-U hypothesis through a subjective proxy of relative deprivation.

The data strongly support the micro assumption. On a scale from 0 to 10, losers report roughly 2.7 points higher average frustration than noncompetitors and roughly 3 points higher frustration than winners. These effects are statistically significant with $p < 0.001$ (Table 5, Models 1 and 3). Contrarily, the inverted-U hypothesis does not receive any support from our findings. We observed no significant differences in frustration levels between the low- and intermediate-mobility treatments in either small or large groups. However, frustration levels were approximately 1.2 to 1.3 points lower in high-mobility treatments than in low-mobility treatments ($p < 0.001$ for groups of both sizes). In essence, frustration remains stable as mobility increases but decreases when mobility reaches its peak (refer to Table 5, Models 2 and 4).

In conclusion, our results do not endorse the inverted-U hypothesis. However, they do affirm the micro assumption that losers experience greater frustration than winners and noncompetitors.

Table 5. Subjective frustration

	Model 1	Model 2	Model 3	Model 4
Loser	2.709***		2.693***	
	(11.16)		(20.70)	
Winner	-0.322		-0.305**	
	(-1.37)		(-2.65)	
Intermediate mobility		0.161		-0.257
		(0.65)		(-1.76)
High mobility		-1.206***		-1.269***
		(-4.73)		(-9.46)
Constant	2.382***	3.509***	2.453***	3.767***
	(13.12)	(19.10)	(26.80)	(31.92)
N	474	474	1640	1640

Note: OLS regression models with subjective frustration (index) as dependent variable. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. t-values in parentheses. Standard errors clustered at the group level. Models 1 and 2 refer to groups of 6; Models 3 and 4 refer to groups of 20. Reference categories: non-competitor, low-mobility condition.

Behavioral hostility

In our analysis of behavioral hostility within the joy-of-destruction game, we observed a distinct pattern. Approximately 40.7% of participants were willing to pay to reduce the payoff of a randomly selected group member. This figure aligns closely with the 39.4% reported in a previous study by Abbink and Sadrieh (2009).

When we break down this behavior by participant type, noncompetitors fall below this baseline at 22.2% whereas losers exceed it at 51.8%. Interestingly, winners align closely with the overall average at 40.1%. Losers spend three times as much (*M* = 2.215) as noncompetitors (*M* = 0.753), and winners spend approximately twice as much (*M* = 1.74).

However, the status of the individual on the receiving end of the hostility, the "target," appears to have minimal impact. For instance, losers invested 2.13, 2.04, and 2.48 to reduce the payoffs of noncompetitors, losers, and winners, respectively.

Consequently, our discussion will primarily focus on general interpersonal hostility, defined as the average individual spending for reduction (Cronbach's $\alpha = .90$; refer to OSMIII Table SV for additional information). This approach allows us to concentrate on the behavior of the instigator, which our data suggest plays a more significant role than the status of the target (refer to Table 6).

Table 6. Hostility depending on the status of a focal individual and a target individual

	Instigator's status		
Target's status	Loser	Winner	Noncompetitor
Loser	2.04	1.65	0.72
Winner	2.48	1.89	0.91
Non-competitor	2.13	1.69	0.63

Note: The table represents the points invested by the focal participant to reduce the payoff of the target, contingent on the instigator's and the target's status. The conversion rate is 100 money points, equivalent to USD 1.

We analyzed behavioral hostility using OLS regression models (Table 7). Initially, we only tested for status effects in Models 1 and 4 for small and large groups, respectively. Next, we tested for treatment effects in Models 2 and 5. Finally, we incorporated the participants' beliefs about the hostile behavior of other group members, which has been identified as a strong predictor of reducing others' payoffs in previous research (Prediger et al., 2014).

Table 7 Behavioral hostility

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Loser	1.761***		0.579**	1.384***		0.621***
	(6.56)		(3.06)	(8.82)		(6.19)
Winner	1.093***		0.0932	0.970***		0.282**
	(4.86)		(0.53)	(5.53)		(2.78)
Intermediate mobility		0.115			0.0956	
		(0.34)			(0.45)	
High mobility		-0.157			0.117	
		(-0.49)			(0.47)	
Beliefs about losers			0.0747*			0.136***
			(2.01)			(6.38)
Beliefs about noncompetitors			0.389***			0.348***
			(8.48)			(11.39)
Beliefs about winners			0.392***			0.343***
			(10.64)			(14.59)
Constant	0.515***	1.569***	-0.510***	0.814***	1.585***	-0.700***
	(4.36)	(7.44)	(-4.04)	(8.55)	(11.60)	(-10.84)
N	474	474	474	1640	1640	1640

Note: OLS regression models with behavioral hostility as dependent variable. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. t-values in parentheses. Standard errors clustered at the group level. Models 1, 2, and 3 refer to groups of 6 participants, and models 4, 5, and 6 refer to groups of 20. Reference categories: non-competitor, low-mobility condition.

The results corroborate our initial findings. Losers consistently spend most on diminishing others' assets, followed by winners and then noncompetitors. This pattern is consistent across both small and large groups (refer to Models 1 and 4 in Table 7; groups of 6:

losers vs. noncompetitors, 1.761, $t = 6.56$, $p < 0.001$; winners vs. noncompetitors, 1.09, $t = 4.86$, $p < 0.001$, losers vs. winners in a test of linear combination, $F = 4.82$, $p < 0.05$; groups of 20: losers vs. noncompetitors, 1.38, t = 8.82, p < 0.001, winners vs. noncompetitors, .97, t = 5.53, p < 0.001, losers vs. winners in a test of linear combination, F = 4.45, p < 0.05).

Treatment effects provide no support for the inverted-U hypothesis, aligning with our analysis of structural and subjective relative deprivation. No significant differences across treatments were observed for either small or large groups (refer to Models 2 and 5 in Table 7).

In a subsequent analysis, we incorporated beliefs about the extent to which other players in the group reduced their group members' assets. This was differentiated by the categories of losers, winners, and noncompetitors. The beliefs of participants in all three categories significantly predict behavioral hostility (Models 3 and 5 in Table 7). Interestingly, when accounting for beliefs, the effect of the instigator's status diminishes. In small groups, once beliefs are factored in, the disparity in hostility between winners and noncompetitors almost vanishes and becomes statistically insignificant (Model 1: 1.09, $t = 4.86$, $p < 0.001$, Model 3: 0.09, $t = 0.53$, $p = 0.596$). In contrast, the surplus hostility of losers remains significant and substantial when adjusting for beliefs (Model 1: 1.76, $t = 6.56$, $p < 0.001$, Model 3: .58, $t = 3.06$, $p < 0.05$). A similar pattern is observed in large groups. When controlling for beliefs, hostility in winners aligns closely with that in noncompetitors (Model 4: 0.97, $t = 5.53$, $p < 0.001$, Model 6: 0.28, $t = 2.787$, $p < 0.01$), whereas the coefficient of hostility in losers remains more than double the coefficient of hostility in winners even when adjusting for beliefs (Model 4: 1.38, $t = 8.82$, $p < 0.01$, Model 6: 0.62, $t = 6.19$, $p < 0.001$).

Why might winners' perceptions of others' hostility shape their own aggressive actions? This remains open to speculation. Winners might exhibit aggression because they anticipate potential threats from others: a kind of pre-emptive retaliation. Alternatively, their actions could stem from a desire to elevate their status. Conversely, the hostility displayed by losers seems to be rooted in frustration, as indicated in Table 4.

Exploratory results

Exploiting our heterogeneous and extensive sample, we conducted a series of exploratory analyses using socioeconomic background (gender, age, education), political ideology, and psychological measures (risk preferences, social value orientation) as predictors of competition entry, subjective frustration, and behavioral hostility. Most predictors were gauged with direct survey questions (see OSM2 for details). However, social value orientation was assessed with an incentive-compatible method (Crosetto et al., 2019; Höglinger and Wehrli, 2017; Murphy and Ackermann, 2014).

Descriptive statistics are presented in OSM3 Table SVI, and regression outcomes from combined small and large group data are in OSM3 Table SVII. Only a few variables showed significant effects. Risk-tolerant individuals (AME = 0.060, z = 19.35, $p < 0.001$) and women (AME = 0.074, z = 4.41, $p < 0.05$) were more inclined to compete, whereas those with graduate degrees were less so than were individuals with a high school education or less (AME = 0.075, z = -2.24, $p < 0.05$). Risk tolerance correlated positively with both perceived frustration (0.044, z = 2.23, $p < 0.05$) and behavioral hostility (0.043, z = 4.75, $p < 0.001$). The latter was also more pronounced among right-leaning individuals than among centrists (0.312, z = 5.96, $p < 0.001$).

Discussion and Conclusion

The rise of populism has reignited scholarly interest in the paradox of societal advancement leading to frustration and social tension (Cutts et al., 2019; Ford and Goodwin, 2014; Gidron and Hall, 2017; Goodwin, 2014; Meuleman et al., 2020; Rico et al., 2017; Rodrik, 2018; Rydgren, 2012; Smith, 1995). However, our understanding of the specific macroconditions and micromechanisms that give rise to this phenomenon is still limited. A game-theoretical model proposed by Boudon (1977) offers a promising approach to this issue. This model connects opportunities for upward social mobility within a social system to the prevalence of relative deprivation in that system. It predicts that the proportion of relatively deprived and frustrated losers in the competition for upward social mobility will follow an inverted U-shaped pattern as mobility increases.

To test this inverted U-shaped hypothesis, we designed an online experiment on MTurk with a large and diverse sample of US citizens (N = 2,114). We allowed participants to choose whether to compete for high-status positions with their group members. The first treatment dimension was the number of positions available per group, which created low, intermediate, or high accessibility to upward mobility. The second treatment dimension was group size: small groups of 6 or large groups of 20. This treatment allowed a robustness check of the results. We employed three metrics to gauge relative deprivation. First, in line with Boudon's suggestion, we used a structural measure to determine the relative frequency of losers within a group.

Second, we assessed participants' subjective frustration upon discovering the competition's outcome using a Likert-type scale. Lastly, we measured behavioral hostility through the joy-of-destruction game (Abbink and Sadrieh, 2009), which evaluates participants' inclination to decrease their group members' payoffs at a personal cost. This measure is of specific interest as it has been linked to the intensity of competition for limited resources in everyday life (Prediger et al., 2014).

We found no inverted-U-shaped relative deprivation prevalence when mobility increased but we did find falling relative deprivation—a result that was robust to variation in group size. The pattern of decreasing relative deprivation with increasing mobility was due to a gap between behavior expected under standard rationality assumptions and observed behavior. Furthermore, we observed overentry into competition with low mobility and underentry with intermediate mobility, with decreasing relative deprivation as a consequence. This result partially echoes previous research by Berger and Diekmann (2015), who similarly found instances of underentry in intermediate-mobility conditions, resulting in a similar pattern of relative deprivation across mobility conditions. The entire deductive sequence is not corroborated by the data due to deviations from the game-theory predictions. In real-world situations, individuals typically have more time to contemplate substantial investment decisions. It is conceivable that those making critical choices, such as job applications, allocate more time to the decision-making process, potentially leading to more rational behavior.

At the same time, the discrepancy between predicted and observed entry into competition with intermediate accessibility to upward social mobility becomes even greater when actors are concerned not only with their own payoffs but also with the payoffs of others (Otten, 2020, 2022). More frustration under increased chances for upward social mobility is thus unlikely to emerge under the conditions exemplified by the model. However, various factors may reinforce this phenomenon. Consider the classic finding by Stouffer et al., which suggests lower average satisfaction with promotion opportunities in those branches of the US Army offering the highest objective chances (Stouffer et al., 1950). Importantly, mid-20th century soldiers constitute a specific demographic group: males. It is well-established that, on average, men exhibit more competitive behavior than women, particularly when winners are selected by performance rather than by lot (Berger, Osterloh and Rost, 2020; Niederle and Vesterlund, 2007, 2011). Consequently, overparticipation and increased frustration when mobility is relatively high may well occur in specific subpopulations with pronounced competitiveness Behavioral contagion in networks could also encourage overentry (Guilbeault et al., 2018; Manzo, 2011).

Beyond the question of overentry, we found an intriguing, exploratory result. Although losers exhibited higher frustration than winners and noncompetitors, as the model suggests, we found a different pattern for behavioral hostility. Not only losers but also winners showed more hostility than noncompetitors. There are two potential explanations. The first is a causal effect. Winners might engage in pre-emptive retaliation due to fear of aggression from losers, or they might wish to increase their status. The second involves self-selection, suggesting that individuals drawn to competition might inherently possess more aggressive traits (Kajonius et al., 2015; Paulhus and Williams, 2002; Tesi et al., 2023; Zitek and Jordan, 2016). Additionally, a combined effect is plausible: Intense competition might heighten inherent tendencies toward antisocial behavior (Berger, Osterloh, Rost et al., 2020). In our study, irrespective of the exact underlying mechanisms, we can definitely exclude the idea that heightened hostility in losers stems solely from self-selection. The division into winners and losers was made at random. Nonetheless, losers consistently displayed more hostility than winners.

In our exploratory analyses, we observed that risk-tolerant individuals and women were more inclined to engage in competition. However, individuals with higher education levels demonstrated a lower propensity for competitiveness. Those with a higher risk tolerance expressed higher feelings of frustration and exhibited more aggressive behavior. The pattern of increased hostility was also notable among individuals with right-leaning political views. Increased competitiveness in women is surprising at first glance, as typically, women are less competitive than men (Balafoutas et al., 2018; Niederle and Vesterlund, 2007, 2011). At the same time, our competition game used a specific method of winner selection: the lot. Random selection has been reported to increasecompetitiveness in women (Berger, Osterloh, and Rost, 2020).

A significant limitation of our study is participant dropout, which primarily occurred in the larger groups and the high-mobility treatment. As a result, the findings for this specific condition should be interpreted with caution. Nevertheless, we believe our main result, decreasing frustration as social mobility improves from low to intermediate, is reliable because we experienced minimal dropout in the low- and intermediate-mobility treatments. Moreover, the results are quite consistent for both small groups, which were largely unaffected by dropout, and for large groups.

To summarize our main results: Firstly, overentry into competition was prevalent in low-mobility scenarios, whereas significant underentry was noticeable in both intermediate and high-mobility situations. This trend led to a reduction in relative deprivation across all the conditions. Secondly, both winners and losers displayed higher antisocial tendencies than did noncompetitors. Importantly, there was no corresponding rise at the aggregate level as mobility increased, suggesting that self-selection at least partly explains nastiness in competitors.

Drawing on our findings, future studies of social structure and relative deprivation should focus on elements that intensify the competitive drive for upward social mobility when more opportunities arise. We assumed that subjects' decisions were governed by the strict rationality standards of game theory and by a utility function that excluded nonmonetary arguments. We also assumed risk neutrality for predictions made from expected monetary values. Further research may also consider relaxing the model assumptions or applying alternative decision principles from bounded rationality theory. Research should also investigate whether the pronounced hostility in winners stems from self-selection or has some causal elements. In parallel, it is worth examining whether societal advancement might amplify frustration due to a growing disparity between winners and losers, rather than focusing exclusively on the "losers of modernization," as suggested by Boudon's model.

Data Availability Statement: The dataset is available on the ResearchGate profile of the first author. [Link to be provided].

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[1] This section draws on Berger and Diekmann (2015). For the game-theoretical model and derivations of the mixed equilibrium strategy, see Raub (1984).

[2] We also computed a full model that includes the two treatment effects (number of positions and group size) with their interaction effects (refer to OSM Table SII). However, in the main manuscript, we present individual regression models as opposed to the full model. This approach was chosen for two reasons. Firstly, the interaction effects were found to be statistically insignificant. Secondly, the theoretical model's predictions for large and small groups are distinct. Conducting separate analyses simplifies the comparison of predicted results with observed outcomes.